IBM Tivoli Netcool Performance Manager 1.3.2
Wireline Component
Document Revision R2E2

Mass Data Extraction User’s Guide
Before using this information and the product it supports, read the information in “Notices” on page 51.
IBM® Tivoli® Netcool® Performance Manager consists of two main components: a wireline component (formerly Tivoli Netcool/Proviso), and a wireless component (formerly Tivoli Netcool Performance Manager for Wireless).

It is assumed that you are a network administrator or operations specialist having the knowledge of database management. Mass Data Extraction (MDE) is a component of Tivoli Netcool Performance Manager.

**Audience**

The audience for this information is an operations specialist who needs to make large volumes of data accessible to external applications, such as Business Reporting tools, for the purposes of data warehousing and data modeling.

To use the MDE utility, it is important to have a knowledge of:

- Tivoli Netcool Performance Manager
- DataChannel metrics and attributes.

**Organization**

The information is organized as follows:

- Chapter 1, “Introduction,” on page 1
- Chapter 2, “MDE setup,” on page 5
- Chapter 3, “MDE API,” on page 7
- Chapter 4, “Mass Data Extraction command-line interface,” on page 13
- Chapter 5, “MDE security,” on page 37
- Chapter 6, “MDE firewall access,” on page 39
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- Appendix A, “ETL Integration Example: DataStage Integration,” on page 43
- Appendix B, “Query Schema XSD,” on page 47
- Appendix C, “Result Schema XSD,” on page 49

**Tivoli Netcool Performance Manager - Wireline Component**

IBM Tivoli Netcool Performance Manager consists of a wireline component (formerly Netcool/Proviso) and a wireless component (formerly Tivoli Netcool Performance Manager for Wireless).

Tivoli Netcool Performance Manager - Wireline Component consists of the following subcomponents:

- DataMart is a set of management, configuration, and troubleshooting GUIs. The Tivoli Netcool Performance Manager System Administrator uses the GUIs to define policies and configuration, and to verify and troubleshoot operations.
- DataLoad provides flexible, distributed data collection and data import of SNMP and non-SNMP data to a centralized database.
• DataChannel aggregates the data collected through Tivoli Netcool Performance Manager DataLoad for use by the Tivoli Netcool Performance Manager DataView reporting functions. It also processes online calculations and detects real-time threshold violations.
• DataView is a reliable application server for on-demand, web-based network reports.
• Technology Packs extend the Tivoli Netcool Performance Manager system with service-ready reports for network operations, business development, and customer viewing.

The following figure shows the different Tivoli Netcool Performance Manager modules.

Tivoli Netcool Performance Manager documentation consists of the following:
• Release notes
• Configuration recommendations
• User guides
• Technical notes
• Online help

Chapter 1. Introduction

Mass Data Extraction (MDE) is a streaming interface that enables users to extract large volumes of data from the Tivoli Netcool Performance Manager database. Using MDE it is possible to extract a subset of data, transform the data, and load the data into a customer-specific reporting warehouse.

About MDE

The Mass Data Extraction utility enables the user to gain a copy of a defined set of data for further processing by an external component.

The Mass Data Extraction utility is made of three components:
- A JDBC-based API.
- A command-line interface that wraps the API.
- A set of services that is hosted by Tivoli Integrated Portal/eWas, which are accessed by MDE through HTTPS.

In the MDE API, from the CLI you can extract specific resource attributes and metrics. The basic extract types that are supported are:
- Raw data extraction between a start and end time.
- Aggregated data extraction between a start and end time.
- Resource attribute extraction for a set point in time.

Further to these basic extraction types, it is possible to edit the resulting output in the following ways:
- Set the output type to be XML, CSV, LIF, or a schema that represents the structure of the requested output.
- The order of output by resource name or time in ascending or descending order.
- Group data output into set batch periods.
- Customize output by adding name and type data.

Data aggregation

The MDE utility supports data aggregation.

The DataChannel component of Tivoli Netcool Performance Manager is responsible for aggregating the raw metric values into daily, weekly, and monthly records. The aggregation is done for efficiency purpose to support the on-demand reporting. The pre-aggregated data can be used to produce reports more quickly than would be possible if large amounts of the raw data had to be aggregated for each query.

During this pre-aggregation process, the DataChannel component is able to do more complex calculations and aggregations on the raw data than at run time of the reports. Therefore, more aggregated/statistical values are supported for a time series with a granularity of a day, week, or month.

There are two sets of aggregation functions, these aggregation functions can be applied to any time period of that you choose. Also, for the time period which
must conform to the aggregation periods, or granularity, as set by DataChannel, that is, greater than the period of one day.

The aggregated/statistical values that are supported by the MDE for granularities of one day or greater are as follows:

**sampleQuality**
Ratio of actual raw values that are collected to the expected number of raw values over the aggregation period. Sample quality is expressed as \((\text{actual count} / \text{expected count}) \times 100\).

For example, with a polling interval of 15 minutes, the expected count of raw metric values for a one day period would be 96. If all 96 values are collected for that one day period, the sampleQuality would be 100, that is \((96 / 96) \times 100\).

**percentile**
You can use a percentile value instead of the average or max statistics to better represent a metric that includes the occasional burst or spike. Occasional bursts or spikes that render a min or max value meaningless, and throw off average and mean calculations. In these cases, you can use a percentile calculation where you can see more accurately how the metric works over time.

The MDE API supports the following aggregation functions for all granularities:

- **avg**: The average of all aggregated values.
- **min**: The minimum of all aggregated values.
- **max**: The maximum of all aggregated values.
- **sum**: The sum of all aggregated values.
- **count**: The number of all aggregated values.

**Granularity**

The granularity, or the time frame over which statistics are aggregated, can be set as follows:

- When you use the command line, the granularity is defined in the query by using the `<granularity>` tag.
  For more information about how to set the granularity when you use MDE through the command line, see the command-line example "Time Series: Raw" on page 24.
- When you use the API, the granularity is set as the **granularity** parameter of the `getResourceAggregatedMetricTimeSeries()` function.
  For more information about how to set the granularity when you use the MDE API, see the function description "`getResourceAggregatedMetricTimeSeries()`" on page 8.

The possible levels of granularity are as follows:

**5min** Sets the granularity of data aggregation to 5 minutes. This level of granularity can be used only if the start and end time do not span more than one day.

**10min** Sets the granularity of data aggregation to 10 minutes. This level of granularity can be used only if the start and end time do not span more than one day.
**15min**  Sets the granularity of data aggregation to 15 minutes. This level of granularity can be used only if the start and end time do not span more than one day.

**20min**  Sets the granularity of data aggregation to 20 minutes. This level of granularity can be used only if the start and end time do not span more than one day.

**30min**  Sets the granularity of data aggregation to 30 minutes. This level of granularity can be used only if the start and end time do not span more than one day.

**1hour**  Sets the granularity of data aggregation to 1 hour. This level of granularity can be used only if the start and end time do not span more than one week.

**2hour**  Sets the granularity of data aggregation to 2 hour. This level of granularity can be used only if the start and end time do not span more than one week.

**3hour**  Sets the granularity of data aggregation to 3 hour. This level of granularity can be used only if the start and end time do not span more than one week.

**day**  Sets the granularity of data aggregation to one day. This level of granularity can be used only if the start and end time do not span more than one week.

**week**  Sets the granularity of data aggregation to seven days. This level of granularity can be used only if the start and end time do not span more than 90 days.

**month**  Sets the granularity of data aggregation to a month. This level of granularity can be used if only the start and end time do not span more than 365 days or one year.

---

**Data customization**

Further to extracting data you can customize the resulting output in MDE.

There are three main forms of data customization.

- Creating more data items.
- Renaming or creating aliases for data items.
- Sorting data output.

**Additional data Items**

It is possible to add bespoke data to your output.

You can do it by configuring the Name, Type and Result query element attributes.

For more information about Additional data items, see “Configuring additional element data” on page 34 section and in the “Adding Alias, Name, and Type Data” on page 21 section.

**Aliasing**

In Aliasing, you can create an entirely new name for a data item.
For more information about Aliasing, see “Adding Alias, Name, and Type Data” on page 21.

**Sorting**

You can set the order of output data. Data can be ordered by resource name or by time.

For more information about Sorting, see “Sorting” on page 20.
Chapter 2. MDE setup

A number of setup steps must be carried out to use MDE.

Before you begin

The version of MDE accompanying Tivoli Netcool Performance Manager Version 1.3.2 is dependent on Java 1.6 at run time.

About this task

Procedure

1. Place the mde.tar file that comes with your Tivoli Netcool Performance Manager distribution into c:\temp.
2. Extract mde.tar in this directory. Two folders are created c:\temp\lib and c:\temp\bin.
   The lib folder must contain the following resources:
   • c:\temp\lib\commons-codec-1.3.jar
   • c:\temp\lib\commons-jexl-1.1.jar
   • c:\temp\lib\commons-logging-1.1.1.jar
   • c:\temp\lib\datalet.jar
   • c:\temp\lib\hummingbird.jar
   • c:\temp\lib\js.jar
   • c:\temp\lib\mde.jar
   • c:\temp\lib\sql.jar
   • c:\temp\lib\script-api.jar
   • c:\temp\lib\script-js.jar
   The bin folder must contain scripts for Windows NT and UNIX:
   • c:\temp\bin\mde.bat
   • c:\temp\bin\mde.sh
3. Make sure that the following environment variables are set for MDE:
   • JAVA_HOME: Set the JAVA_HOME environment variable to point to the directory where the Java runtime environment (JRE) is installed on your computer, the default location is /opt/IBM/java.
     IBM JDK 1.6
     You must ensure that you are using the IBM JRE and not the RHEL JRE.
     To ensure that you are using the right JRE you can download and install the required JRE, and set the correct JRE path. See the Tivoli Netcool Performance Manager for JRE download details.
   • Set MDE_JDBC_DRIVER to point directly to the required JDBC driver implementation.

Note: MDE_JDBC_DRIVER must point to the file ojdbc6.jar, which is in the directory where Oracle 11g client 32-bit is installed.
Chapter 3. MDE API

Describes the Mass Data Extraction (MDE) API.

The MDE API forms the foundation for the MDE utility. It is made up of three functions.

getResourceManagerTimeSeries()

The getResourceMetricTimeSeries() function helps you to extract the raw data.

Purpose

The getResourceMetricTimeSeries() function retrieves, through JDBC, raw data for a set of resources in a set of resource groups over a set time period.

generateResourceMetricTimeSeries (String group,
String[] metricTypes, String[] attributeTypes,
Timestamp startTime, Timestamp endTime,
String[] hint)

Parameters

*groups* String
A resource group name.

*metricTypes* String[]
An array of metrics to be retrieved. An entry is either the name of the metric or its id.

*startTime* Timestamp
The beginning of the extraction time window. This date is inclusive.

*endTime* Timestamp
The end of the extraction time window.

*hint* String
The sorting order for the result set. The parameter is optional:

- **ascending(resource)**
  Query results are given by a primary sort resource in ascending order. The default secondary sort is by time in ascending order.

- **ascending(time)**
  Query results are given by a primary sort time in ascending order. The default secondary sort is by resource in ascending order.

- **descending(resource)**
  Query results are given by a primary sort resource in descending order. The default secondary sort is by time in descending order.

- **descending(time)**
  Query results are given by a primary sort time in descending order. The default secondary sort is by resource in descending order.

- **includeNearRealTime**
  Causes any other query hint to be ignored and enforce ascending (time) sorting, which by default means that the secondary sort is by ascending resource.

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Example

The following example extracts metrics and attributes over a set time period:

Note: To ensure that the following command does not run off the page, carriage returns are inserted. A forward slash, "/", identifies where a carriage return is added.

getResourceMetricTimeSeries("NOC Reporting", ["AP~Generic~Universal~Throughput~Inbound Throughput (bps)","AP~Generic~Universal~Throughput~Outbound Throughput (bps)"] , / ["AP_ifSpeed","AP_ifStatus","AP_ifType"] , / 2009-12-05 00:00:00.0-0000, 2009-12-05 23:00:00.0-0000, ["""])

The sample requests the following attributes and raw metrics from the NOC Reporting group:
- The AP~Generic~Universal~Throughput~Inbound Throughput (bps) metric.
- The AP~Generic~Universal~Throughput~Outbound Throughput (bps) metric.
- The AP_ifSpeed attribute.
- The AP_ifStatus attribute.
- The AP_ifType attribute.
- The query identifier, Raw_Timeseries, is used in the naming of the output file.

Note: This example corresponds to the command-line example "Time Series: Raw" on page 24

getResourceAggregatedMetricTimeSeries()

The function getResourceAggregatedMetricTimeSeries() helps you to extract the aggregated data.

Purpose

generateAggregatedMetricTimeSeries() retrieves, through JDBC, data for a set of resources. The function provides the additional options of aggregating the extracted data, you can use one of the aggregation types, and also set the granularity of aggregation, or the time period over which the selected aggregation operation is applied.

getResourceAggregatedMetricTimeSeries (String group,
String[] metricTypes, String[] attributeTypes, String granularity,
Timestamp startTime, Timestamp endTime,
String[] Hint)

Parameters

group String
A resource group name.

metricTypes String[]
Array of metric summaries to be retrieved. Each metric summary is specified as follows:
<statistic>(<metric path>)

Where:
- <statistic>: can be min, max, sum, count, avg, percentile, or sampleQuality.
- <metric path>: is the metric, for example,
  AP~Generic~Universal~Throughput~Inbound Throughput (bps).
The metric type name is either the readable name of the metric or its id. (If id instead of the name is used, it must also be used in the result).

With the aggregation parameter, you can define the operation that is carried out on the data for the period as set by `granularity`. The MDE API supports the following aggregation functions for all granularities:

- **avg** The average of all aggregated values.
- **min** The minimum of all aggregated values.
- **max** The maximum of all aggregated values.
- **sum** The sum of all aggregated values.
- **count** The number of all aggregated values.

For more information about the possible operations, see “Data aggregation” on page 1.

`attributeTypes String[]` The array of attributes to be retrieved. An entry is either the name of the attribute or its id. (If id instead of the name is used, it must also be used in the result).

`granularity String` You can express the Granularity as one of the following: 5min, 10min, 15min, 20min, 30min, 1hour, 2hour, 3hour, day, week, month.

For more information about granularity and its constraints, see “Data aggregation” on page 1.

`startTime Timestamp` Beginning of the extraction time window. This date is inclusive.

`endTime Timestamp` End of the extraction time window.

`hint String` The sorting order for the result set. The parameter is optional:

- **ascending(resource)**  
  Query results are given by a primary sort resource in ascending order. The default secondary sort is by time in ascending order.

- **ascending(time)**  
  Query results are given by a primary sort time in ascending order. The default secondary sort is by resource in ascending order.

- **descending(resource)**  
  Query results are given by a primary sort resource in descending order. The default secondary sort is by time in descending order.

- **descending(time)**  
  Query results are given by a primary sort time in descending order. The default secondary sort is by resource in descending order.

`includeNearRealTime` Causes any other query hint to be ignored and enforce **ascending(time)** sorting, which by default means that the secondary sort is by ascending resource.
Example

This example extracts attributes and aggregated metrics.

Note: To ensure that the following command does not run off the page, carriage returns are inserted. A forward slash, "/", identifies where a carriage return is added.

getResourceAggregatedMetricTimeSeries("NOC Reporting", "/\"min(AP\"Generic\"Universal\"Throughput\"Inbound Throughput (bps))\"", "/\"max(AP\"Generic\"Universal\"Throughput\"Inbound Throughput (bps))\"", "/\"avg(AP\"Generic\"Universal\"Throughput\"Inbound Throughput (bps))\"", "/\"sum(AP\"Generic\"Universal\"Throughput\"Inbound Throughput (bps))\"", "/\"count(AP\"Generic\"Universal\"Throughput\"Inbound Throughput (bps))\"", "/\"sampleQuality(AP\"Generic\"Universal\"Throughput\"Inbound Throughput (bps))\"", "/\"percentile(AP\"Generic\"Universal\"Throughput\"Inbound Throughput (bps))\"", "/[\"AP\_ifSpeed\",\"AP\_ifStatus\",\"AP\_ifType\"]\", \"day\"\", /2009-12-15 00:00:00.0-0000, 2009-12-16 00:00:00.0-0000, [\"\"])

The example extracts the following and from the NOC Reporting group the following attributes and metrics are requested:

- The min(AP\"Generic\"Universal\"Throughput\"Inbound Throughput (bps)) metric. This metric is wrapped with the min statistical wrapper. The output is an element that contains the minimum result for this metric over the period as set in the granularity element.
- The max(AP\"Generic\"Universal\"Throughput\"Inbound Throughput (bps)) metric. This metric is wrapped with the max statistical wrapper. The output is an element that contains the maximum result for this metric over the period as set in the granularity element.
- The avg(AP\"Generic\"Universal\"Throughput\"Inbound Throughput (bps)) metric. This metric is wrapped with the avg statistical wrapper. The output is an element that contains the average result for this metric over the period as set in the granularity element.
- The sum(AP\"Generic\"Universal\"Throughput\"Inbound Throughput (bps)) metric. This metric is wrapped with the sum statistical wrapper. The output is an element that contains the sum of all results for this metric over the period as set in the granularity element.
- The count(AP\"Generic\"Universal\"Throughput\"Inbound Throughput (bps)) metric. This metric is wrapped with the count statistical wrapper. The output is an element that contains the total number of occurrences of this metric over the period as set in the granularity element.
- The sampleQuality(AP\"Generic\"Universal\"Throughput\"Inbound Throughput (bps)) metric. This metric is wrapped with the sampleQuality statistical wrapper. The output is an element that contains count expressed as a percentage of the number of expected occurrences of this metric. This aggregation type can be used only if the granularity, or period of aggregation, is greater than one day.
- The percentile(AP\"Generic\"Universal\"Throughput\"Inbound Throughput (bps)) metric. This metric is wrapped with the percentile statistical wrapper. This metric can be used only if the granularity, or period of aggregation, is greater than one day.
- The AP\_ifSpeed attribute.
- The AP\_ifStatus attribute.
- The AP\_ifType attribute.
- The queryIdentifier, ResourcesNocReporting is used in the naming of the output file.
**getResourceSnapshot()**

The `getResourceSnapshot()` function helps you to extract the topology data.

**Purpose**

The purpose of the `getResourceSnapshot()` is to get a snapshot of the resources available in a set of groups.

```java
getResourceSnapshot (String group,
       String[] attributeTypes[],Timestamp time)
```

**Parameters**

- `group` *String*
  A resource group name.

- `attributeTypes` *String[]*
  The array of attributes to be retrieved. An entry is either the name of the attribute or its id. (If id instead of the name is used, it must also be used in the result)

- `time` *Timestamp*
  Time of the snapshot; the time at which the resource information is retrieved. If this time is not specified. The most current values are retrieved.

**Example**

The sample takes a snapshot:

```java
Note: To ensure that the following command does not run off the page, carriage returns are inserted. A forward slash, "/", identifies where a carriage return is added.

getResourceSnapshot("NOC Reporting", / ["AP_ifSpeed","AP_ifStatus","AP_ifType"] /,2009-12-05 00:00:00.0-0000)
```

From the NOCReporting group, the following attributes are requested:

- The `AP_ifSpeed` attribute.
- The `AP_ifStatus` attribute.
- The `AP_ifType` attribute.

**Note:** This example corresponds to the command-line example “Snapshot” on page 22
Chapter 4. Mass Data Extraction command-line interface

The Mass Data Extraction (MDE) utility can be run from the command line.

Running the MDE from the command line requires two things:
• An XML data query that defines the various metrics and attributes to extract.
• An MDE command that contains the appropriate arguments.

For details on how to use the MDE API, see Chapter 3, “MDE API,” on page 7

Command-line options

The Mass Data Extraction command-line interface provides all the details that are required to extract data.

The following table lists all MDE command-line options:

<table>
<thead>
<tr>
<th>Option</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-u[ser]</td>
<td>username string</td>
<td>Username that is required to start extraction.</td>
</tr>
<tr>
<td>-p[assword]</td>
<td>password string</td>
<td>Password credentials. This argument is optional, as it can be specified as an environment variable, MDE_PASSWORD.</td>
</tr>
<tr>
<td>-host</td>
<td>Can be entered as a hostname or an ip(4</td>
<td>5) address.</td>
</tr>
<tr>
<td>-port</td>
<td>port number</td>
<td>Access port to the service. You are allowed to use either of the two ports that are configured for Tivoli Integrated Portal, these ports are typically included in the URL used to connect to DataView on Tivoli Integrated Portal: Note: For more information about setting up secure data extraction by using MDE, see Chapter 5, “MDE security,” on page 37.</td>
</tr>
<tr>
<td>-q[query]</td>
<td>XML file name</td>
<td>The name of the XML file that defines the query scope.</td>
</tr>
<tr>
<td>-s[ta rt]</td>
<td>• yyyy-MM-dd'T'HH:mm:ss.SZ • yyyy-MM-dd'T'HH:mm:ssS • yyyy-MM-dd'T'HH:mm:ssZ • yyyy-MM-dd'T'HH:mm:ss • yyyy-MM-dd'T'HH:mmZ • yyyy-MM-dd'T'HH:mm • yyyy-MM-ddZ • yyyy-MM-dd</td>
<td>Start time of the extraction window. If not specified, the current time is used. Not providing a timezone (Z), defaults to UTC/6MT-0000.</td>
</tr>
</tbody>
</table>
Batch mode

You can batch the extracted data in MDE utility. The result of which is, instead of one output file, extracted data is split up and output as a set of files, where each file contains data for a set time period.

Also, being able to specify the time frame for data extraction by using the start and end command-line parameters, it is possible to batch the resulting output into multiple files.

For example, if the start and end time span one day, you can batch output into one hour group. The result of which is a discrete set of files where each file contains one hour of data. The advantage of this is that you can create a greater level of granularity, reduce file size and increase readability.

To output your data in batch mode, use the command-line -b option followed by the batch period in minutes.

Limitations

The batch period is set in minutes. The batch period can be set 5 - 60 minutes.
If only attributes are defined in your query, then any batching information that is supplied is ignored and the end time is ignored. An extract of only attributes is called a snapshot.

If you set the batch mode to output a file once an hour, the output is created on the hour, obeying the start and end time you set.

Output conventions and formats

Describes the available formats for output files and their conventions.

There are four types of output formats available:

- XML (Extensible Markup Language)
- LIF (Loader Input Format)
- CSV (Comma Separated Values)
- Schema

XML

The following rules and conventions apply to any output saved in the XML format:

- If a specific resource does not have a metric or attribute value, it is not included in the output.
- Dates and times are expressed as the standard XML/XSLDate/Time type: YYYY-MM-DDThh:mm:ss.SZ (UTC time).
- The order of the results follows the order of declaration of the attributes and metrics.
- All output strings are wrapped in the "CDATA" element.

The following is an example of XML output.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<response>
  <result>
    <granularity>raw</granularity>
    <header>
      <measType indx="4" type="double">raw(AP~Generic~Universal~Throughput~Inbound Throughput (bps))</measType>
      <measType indx="5" type="double">raw(AP~Generic~Universal~Throughput~Outbound Throughput (bps))</measType>
      <measType indx="6" type="string">resource[AP~ifSpeed]</measType>
      <measType indx="7" type="string">resource[AP~ifStatus]</measType>
      <measType indx="8" type="string">resource[AP~ifType]</measType>
    </header>
    <measInfo>
      <group><![CDATA[NOC Reporting~Devices~Interfaces~10.44.240.56]]></group>
      <id><![CDATA[10.44.240.56_If<2>]]></id>
      <time>2012-11-01T00:00:00.0+0000</time>
      <measValue indx="4">7527711.035808</measValue>
      <measValue indx="5">24179605.594996</measValue>
      <measValue indx="6">1000000000</measValue>
      <measValue indx="7">up:up</measValue>
      <measValue indx="8">ethernetCsmacd</measValue>
      <resourceName><![CDATA[10.44.240.56_If<2>]]></resourceName>
      <resourceLabel><![CDATA[IF: 2 "1 Gbps" "igb0"]]</resourceLabel>
    </measInfo>
    <measInfo>
      <group><![CDATA[NOC Reporting~Devices~Interfaces~10.44.240.56]]></group>
      <id><![CDATA[10.44.240.56_If<2>]]></id>
      <time>2012-11-01T00:15:00.0+0000</time>
      <measValue indx="4">4477239.364374</measValue>
      <measValue indx="5">14383907.395184</measValue>
      <measValue indx="6">1000000000</measValue>
      <measValue indx="7">up:up</measValue>
      <measValue indx="8">ethernetCsmacd</measValue>
      <resourceName><![CDATA[10.44.240.56_If<2>]]></resourceName>
      <resourceLabel><![CDATA[IF: 2 "1 Gbps" "igb0"]]</resourceLabel>
    </measInfo>
  </result>
</response>
```
LIF

LIF is a proprietary Tivoli Netcool Performance Manager data format.

The LIF format is a hierarchical grouping of name-value pairs and fits the nature of the data exported.

If a specific resource does not have a metric, or attribute value, the field is left blank. Attributes and metric names are translated to respect the restrictions of the LIF format. The restrictions are:

- Only ASCII characters that allowed, any non-ASCII characters are replaced with an underscore, that is, "_".
- Any whitespace is replaced with an underscore, that is, "_".
- Any occurrence of ",", ",", ",", are replaced with an underscore, that is, "_".
- Strings are wrapped in quotation marks.

lifblock

When you choose the LIF output format, specifying the -lifblock option where you can add extra formatting to the output file. We have two options:

- **Fixed:** When you choose this option you must supply a name through the command line, which is given to each output block.

  For example:
  
  -f lif -lifblock fixed "Fixed_Name"

  This results in each block that is given the name "Fixed_Name". This name also has the granularity of the result that is appended, so the output for each block looks similar to the following output:

  ```
  { 
    Fixed_Name_1hour 
      resource_group 'NOC Reporting"Devices"Interfaces"10.44.240.56' 
      resource_id '10.44.240.56_If<2>' 
      day 01Nov2012 
      start_time 00:00 
      resource_AP_ifSpeed_ '1000000000' 
      resource_AP_ifStatus_ 'up:up' 
      resource_AP_ifType_ 'ethernetCsmacd' 
      raw_AP_Generic_Universal_Throughput_Inbound_Throughput__bps__ 7527711.035808 
      raw_AP_Generic_Universal_Throughput_Outbound_Throughput__bps__ 24179605.594996 
      resourceName '10.44.240.56_If<2>' 
      resourceLabel 'IF: 2 "1 Gbps" "igb0"'
    measurement_seconds 'raw'
  }
  ```
Type: The type option forces each block to use the defined type element, which is created by using the query, to set the block name. This means that the type must be present for each block. If not, then the granularity is used.

For more information about how the type element is set for a query, see “Adding Alias, Name, and Type Data” on page 21

The following is an example of LIF output.

```
#sprn

{  
  raw {   
    resource_group 'NOC Reporting~Devices~Interfaces~10.44.240.56'   
    resource_id '10.44.240.56_No<2>'   
    day 01Nov2012   
    start_time 00:00   
    resource_AP_ifSpeed_ '1000000000'   
    resource_AP_ifStatus_ 'up:up'   
    resource_AP_ifType_ 'ethernetCsmacd'   
    raw_AP_Generic_Universal_Throughput_Inbound_Throughput__bps__ 75277711.035808   
    raw_AP_Generic_Universal_Throughput_Outbound_Throughput__bps__ 24179605.994996   
    resourceName '10.44.240.56_No<2>'   
    resourceLabel 'IF: 2 "1 Gbps" "igb0"'   
    measurement_seconds 'raw'  
  }  
  raw {   
    resource_group 'NOC Reporting~Devices~Interfaces~10.44.240.56'   
    resource_id '10.44.240.56_No<2>'   
    day 01Nov2012   
    start_time 00:15   
    resource_AP_ifSpeed_ '1000000000'   
    resource_AP_ifStatus_ 'up:up'   
    resource_AP_ifType_ 'ethernetCsmacd'   
    raw_AP_Generic_Universal_Throughput_Inbound_Throughput__bps__ 4477239.364374   
    raw_AP_Generic_Universal_Throughput_Outbound_Throughput__bps__ 14383907.395184   
    resourceName '10.44.240.56_No<2>'   
    resourceLabel 'IF: 2 "1 Gbps" "igb0"'   
    measurement_seconds 'raw'  
  }  
  raw {   
    resource_group 'NOC Reporting~Devices~Interfaces~10.44.240.56'   
    resource_id '10.44.240.56_No<2>'   
    day 01Nov2012   
    start_time 00:30   
    resource_AP_ifSpeed_ '1000000000'   
    resource_AP_ifStatus_ 'up:up'   
    resource_AP_ifType_ 'ethernetCsmacd'   
    raw_AP_Generic_Universal_Throughput_Inbound_Throughput__bps__ 1084809.79512   
    raw_AP_Generic_Universal_Throughput_Outbound_Throughput__bps__ 10386094.147713   
    resourceName '10.44.240.56_No<2>'   
    resourceLabel 'IF: 2 "1 Gbps" "igb0"'   
    measurement_seconds 'raw'  
  } ...  
} ...
```

CSV

The following rules and conventions apply to any output saved in the CSV format:

- For the CSV format, all strings are wrapped in double quotation marks.
- If a specific resource does not have a metric, or attribute value, the field is left blank.
- Time is expressed in the following format: YYYY-MM-DDThh:mm:ss.SZ (UTC time).

The following is an example of CSV output.

**Note:** To ensure that the following output does not run off the page, the CSV table is split length-ways in three.
Table 2. CSV Part 1

<table>
<thead>
<tr>
<th>group</th>
<th>id</th>
<th>time</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOC Reporting<del>Devices</del>Interfaces~10.44.240.56</td>
<td>10.44.240.56_If&lt;2&gt;</td>
<td>2012-11-01T00:00:00.0+0000</td>
</tr>
<tr>
<td>NOC Reporting<del>Devices</del>Interfaces~10.44.240.56</td>
<td>10.44.240.56_If&lt;2&gt;</td>
<td>2012-11-01T00:15:00.0+0000</td>
</tr>
<tr>
<td>NOC Reporting<del>Devices</del>Interfaces~10.44.240.57</td>
<td>10.44.240.57_If&lt;2&gt;</td>
<td>2012-11-01T00:45:00.0+0000</td>
</tr>
</tbody>
</table>

Table 3. CSV Part 2

<table>
<thead>
<tr>
<th>raw(AP<del>Generic</del>Universal<del>Throughput</del>Inbound Throughput (bps))</th>
<th>raw(AP<del>Generic</del>Universal<del>Throughput</del>Outbound Throughput (bps))</th>
</tr>
</thead>
<tbody>
<tr>
<td>3678.653908</td>
<td>1723.779153</td>
</tr>
<tr>
<td>2907.169677</td>
<td>1738.927532</td>
</tr>
<tr>
<td>2837.430801</td>
<td>1685.745404</td>
</tr>
</tbody>
</table>

Table 4. CSV Part 3

<table>
<thead>
<tr>
<th>resourceAP_ifSpeed</th>
<th>resourceAP_ifStatus</th>
<th>resourceAP_ifType</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000000000</td>
<td>up:up</td>
<td>ethernetCsmacd</td>
</tr>
<tr>
<td>1000000000</td>
<td>up:up</td>
<td>ethernetCsmacd</td>
</tr>
<tr>
<td>1000000000</td>
<td>up:up</td>
<td>ethernetCsmacd</td>
</tr>
</tbody>
</table>

Table 5. CSV Part 4

<table>
<thead>
<tr>
<th>resourceName</th>
<th>resourceLabel</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.44.240.57_If&lt;2&gt;</td>
<td>IF: 2 &quot;1 Gbps&quot; “igb0”</td>
</tr>
<tr>
<td>10.44.240.56_If&lt;2&gt;</td>
<td>IF: 2 &quot;1 Gbps&quot; “igb0”</td>
</tr>
</tbody>
</table>

Schema

A schema file can be generated only when a query file is defined. The schema is generated by MDE from the query results. This format has been introduced to allow for DataStage integration.

For information about how to set up DataStage® integration, see “Data aggregation” on page 1

The following is an example of Schema output.

```plaintext
record{group:string;id:string;time:timestamp[microseconds];
raw_AP_Generic_Throughput_Inbound_Bps_:dfloat;
raw_AP_Generic_Throughput_Outbound_Bps_:dfloat;
resource_AP_ifSpeed_:string;resource_AP_ifStatus_:string;
resource_AP_ifType_:string;resourceName:string;resourceLabel:string;}
```
**Naming of output files**

The file naming conventions for output files conforms to the 3GPP format.

An example is `A20090601.1200+0300-20090602.1200+0300_RawNocReporting.xml`. A basic breakdown of the 3GPP format is:

- **A** indicates that the file relates to a single network element and single granularity period.

- **20090601.1200+0300**
  - The start time, date, and time zone offset.

- **20090602.1200+0300**
  - The end time, date, and time zone offset.

- **RawNocReporting**
  - Is the query identifier as set in the query XML. There must be no spaces in the query identifier.

In the case where batch output is in operation, the file name changes to:

```
<filename>_-_<batchIndex>._<format>
```

For example, `A20090601.1200+0300-20090602.1200+0300_RawNocReporting_-_001.xml`

In the case where a file is duplicated, the file name changes to:

```
<filename>_<duplicateIndex>._<format>
```

For example, `A20090601.1200+0300-20090602.1200+0300_RawNocReporting_1.xml`

In the case where there are duplicate batch files, the file name changes to:

```
<filename>_<duplicateIndex>_-_<batchIndex>._<format>
```

For example, `A20090601.1200+0300-20090602.1200+0300_RawNocReporting_1_-_001.xml`

When files are created they are placed in a temporary folder until all processing is complete, then they are relocated to the output location specified.

**Creating a query**

Every MDE command-line interface command must be accompanied by a query definition. This topic describes how to create that query.

**A Basic Query**

You can specify the attributes and metrics that are to be extracted by using MDE query.

A basic query requires the following tags:

- `<query>`: This tag is used to wrap all other tags and indicate that they form a query.
- `<resourcegroup>`: This tag is used to indicate where the required attributes or metrics can be found. This resource group is the top node within the network element tree we are exploring.
- `<attribute>`: This tag is used to identify a wanted attribute. Your query can contain a minimum of 1 and an unbounded maximum of these tags.
- `<metric>`: This tag is used to identify a wanted metric. Your query can contain a minimum of 0 and an unbounded maximum of these tags.
Group, metric, and attribute naming

To create well formed queries that it is important that the correct names for groups, metrics and attributes are used. These names can be obtained by querying the database directly, or by using the DataMart tool Resource Editor. The Resource Editor provides the full group and metric paths, and attributes on a resource.

Limitations

It is recommended that the number of metric/statistic combinations that are requested in a single execution of the query must be limited to 30-50 combinations. Such a limit must fit within the physical configuration, block size of the Oracle database.

There are circumstances where its necessary to increase the maximum heap size setting:
- A large volume of data is to be processed

The MDE launch script (mde.bat/mde.sh) configures the JVM heap size with a default minimum size of 128 Mb (-Xms128m) and a default maximum of 1 Gb (-Xmx1g). These settings are appropriate for most systems that may run MDE.
- -Xms128m: This is the minimum amount of memory that the JVM requires to allocate to the heap before you start
- -Xmx1g: This is the maximum amount of that the JVM requires reserve/allocate to the heap before you start. Note that this memory must be available for JVM to start.

These settings can be edited directly within the MDE script you are using, either of mde.bat or mde.sh.

Advanced Settings

Within a query, you can also define:
- The sorting of output. For more information about Sorting, see "Sorting."
- Additional type and name elements, plus alternative names, or aliases, for any attribute or metric. For more information, see "Adding Alias, Name, and Type Data" on page 21

The following sections explain how a query can be defined to incorporate these settings.

Sorting

To set the sorting order of query results, include the <hint> tag.

MDE supports the primary and secondary sorting of result elements. The primary sorting order is set by using the query <hint> tag. The secondary sorting order is set to a default based on the primary.

If no hint is set in the query, the default for sorting is resource in ascending order.

Only one query hint must be set. The following is the content for the <hint> tag:

`ascending(resource)`

Query results are given by a primary sort resource in ascending order. The default secondary sort is by time in ascending order.
ascending(time)
Query results are given by a primary sort time in ascending order. The default secondary sort is by resource in ascending order.

descending(resource)
Query results are given by a primary sort resource in descending order. The default secondary sort is by time in descending order.

descending(time)
Query results are given by a primary sort time in descending order. The default secondary sort is by resource in descending order.

includeNearRealTime
Causes any other query hint to be ignored and enforce ascending(time) sorting, which by default means that the secondary sort is by ascending resource.

If resource is set as the primary sorting hint, then time is set as the secondary sort by default. If time is set as the primary sorting hint, then resource is set as the secondary sort by default.

Adding Alias, Name, and Type Data
It is possible to add an alias to a result item, and add name or type elements to the result set.

Aliasing is made possible to add a more informative name to a result element.

Network elements within Tivoli Netcool Performance Manager contain no name or type data; they do not have a specific name element or type element. For this reason, it is made possible to create a name or type element from an existing attribute result.

An Alias can be applied to both metrics and attributes. Name, Type, Result attributes can be specified only on attribute elements.

The XML schema that defines the query structure is:

```
<!-- Metric Type -->
<xsd:complexType name="MetricType">
  <xsd:simpleContent>
    <xsd:extension base="xsd:string">
      <xsd:attribute name="alias" type="xsd:string" />
    </xsd:extension>
  </xsd:simpleContent>
</xsd:complexType>

<!-- Attribute Type -->
<xsd:complexType name="AttributeType">
  <xsd:simpleContent>
    <xsd:extension base="xsd:string">
      <xsd:attribute name="alias" type="xsd:string" />
      <xsd:attribute name="name" type="xsd:boolean" />
      <xsd:attribute name="type" type="xsd:boolean" />
      <xsd:attribute name="result" type="xsd:boolean" />
    </xsd:extension>
  </xsd:simpleContent>
</xsd:complexType>
```

The XML schema lists the following attributes for the Attribute elements:
## MDE Command Line Examples

Illustrates a set of MDE command-line examples.

Each example contains:
- The command
- The required query definition.
- An output excerpt.

There are five command-line examples.

### Snapshot

The MDE command-line snapshot example.

### Purpose

The purpose of a snapshot is to return attribute data for a set point in time. A snapshot is what is automatically returned when the user defines a query that contains only attributes. Any supplied batching information or end time is ignored.

As with all the MDE examples there are two things, you must define to gain the required output:
- The command, where you supply details of the application server, access credentials, timing, and so on.
- The query, which can specify the wanted attributes, sorting, aliasing, and more.

### Command Line

**Note:** To ensure that the following command does not run off the page, carriage returns are inserted. A forward slash, "/", identifies where a carriage return is added.

```
mde -u tipadmin -p tipadmin -host host.us.ibm.com -port 16315/
-query ..\queries\SnapshotQuery.xml -o ..\output\ -f xml
```

**Note:** The mde command string that is used in the sample is `mde.sh` for UNIX and `mde.bat` for Windows.
The following is also specified in the command:

- `-u tipadmin`: The username is set to `tipadmin`.
- `-p tipadmin`: The password is set to `tipadmin`.
- `-host host.us.ibm.com`: The application server name is set to `host.us.ibm.com`.
- `-port 16315`: The access port is set to 16315.
- `-query ..\queries\SnapshotQuery.xml`: The query file that contains the attributes and metrics to be extracted is set to `SnapshotQuery.xml`.
- `-o ..\output\`: The output directory is set to be the `..\output\` directory.
- `-f xml`: The output format is set to be xml.

**Note:** No start or end time were stated in the command, which means the start time is taken as the time the command was run and the most current data is extracted.

**Query**

In the following query only attributes are defined, and are, therefore, part of our extract. When only attributes are defined in the query, the extract is a snapshot.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<query>
  <resourcegroup>NOC Reporting</resourcegroup>
  <attribute>AP_ifSpeed</attribute>
  <attribute>AP_ifStatus</attribute>
  <attribute>AP_ifType</attribute>
  <queryidentifier>Snapshot</queryidentifier>
</query>
```

From the NOCReporting group, the following attributes are requested:
- The `AP_ifSpeed` attribute.
- The `AP_ifStatus` attribute.
- The `AP_ifType` attribute.
- The `queryidentifier`, Snapshot is used in the naming of the output file.

**Output Excerpt**

The output is displayed in XML format.

```xml
<response><result><granularity>raw</granularity><header><measType indx="4" type="string"><![CDATA[resource[AP_ifSpeed]]]></measType><measType indx="5" type="string"><![CDATA[resource[AP_ifStatus]]]></measType><measType indx="6" type="string"><![CDATA[resource[AP_ifType]]]></measType></header><measInfo><group><![CDATA[NOC Reporting"Devices"Interfaces"10.44.240.107]]]></group><id><![CDATA[10.44.240.107..<NULL>]]></id><time>2012-11-01T00:00:00.0+0000</time><resourceName><![CDATA[10.44.240.107..<NULL>]]></resourceName><resourceLabel><![CDATA[tnpminsunz1.persistent.co.in]]></resourceLabel><measValue indx="4"><![CDATA[127000000]]></measValue><measValue indx="5"><![CDATA[up:up]]></measValue><measValue indx="6"><![CDATA[softwareLoopback]]></measValue><resourceName><![CDATA[tnpminsunz22.persistent.co.in_if<1>]]></resourceName><resourceLabel><![CDATA[IF: 1 "127 Mbps" "lo0:20"]]></resourceLabel>```

......
The three index headers are stated at the beginning so that the naming information does not have to be repeated throughout the output file.

The header information is wrapped in the <header> tag. All measurement information is wrapped in the <measInfo> tags.

**Time Series Examples**

The time series examples demonstrate how to extract data for a given time period.

There are two time series examples.

**Time Series: Raw**

The MDE command line raw time series example.

**Purpose**

The purpose of this example to demonstrate how to gather raw data for a set time period.

As with all the MDE examples there are two things, you must define to gain the required output:

- The command, where you can supply details of the application server, access credentials, timing, and so on.
- The query, which specifies the wanted metrics and attributes, sorting, aliasing, and more.

As part of this MDE example, a short excerpt from the output file is displayed.

**Command line**

**Note:** To ensure that the following command does not run off the page, carriage returns are inserted. A forward slash, "/", identifies where a carriage return is added.

```bash
mde -u tipadmin -p tipadmin -host host.us.ibm.com -port 16315 -s 2009-12-05T00:00:00.0+0000/
-e 2009-12-05T23:00:00.0+0000 -query ..\queries\RawTimeSeriesQuery.xml -o ..\output\ -f xml
```

**Note:** The mde command string that is used in the sample is mde.sh for UNIX and mde.bat for Windows.

The following is specified in the command:

- `-u tipadmin`: The username is set to tipadmin.
- `-p tipadmin`: The password is set to tipadmin.
- `-host host.us.ibm.com`: The application server name is set to host.us.ibm.com.
-port 16315: The access port is set to 16315.
-query ..\queries\RawTimeSeriesQuery.xml: The query file that contains the attributes and metrics to be extracted is set to RawTimeSeriesQuery.xml.
-s 2009-12-05T00:00:00.0+0000: The start time is set to 2009-12-05T00:00:00.0+0000.
-e 2009-12-05T23:00:00.0+0000: The end time is set to 2009-12-05T23:00:00.0+0000.
-o ..\output\: The output directory is set to be the ..\output\ directory.
-f xml: The output format is set to be xml.

Query

In the following query, both attributes and metrics are defined.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<query>
  <resourcegroup>NOC Reporting</resourcegroup>
  <metric>AP~Generic~Universal~Throughput~Inbound Throughput (bps)</metric>
  <metric>AP~Generic~Universal~Throughput~Outbound Throughput (bps)</metric>
  <attribute>AP_ifSpeed</attribute>
  <attribute>AP_ifStatus</attribute>
  <attribute>AP_ifType</attribute>
  <queryidentifier>Raw_Timeseries</queryidentifier>
</query>
```

From the NOC Reporting group, the following attributes and metrics are requested:
- The AP"Generic"Universal"Throughput"Inbound Throughput (bps) metric.
- The AP"Generic"Universal"Throughput"Outbound Throughput (bps) metric.
- The AP_ifSpeed attribute.
- The AP_ifStatus attribute.
- The AP_ifType attribute.
- The queryidentifier, Raw_Timeseries, is used in the naming of the output file.

Note: Multiple occurrences of the same metric in a query produces only one result.

Output Excerpt

```xml
<?xml version="1.0" encoding="UTF-8"?>
<response>
  <result>
    <granularity>raw</granularity>
    <header>
      <measType indx="4" type="double"><![CDATA[AP~Generic~Universal~Throughput~Inbound Throughput (bps)]]></measType>
      <measType indx="5" type="double"><![CDATA[AP~Generic~Universal~Throughput~Outbound Throughput (bps)]]></measType>
      <measType indx="6" type="string"><![CDATA[resource[AP_ifSpeed]]]></measType>
      <measType indx="7" type="string"><![CDATA[resource[AP_ifStatus]]]></measType>
      <measType indx="8" type="string"><![CDATA[resource[AP_ifType]]]></measType>
    </header>
    <measInfo>
      <group><![CDATA[NOC Reporting Devices Interfaces 10.44.240.56]]></group>
      <id><![CDATA[10.44.240.56 If<2>]]></id>
      <time>2012-11-01T00:00:00.0+0000</time>
      <measValue indx="4">7527711.035808</measValue>
      <measValue indx="5">24179605.594996</measValue>
      <measValue indx="6">1000000000</measValue>
      <measValue indx="7">up:up</measValue>
      <measValue indx="8">ethernetCsmacd</measValue>
    </measInfo>
    ........
  </result>
</response>
```
Time Series: Aggregated
The MDE command line aggregated time series example.

Purpose

The purpose of this example to demonstrate to extract aggregated data over a set time period.

As with all the MDE examples there are two things, you must define to gain the required output:

- The command, where you can supply details of the application server, access credentials, timing, and so on.
- The query, which specifies the wanted metrics and attributes, sorting, aliasing, and more.

As part of this MDE example, a short excerpt from the output file is displayed.

Command line

Note: To ensure that the following command does not run off the page, carriage returns are inserted. A forward slash, ‘/’, identifies where a carriage return is added.

```
mde -u tipadmin -p tipadmin -host host.us.ibm.com -port 16315 -s 2009-12-15T00:00:00.0+0000/ -e 2009-12-16T00:00:00.0+0000 -query ..\queries\AggregatedTimeSeriesQuery.xml -o ..\output\ -f xml
```

Note: The mde command string that is used in the sample is mde.sh for UNIX and mde.bat for Windows.

The following is specified in the command:

- -u tipadmin: The username is set to tipadmin.
- -p tipadmin: The password is set to tipadmin.
- -host host.us.ibm.com: The application server name is set to host.us.ibm.com.
- -port 16315: The access port is set to 16315.
- -query ..\queries\AggregatedTimeSeriesQuery.xml: The query file that contains the attributes and metrics to be extracted is set to AggregatedTimeSeriesQuery.xml.
- -s 2009-12-15T00:00:00.0+0000: The start time is set to 2009-12-15T00:00:00.0+0000.
- -e 2009-12-16T00:00:00.0+0000: The end time is set to 2009-12-16T00:00:00.0+0000.
- -o ..\output\: The output directory is set to be ..\output\.
- -f xml: The output format is set to be xml.
Query

In the following query, both attributes and metrics are defined. The metrics have statistical wrappers. Statistical wrappers can be added only to the metrics when a granularity is defined. The operators that are defined in the statistical wrapper are applied over the period that is set in the granularity element.

<?xml version="1.0" encoding="UTF-8"?>
<query>
  <resourcegroup>NOC Reporting</resourcegroup>
  <metric>min(AP~Generic~Universal~Throughput~Inbound Throughput (bps))</metric>
  <metric>max(AP~Generic~Universal~Throughput~Inbound Throughput (bps))</metric>
  <metric>avg(AP~Generic~Universal~Throughput~Inbound Throughput (bps))</metric>
  <metric>sum(AP~Generic~Universal~Throughput~Inbound Throughput (bps))</metric>
  <metric>count(AP~Generic~Universal~Throughput~Inbound Throughput (bps))</metric>
  <metric>sampleQuality(AP~Generic~Universal~Throughput~Inbound Throughput (bps))</metric>
  <metric>percentile(AP~Generic~Universal~Throughput~Inbound Throughput (bps))</metric>
  <attribute>AP_ifSpeed</attribute>
  <attribute>AP_ifStatus</attribute>
  <attribute>AP_ifType</attribute>
  <granularity>day</granularity>
  <queryidentifier>Aggregated_Timeseries</queryidentifier>
</query>

From the NOC Reporting group, the following attributes and metrics are requested:

- The min(AP~Generic~Universal~Throughput~Inbound Throughput (bps)) metric. This metric is wrapped with the min statistical wrapper. The output is an element that contains the minimum result for this metric over the period as set in the granularity element.

- The max(AP~Generic~Universal~Throughput~Inbound Throughput (bps)) metric. This metric is wrapped with the max statistical wrapper. The output is an element that contains the maximum result for this metric over the period as set in the granularity element.

- The avg(AP~Generic~Universal~Throughput~Inbound Throughput (bps)) metric. This metric is wrapped with the avg statistical wrapper. The output is an element that contains the average result for this metric over the period as set in the granularity element.

- The sum(AP~Generic~Universal~Throughput~Inbound Throughput (bps)) metric. This metric is wrapped with the sum statistical wrapper. The output is an element that contains the sum of all results for this metric over the period as set in the granularity element.

- The count(AP~Generic~Universal~Throughput~Inbound Throughput (bps)) metric. This metric is wrapped with the count statistical wrapper. The output is an element that contains the total number of occurrences of this metric over the period as set in the granularity element.

- The sampleQuality(AP~Generic~Universal~Throughput~Inbound Throughput (bps)) metric. This metric is wrapped with the sampleQuality statistical wrapper. The output is an element that contains count expressed as a percentage of the number of expected occurrences of this metric. This aggregation type can be used only if the granularity, or period of aggregation, is greater than one day.

- The percentile(AP~Generic~Universal~Throughput~Inbound Throughput (bps)) metric. This metric is wrapped with the percentile statistical wrapper. This metric can be used only if the granularity, or period of aggregation, is greater than one day.

- The AP_ifSpeed attribute.

- The AP_ifStatus attribute.

- The AP_ifType attribute.

The following is also specified:
The <granularity> tag sets the time period over which the operations defined in the statistical wrappers are applied. If a statistical wrapper is not defined, the AVG wrapper is used by default.

The query identifier, Aggregated_Timeseries is used in the naming of the output file.

Note: Multiple occurrences of the same metric in a query produce only one result.

Output Excerpt

```xml
<?xml version="1.0" encoding="UTF-8"?>
<response>
  <result>
    <granularity>1hour</granularity>
    <header>
      <measType indx="4" type="double">min(AP\Generic\Universal~Throughput\Inbound Throughput (bps))</measType>
      <measType indx="5" type="double">max(AP\Generic\Universal~Throughput\Inbound Throughput (bps))</measType>
      <measType indx="6" type="double">avg(AP\Generic\Universal~Throughput\Outbound Throughput (bps))</measType>
      <measType indx="7" type="double">sum(AP\Generic\Universal~Throughput\Outbound Throughput (bps))</measType>
      <measType indx="8" type="string">resource[AP_ifSpeed]</measType>
      <measType indx="9" type="string">resource[AP_ifStatus]</measType>
      <measType indx="10" type="string">resource[AP_ifType]</measType>
    </header>
    <measInfo>
      <group>NOC Reporting~Devices~Interfaces~10.44.240.56</group>
      <id>10.44.240.56_If<2></id>
      <time>2012-11-01T00:00:00.0+0000</time>
      <measValue indx="4">1084809.79512</measValue>
      <measValue indx="5">7635924.08</measValue>
      <measValue indx="6">17696966.666034</measValue>
      <measValue indx="7">70787866.664136</measValue>
      <measValue indx="8">1000000000</measValue>
      <measValue indx="9">up:up</measValue>
      <measValue indx="10">ethernetCsmacd</measValue>
      <resourceName>10.44.240.56_If<2></resourceName>
      <resourceLabel>IF: 2 "1 Gbps" "igb0"
    </measInfo>
    ...
    <measInfo>
      <group>NOC Reporting~Devices~Interfaces~10.44.240.57</group>
      <id>10.44.240.57_If<2></id>
      <time>2012-11-05T00:00:00.0+0000</time>
      <measValue indx="4">4714134.07707</measValue>
      <measValue indx="5">14736046.294877</measValue>
      <measValue indx="6">17792816.91167475</measValue>
      <measValue indx="7">71171267.646699</measValue>
      <measValue indx="8">1000000000</measValue>
      <measValue indx="9">up:up</measValue>
      <measValue indx="10">ethernetCsmacd</measValue>
      <resourceName>10.44.240.57_If<2></resourceName>
      <resourceLabel>IF: 2 "1 Gbps" "igb0"
    </measInfo>
  </result>
</response>
```
Batched Output

The MDE command line batched output example.

Purpose

The purpose of this example to demonstrate how you can batch your MDE output.

As with all our MDE examples there are two parts that are required to gain the required output:

- The command, where the details of the application server, access credentials, timing are supplied.
- The query, where you can specify the wanted metrics and attributes, sorting, and aliasing.

As part of this MDE example, a short excerpt from the output file is displayed.

Command

In the following command, a start time, and an end time are specified. These spans a three hour period. The batch period is set to 60 minutes. Which means that three files are the output and 3 hours of data must be present.

Note: To ensure that the following command does not run off the page, carriage returns are inserted. A forward slash, "/", identifies where a carriage return is added.

```
mde -u tipadmin -p tipadmin -host host.us.ibm.com -port 16315 -s 2009-12-05T00:00:00.0+0000/
   -e 2009-12-05T03:00:00.0+0000 -query ..\queries\RawTimeSeriesQuery.xml -o ..\output\ -f xml -b 60
```

The following is specified in the command:

- `-u tipadmin`: The username is set to `tipadmin`
- `-p tipadmin`: The password is set to `tipadmin`
- `-host host.us.ibm.com`: The application server name is set to `host.us.ibm.com`
- `-port 16315`: The access port is set to `16315`
- `-q queryBatchedOutput.xml`: The query file that contains the attributes and metrics to be extracted is set to `queryBatchedOutput.xml`
- `-s 2009-12-05T00:00:00.0+0000`: The start time is set to `2009-12-05T00:00:00.0+0000`
- `-e 2009-12-05T03:00:00.0+0000`: The end time is set to `2009-12-05T03:00:00.0+0000`. The end time is set to 3 hours after the start time, meaning data for 3 hours will be extracted.
- `-o ..\output\`: The output directory is set to be the `..\output\` directory.
- `-f xml`: The output format is set to be `xml`.
- `-b 60`: The batch period is set to `60`. Which means data is output at one time for each hour between the start and end time. The time span is 3 hours, so three files are output.

Query

In the following query, both attributes and metrics are defined.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<query>
  <resourcegroup>NOC Reporting</resourcegroup>
  <metric>AP~Generic~Universal~Throughput~Inbound Throughput (bps)</metric>
</query>
```
From the NOC Reporting group, the following metrics and attributes are requested:
- The AP~Generic~Universal~Throughput~Inbound Throughput (bps) metric.
- The AP~Generic~Universal~Throughput~Outbound Throughput (bps) metric.
- The AP_ifSpeed attribute.
- The AP_ifStatus attribute.
- The AP_ifType attribute.

The following is also specified:
- The queryidentifier, Raw_Timeseries is used in the naming of the output file.

**Output Excerpt**

The output is displayed in XML format.

**File 1:** with name A20091205.1200+0000_Raw_Timeseries_001.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<response>
  <result>
    <granularity>raw</granularity>
    <header>
      <measType indx="4" type="double"><![CDATA[raw(AP~Generic~Universal~Throughput~InboundThroughput (bps))]]></measType>
      <measType indx="5" type="double"><![CDATA[raw(AP~Generic~Universal~Throughput~Outbound Throughput (bps))]]></measType>
      <measType indx="6" type="string"><![CDATA[resource[AP_ifSpeed]]]]></measType>
      <measType indx="7" type="string"><![CDATA[resource[AP_ifStatus]]]]></measType>
      <measType indx="8" type="string"><![CDATA[resource[AP_ifType]]]]></measType>
    </header>
    <measInfo>
      <group><![CDATA[NOC Reporting~Devices~Interfaces~10.44.240.56]]></group>
      <id><![CDATA[10.44.240.56_If<2>]]></id>
      <time>2012-11-01T00:00:00.0+0000</time>
      <measValue indx="4">7527711.035808</measValue>
      <measValue indx="5">24179605.594996</measValue>
      <measValue indx="6"><![CDATA[1000000000]]></measValue>
      <measValue indx="7"><![CDATA[up:up]]></measValue>
      <measValue indx="8"><![CDATA[ethernetCsmacd]]></measValue>
      <resourceName><![CDATA[10.44.240.56_If<2>]]></resourceName>
      <resourceLabel><![CDATA[IF: 2 "1 Gbps" "igb0"]]></resourceLabel>
    </measInfo>
    <measInfo>
      <group><![CDATA[NOC Reporting~Devices~Interfaces~10.44.240.57]]></group>
      <id><![CDATA[10.44.240.57_If<2>]]></id>
      <time>2012-11-01T00:45:00.0+0000</time>
      <measValue indx="4">18349193.048734</measValue>
      <measValue indx="5">21186904.223568</measValue>
      <measValue indx="6"><![CDATA[1000000000]]></measValue>
      <measValue indx="7"><![CDATA[up:up]]></measValue>
      <measValue indx="8"><![CDATA[ethernetCsmacd]]></measValue>
      <resourceName><![CDATA[10.44.240.57_If<2>]]></resourceName>
      <resourceLabel><![CDATA[IF: 2 "1 Gbps" "igb0"]]></resourceLabel>
    </measInfo>
    <measInfo>
      <group><![CDATA[NOC Reporting~Devices~Interfaces~10.44.240.56]]></group>
      <id><![CDATA[10.44.240.56]]></id>
      <time>2012-11-01T00:00:00.0+0000</time>
      <measValue indx="4">7527711.035808</measValue>
      <measValue indx="5">24179605.594996</measValue>
      <measValue indx="6"><![CDATA[1000000000]]></measValue>
      <measValue indx="7"><![CDATA[up:up]]></measValue>
      <measValue indx="8"><![CDATA[ethernetCsmacd]]></measValue>
      <resourceName><![CDATA[10.44.240.56]]></resourceName>
      <resourceLabel><![CDATA[IF: 1 "1 Gbps" "igb0"]]></resourceLabel>
    </measInfo>
    <measInfo>
      <group><![CDATA[NOC Reporting~Devices~Interfaces~10.44.240.57]]></group>
      <id><![CDATA[10.44.240.57]]></id>
      <time>2012-11-01T00:45:00.0+0000</time>
      <measValue indx="4">18349193.048734</measValue>
      <measValue indx="5">21186904.223568</measValue>
      <measValue indx="6"><![CDATA[1000000000]]></measValue>
      <measValue indx="7"><![CDATA[up:up]]></measValue>
      <measValue indx="8"><![CDATA[ethernetCsmacd]]></measValue>
      <resourceName><![CDATA[10.44.240.57]]></resourceName>
      <resourceLabel><![CDATA[IF: 1 "1 Gbps" "igb0"]]></resourceLabel>
    </measInfo>
  </result>
</response>
```

**File 2:** with name A20091205.0100+0000_Raw_Timeseries_002.xml
Each output file covers one hour as set in the batch period.

The five index headers are stated at the beginning so they are not repeated throughout the output file. All are wrapped in the <header> tag.

It must be noted that the headers that describe the metrics are wrapped in the raw(...) statistical wrapper. The reason for this is no aggregation operations were supplied, and, therefore, raw data is the output.

All measurement information is wrapped in the <measInfo> tags.

**Alias**

The MDE alias command-line example.

**Purpose**

The purpose of this example to demonstrate how you can add custom names to metrics and attributes to be displayed in the MDE output.

As with all our MDE examples there are two parts that are required to gain the required output:

- The command, The command, where the details of the application server, access credentials, timing are supplied.
- The query, where you can specify the wanted metrics and attributes, sorting, and aliasing.

As part of this MDE example a short excerpt from the output file is displayed.

**Command line**

*Note:* To ensure that the following command does not run off the page, carriage returns are inserted. A forward slash, “/”, identifies where a carriage return is added.

```
mdc -u tipadmin -p tipadmin -host host.us.ibm.com -port 16315 -s 2009-12-05T00:00:00.000+0000/ -e 2009-12-05T03:00:00.000+0000 -query ..\queries\AliasedRawTimeSeriesQuery.xml -o ..\output\ -f xml
```

The following is also specified in the command:
-u tipadmin: The username is set to tipadmin.
-p tipadmin: The password is set to tipadmin.
-host host.us.ibm.com: The application server name is set to host.us.ibm.com.
-port 16315: The access port is set to 16315.
-query ..\queries\AliasedRawTimeSeriesQuery.xml: The query file that contains the attributes and metrics to be extracted is set to AliasedRawTimeSeriesQuery.xml.
-s 2009-12-05T00:00:00.0+0000: The start time is set to 2009-12-05T00:00:00.0+0000.
-e 2009-12-05T03:00:00.0+0000: The end time is set to 2009-12-05T03:00:00.0+0000.
-o ..\output\: The output directory is set to be the ..\output\ directory.
-f xml: The output format is set to be xml.

Query

In the following query all defined metrics and attributes are given an alias.

Note: To ensure that the following command does not run off the page, carriage returns are inserted. A forward slash, "/", identifies where a carriage return is added.

<?xml version="1.0" encoding="UTF-8"?>
<query>
  <resourcegroup><![CDATA[NOC Reporting]]></resourcegroup>
  <metric alias="ap.gen.uni.thr.in"><![CDATA[AP~Generic~Universal~Throughput~Inbound / Throughput (bps)]]></metric>
  <metric alias="ap.gen.uni.thr.out"><![CDATA[AP~Generic~Universal~Throughput~Outbound / Throughput (bps)]]></metric>
  <attribute alias="ap.ifspeed"><![CDATA[AP_ifSpeed]]></attribute>
  <attribute alias="ap.ifstatus"><![CDATA[AP_ifStatus]]></attribute>
  <attribute alias="ap.iftype"><![CDATA[AP_ifType]]></attribute>
  <queryidentifier>Aliased_Raw_TimeSeries</queryidentifier>
</query>
</query>

From the NOC Reporting group, the following attributes are requested:
- The AP~Generic~Universal~Throughput~Inbound Throughput (bps) metric. Which is given in the alias ap.gen.uni.thr.in by using the alias element attribute.
- The AP~Generic~Universal~Throughput~Outbound Throughput (bps) metric. Which is given in the alias ap.gen.uni.thr.out by using the alias element attribute.
- The AP_ifSpeed attribute. Which is given in the alias ap.ifspeed by using the alias element attribute.
- The AP_ifStatus attribute. Which is given in the alias ap.ifstatus by using the alias element attribute.
- The AP_ifType attribute. Which is given in the alias ap.iftype by using the alias element attribute.

Output Excerpt

<?xml version="1.0" encoding="UTF-8"?>
<response>
  <result>
    <granularity>raw</granularity>
    <header>
      <measType index="4" type="string"><![CDATA[resource[AP_ifSpeed]]]></measType>
      <measType index="5" type="string"><![CDATA[resource[AP_ifStatus]]]></measType>
      <measType index="6" type="string"><![CDATA[resource[AP_ifType]]]></measType>
    </header>
  </result>
</response>
The five index headers are stated at the beginning so they are not repeated throughout the output file. All are wrapped in the <header> tag and contain the aliases as set in the query file.

All measurement information is wrapped in the <measInfo> tags. All information is sorted by time in ascending order.

### Configuring additional element data

The configuring additional element data MDE example.

### Purpose

The purpose of this example to demonstrate how you can use Name, Type and Result query element attributes to add a name or type elements to your result set.

As with all our MDE examples there are two parts that are required to gain the required output:

- The command, The command, where the details of the application server, access credentials, timing are supplied.
- The query, where you can specify the wanted metrics and attributes, sorting, and aliasing.

As part of this MDE example, a short excerpt from the output file is included.
**Command line**

**Note:** To ensure that the following command does not run off the page, carriage returns are inserted. A forward slash, "/", identifies where a carriage return is added.

```
mde.bat -u tipadmin -p tipadmin -host host1-host3.us.ibm.com -port 16315 -s 2009-12-05T00:00:00.0+0000/ -e 2009-12-05T03:00:00.0+0000 -query ..\queries\AdvancedTimeSeriesQuery.xml -o ..\output\ -f xml
```

The following is also specified in the command:

- `-u tipadmin`: The username is set to `tipadmin`.
- `-p tipadmin`: The password is set to `tipadmin`.
- `-host host.us.ibm.com`: The application server name is set to `host.us.ibm.com`.
- `-port 16315`: The access port is set to 16315
- `-query ..\queries\AdvancedTimeSeriesQuery.xml`: The query file that contains attributes and metrics to be extracted is set to `AdvancedTimeSeriesQuery.xml`.
- `-s 2009-06-01T12:00:00.0+0300`: The start time is set to `2009-06-01T12:00:00.0+0300`.
- `-e 2009-06-02T12:00:00.0+0300`: The end time is set to `2009-06-02T12:00:00.0+0300`.
- `-o ..\output\`: The output directory is set to be the `..\output\` directory.
- `-f xml`: The output format is set to be xml.

**Query**

In the following query the name, type and result element attributes are used to add new name and type element and to remove certain elements from the output result set.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<query>
  <resourcegroup>NOC Reporting~Interfaces~Bit Throughput~ethernetCsmacd</resourcegroup>
  <metric>AP~Generic~Universal~Throughput~Inbound Throughput (bps)</metric>
  <metric>AP~Generic~Universal~Throughput~Outbound Throughput (bps)</metric>
  <attribute type="true" result="false">AP_ifSpeed</attribute>
  <attribute name="true">AP_ifStatus</attribute>
  <attribute>AP_ifType</attribute>
  <queryidentifier>Advanced</queryidentifier>
</query>
```

From the NOC Reporting~Interfaces~Bit Throughput~ethernetCsmacd group the following attributes and metrics are requested:

- The `AP"Generic"Universal"Throughput"Inbound Throughput (bps)` metric.
- The `AP"Generic"Universal"Throughput"Outbound Throughput (bps)` metric.
- The `AP_ifSpeed` attribute. Which has the type attribute element that is set to true, which means the result is repeated in the output as a `<type>` element. However, as result element attribute is set to false, the line is omitted as a result from the output.
- The `AP_ifStatus` attribute. Which has the name attribute element that is set to true, which means the result output is as a `<name>` element.
- The `AP_ifType` attribute.

**Output Excerpt**

The output is displayed in XML format.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<response>
  <result>
```
Despite the query that defines two metrics and three attributes only four index headers are stated. That is because one of the attributes that are mentioned in the query had their Result element attribute that is set to false. The index headers are stated at the beginning so they are not repeated throughout the output file.

All measurement information is wrapped in the <measInfo> tags.

The result of the metric that had its Type element attribute that is set to true, AP_ifSpeed, is displayed wrapped in the <type> tag, <type> <![CDATA[100000000]]> </type>. Its result element attribute is set to false, which means it is included in the output as a result.

The result of the metric that had its name element attribute that is set to true, AP_ifStatus, is displayed wrapped in the <name> tag, <name> <![CDATA[up:up]]> </name>.

If an attribute or metric is not present for a specific time or group it is not displayed, for this reason, the <name> is missing from the result set that is displayed in the output excerpt.
Chapter 5. MDE security

MDE can be configured so that it operates over a secure channel.

Security is set up for MDE by creating a secure connection to a Tivoli Integrated Portal hosted service.

The basic requirements of a secure MDE environment are
- Tivoli Integrated Portal Server, with Dataview installation
- MDE deployment
- JRE installation for MDE

Enabling MDE security

To use the MDE over a secured channel:

1. Download the security certificate from the Tivoli Integrated Portal server
2. Add the security certificate to the local JRE keystore.
3. Specify the secure port number when you are running the MDE from the command-line interface.

   It is the standard port that is used for secure access, requiring the certificate to be available on the client workstation.

   Note: By default it is 16316, but it can be changed at the time of installation.

Getting the security certificate from the Tivoli Integrated Portal server

The first step in enabling MDE security is to download the security certificate from the Tivoli Integrated Portal server.

Procedure

1. Log on to Tivoli Integrated Portal as administrator. Typically:
   - Username: tipadmin
   - Password: tipadmin
2. In the left (navigation) pane, click Setting > WebSphere Administrative Console. It opens the Websphere Administration Console
3. Click Launch Websphere administrative console.
4. Click Security > SSL certificate and key management.
5. Click Manage endpoint security configurations under the heading Configuration settings. Local Topology tab is displayed.
6. Under the Local Topology tab, click Inbound > TIPCell > notes > TIPNode(NodeDefaultSSLSettings.null). This is the TIPNode view
7. In the TIPNode view, click the Manage certificates. Personal certificates view is displayed.
8. Select the default check box from the table shown.
9. Click extract. Extract certificate view is displayed.
10. In the Configuration tab, under the heading General Properties, in the Certificate file name field, add the local file system path and name where the certificate must be downloaded. For example, NT C:\temp\mdeCert.cer
11. Click Apply.
12. Verify on the file system that the file C:\temp\mdeCert.cer is created.

---

**Import security certificate to the JRE Keystore**

The certificate that is downloaded when you enable MDE security must be imported into the JRE Keystore.

**Procedure**

1. Locate the keystore location in the JRE.
   - Typically this keystore is at JAVA_HOME\jre\lib\security\cacerts.
   - The keytool that is used to access the keystore is typically installed with the JRE and ready to use.
2. Run the standard keytool to import the certificate, from JAVA_HOME\jre\lib\security.
   - `keytool -import -trustcacerts -alias mdecert -file C:\temp\mdeCert.cer -keystore cacerts`
3. When prompted **Enter keystore password**: enter "changeit".
   - By default keystores have a password of "changeit"
4. When prompted **Trust this certificate? [no]**, enter "yes".
   - This imports the certificate into the keystore and display the message: "Certificate was added to keystore".
MDE can be configured to access data through a firewall.

To enable MDE to access a database protected by a firewall, follow these steps:
1. Configure your firewall so that access to the DB port is enabled. This allows the MDE instance to have direct access to the database.
2. Use the MDE CLI host and port to identify the correct host and port connection.

**Actions taken by the MDE**

The MDE does the following actions:
1. The MDE connects to the server and downloads a configuration file. Within this configuration files, there are two information sets required by the MDE:
   - The names of the DAR files (impl of DAL queries) and the timestamp the DAR files were last modified.
   - The DAL data source information, as it is configured on the application server, which includes the DB url, user and password data.
2. The MDE uses this configuration data to:
   - Download the lasted DAR file implementations. A comparison is made between the timestamp on the local copy and that on the server file. If the timestamps differ, then the latest version of the DAR file is downloaded.
   - Configure the MDE DAL to connect directly to the Database.
Chapter 7. ETL integration

The MDE utility can integrate with any Extraction, Transformation, and Loading (ETL) that supports JDBC.

MDE can be associated with a full Extraction, Transformation, and Loading (ETL) chain, through integration with existing ETL tooling, for example, DataStage.

MDE can support integration with an ETL Server by providing a wrapper class for the MDE Engine class that extends the com.ascentialsoftware.jds.Stage class. This allows the MDE Engine to be used as a Java client stage, supporting one output link for writing data, within an ETL Job.

As the implemented Engine Stage gets its inputs as stage properties, it is known as a source stage, the primary job of which is to provide data to the output link.

The class provided by the MDE to act as a Java client stage is:

Note: Please see Appendix A, “ETL Integration Example: DataStage Integration,” on page 43 for a full example of ETL integration using DataStage.
Appendix A. ETL Integration Example: DataStage Integration

This example describes how to integrate MDE with DataStage.

DataStage setup

To use the 1.3.2 version of the MDE as a java client within DataStage to connect to a 1.3.2 TNM server instance, you must use DataStage 8.5.

- **DataStage server version**: The current version of the DataStage Server used by development is DataStage V8.5, this server is deployed as a managed server within the Information Server V8.5 framework.
- **DataStage designer client version**: Websphere DataStage Designer Client V8.5 installed in a Windows development environment. This client is used to create and configure DataStage jobs.

Deploying MDE to server

The runtime resources for the MDE are available on a new Tivoli Netcool Performance Manager build/distribution at /SOLARIS/DataView/SOL10/misc/mde/mde.tar.

The mde.tar needs to be untarred on the server where the Engine Stage job will run.

Setting up an MDE engine stage instance

To achieve DataStage integration you must set up an MDE engine stage instance within DataStage.

Procedure

1. Login into DataStage Designer Client.
2. Create a Parallel Job.
3. Create a Java Client Stage.
4. Create a Sequential File Stage.
5. Link the Java Client Stage to the Sequential File Stage.
6. Configure the Java Client Stage to use Engine Stage implementation as follows:
   a. Set EngineStage as the implementation class. This is the class that is responsible for generating output data: com.ibm.tivoli.tnpn.dal.mde.client.datastage.EngineStage.
   b. Set the Java runtime classpath to include MDE resources from mde.tar
      - /opt/oracle/product/10.2.0/jdbc/lib/ojdbc14.jar

   **Note**: This file can be taken from the Oracle server and using ftp placed on the DataStage server.
      - $MDE_INSTALL/lib/mde.jar
      - $MDE_INSTALL/lib/datalet.jar
      - $MDE_INSTALL/lib/commons-codec-1.3.jar
      - $MDE_INSTALL/lib/commons-jexl-1.1.jar
      - $MDE_INSTALL/lib/commons-logging-1.1.1.jar
c. Set JVM Options.

d. Load Engine parameters, using the property file utility.

The runtime parameters for the Engine are loaded from the user properties client configuration utility, and are set as follows:

- `engine.user` Login username mandatory
- `engine.password` Login password mandatory
- `engine.host` Host server mandatory
- `engine.port` Host port mandatory
- `engine.query.file` Query configuration file mandatory
- `engine.start.time` Start time for the query
- `engine.end.time` End time for the query

**Note:** These parameters are the same as those used by the MDE CLI.

7. Configure the Output Format:

To consume the data generated by the Engine Stage, the product result set metadata must be configured. The content of the result set is directly related to attributes and metrics present in each MDE query file instance.

By using the CLI schema format flag option, you can get the MDE to create a Datastage Table Definition schema file, for a query instance, as demonstrated in the following command:

**Note:** To ensure that the following command does not run off the page, carriage returns are inserted. A forward slash, "/", identifies where a carriage return is added.

```
mde.bat -u tipadmin -p tipadmin -host host.us.ibm.com -port 16315 /
-query timeSeriesQuery.xml -format schema -o .
generatedschema\n```

**Note:** Due to Datastage naming constraints, attribute and metric names from the query file may be normalized in the generated table definition schema file. The generated table definition schema file can be imported by Datastage as a table definition. To import the table definition schema do the following in the Datastage Designer menu:

a. Click **Import > Table Definitions > Orchestrate Schema Definitions**.

b. Enter location of generated schema file.

Once a table definition schema file is imported it can be associated with a java client, using the following steps in the Datastage Designer:

a. Select the **Parallel Job**.

b. Select the **Java Client Stage**

c. Select **Output** tab

d. Select **Columns** tab

e. Click the **Load** button

f. Navigate the **Table Definitions** tree node, to select the imported table definition schema
Engine Stage workflow

The Engine Stage when invoked will follow three steps.

Procedure

1. Initialize:
   When the Engine Stage is initialized, it instantiates an MDE Engine object with a list of properties, these are the Engine parameters provided to the stage at design time.
   If the Engine parameters are correct, the Engine executes, returning a JDBC result set representing the query results.

2. Process:
   Each row of the result set returned from the Engine is processed, and the contents of each record copied directly to a com.ascentialsoftware.jds.Row object, which is output by the Engine Stage for further use within the job.

3. Terminate:
   The result set is closed.

Running the engine stage

When the Engine Stage has been created and configured, then the job must be compiled within the Datastage Designer Client before it can be executed.

About this task

When the Engine Stage Job is in a compiled state, it can be run and monitored within the client.

Procedure

2. Set up the environment:
   ./dsenv
3. Run a compiled Job:
   ./bin/dsjob -run mdeproject ResourceSnapshot
4. Check the job status:
   ./bin/dsjob -jobinfo mdeproject TimeSeries
Appendix B. Query Schema XSD

The Query schema file.

Schema

The following is the XML schema definition.

Note: To ensure the following command does not run off the page, carriage returns have been inserted. A forward slash, "/", identifies where a carriage return has been added.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<!--
Licensed Materials - Property of IBM
5724-W86, 5724-X63
© Copyright IBM Corporation 2010. All Rights Reserved.
US Government Users Restricted Rights- Use, duplication or disclosure
restricted by GSA ADP Schedule Contract with IBM Corp.
-->
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  elementFormDefault="qualified"
  attributeFormDefault="qualified">
  <xsd:annotation>
    <xsd:documentation>MDE (massive data extractor) data query</xsd:documentation>
    <xsd:appinfo></xsd:appinfo>
  </xsd:annotation>
  <xsd:element name="query">
    <xsd:annotation>
      <xsd:documentation></xsd:documentation>
    </xsd:annotation>
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element name="resourcegroup" type="xsd:string" minOccurs="1" maxOccurs="1"/>
        <xsd:choice minOccurs="1" maxOccurs="unbounded">
          <xsd:element name="metric" type="MetricType"/>
          <xsd:element name="attribute" type="AttributeType"/>
        </xsd:choice>
        <xsd:element name="granularity" type="GranularityType" minOccurs="0" maxOccurs="1"/>
        <xsd:element name="hint" type="HintType" minOccurs="0" maxOccurs="2"/>
        <xsd:element name="queryidentifier" type="NormalizedstringType" minOccurs="1" maxOccurs="1"/>
      </xsd:sequence>
    </xsd:complexType>
  </xsd:element>
  <!-- Normalized String Type -->
  <xsd:simpleType name="NormalizedstringType">
    <xsd:restriction base="xsd:string">
      <xsd:pattern value="([a-z][A-Z][0-9]|\[\-\])+"/>
    </xsd:restriction>
  </xsd:simpleType>
  <!-- Metric Type -->
  <xsd:complexType name="MetricType">
    <xsd:simpleContent>
      <xsd:extension base="xsd:string">
        <xsd:attribute name="alias" type="xsd:string"/>
      </xsd:extension>
    </xsd:simpleContent>
  </xsd:complexType>
  <!-- Attribute Type -->
  <xsd:complexType name="AttributeType">
    <xsd:simpleContent>
      <xsd:extension base="xsd:string">
        <xsd:attribute name="alias" type="xsd:string"/>
      </xsd:extension>
    </xsd:simpleContent>
  </xsd:complexType>
</xsd:schema>
```
<xsd:complexType name="GranularityType">
  <xsd:documentation>Granularity types for mde</xsd:documentation>
  <xsd:restriction base="xsd:string">
    <xsd:enumeration value="5min"/>
    <xsd:enumeration value="10min"/>
    <xsd:enumeration value="15min"/>
    <xsd:enumeration value="20min"/>
    <xsd:enumeration value="30min"/>
    <xsd:enumeration value="1hour"/>
    <xsd:enumeration value="2hour"/>
    <xsd:enumeration value="3hour"/>
    <xsd:enumeration value="day"/>
    <xsd:enumeration value="week"/>
    <xsd:enumeration value="month"/>
  </xsd:restriction>
</xsd:simpleType>

<!-- Granularity Type -->
<xsd:simpleType name="HintType">
  <xsd:documentation>Hint content is restricted to the following options</xsd:documentation>
  <xsd:restriction base="xsd:string">
    <xsd:enumeration value="ascending(resource)"/>
    <xsd:enumeration value="descending(resource)"/>
    <xsd:enumeration value="ascending(time)"/>
    <xsd:enumeration value="descending(time)"/>
    <xsd:enumeration value="includeNearRealTime"/>
  </xsd:restriction>
</xsd:simpleType>
Appendix C. Result Schema XSD

The Result schema file.

Schema

The following is the XML schema definition.

Note: To ensure the following command does not run off the page, carriage returns have been inserted. A forward slash, "/", identifies where a carriage return has been added.

```xml
<?xml version="1.0" encoding="utf-8" ?>
<!--
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-->
<xs:schema attributeFormDefault="unqualified" elementFormDefault="qualified" id="response"
xmlns:xs="http://www.w3.org/2001/XMLSchema">
  <!-- Response Element -->
  <xs:element name="response">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="result" type="resultType" />
      </xs:sequence>
    </xs:complexType>
  </xs:element>
  <!-- headerType -->
  <xs:complexType name="headerType">
    <xs:sequence>
      <xs:element name="measType" type="measTypeType" maxOccurs="unbounded" />
    </xs:sequence>
  </xs:complexType>
  <!-- measTypeType -->
  <xs:complexType name="measTypeType" mixed="true">
    <xs:attribute name="indx" type="xs:string" />
  </xs:complexType>
  <!-- measValueType -->
  <xs:complexType name="measValueType" mixed="true">
    <xs:attribute name="indx" type="xs:string" />
  </xs:complexType>
  <!-- measInfoType -->
  <xs:complexType name="measInfoType">
    <xs:sequence>
      <xs:element name="id" type="xs:string" minOccurs="1" />
      <xs:element name="group" type="xs:string" minOccurs="1" />
      <xs:element name="measValue" type="measValue Type" maxOccurs="unbounded" />
      <xs:element name="time" type="xs:string" minOccurs="1" />
      <xs:element name="type" type="xs:string" minOccurs="0" />
      <xs:element name="name" type="xs:string" minOccurs="0" />
    </xs:sequence>
  </xs:complexType>
  <!-- resultType -->
  <xs:complexType name="resultType">
    <xs:sequence>
      <xs:element name="granularity" type="xs:string" />
      <xs:element name="header" type="headerType" />
      <xs:element name="measInfo" type="measInfoType" maxOccurs="unbounded" />
    </xs:sequence>
  </xs:complexType>
</xs:schema>
```
</xs:sequence>
</xs:complexType>
</xs:schema>
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