



Cisco WAE Live 6.3 Administration Guide

November, 2015

Cisco Systems, Inc.

www.cisco.com

Cisco has more than 200 offices worldwide. Addresses, phone numbers, and fax numbers are listed on the Cisco website at www.cisco.com/go/offices.

THE SPECIFICATIONS AND INFORMATION REGARDING THE PRODUCTS IN THIS MANUAL ARE SUBJECT TO CHANGE WITHOUT NOTICE. ALL STATEMENTS, INFORMATION, AND RECOMMENDATIONS IN THIS MANUAL ARE BELIEVED TO BE ACCURATE BUT ARE PRESENTED WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. USERS MUST TAKE FULL RESPONSIBILITY FOR THEIR APPLICATION OF ANY PRODUCTS.

THE SOFTWARE LICENSE AND LIMITED WARRANTY FOR THE ACCOMPANYING PRODUCT ARE SET FORTH IN THE INFORMATION PACKET THAT SHIPPED WITH THE PRODUCT AND ARE INCORPORATED HEREIN BY THIS REFERENCE. IF YOU ARE UNABLE TO LOCATE THE SOFTWARE LICENSE OR LIMITED WARRANTY, CONTACT YOUR CISCO REPRESENTATIVE FOR A COPY.

The Cisco implementation of TCP header compression is an adaptation of a program developed by the University of California, Berkeley (UCB) as part of UCB's public domain version of the UNIX operating system. All rights reserved. Copyright © 1981, Regents of the University of California.

NOTWITHSTANDING ANY OTHER WARRANTY HEREIN, ALL DOCUMENT FILES AND SOFTWARE OF THESE SUPPLIERS ARE PROVIDED "AS IS" WITH ALL FAULTS. CISCO AND THE ABOVE-NAMED SUPPLIERS DISCLAIM ALL WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, THOSE OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT OR ARISING FROM A COURSE OF DEALING, USAGE, OR TRADE PRACTICE.

IN NO EVENT SHALL CISCO OR ITS SUPPLIERS BE LIABLE FOR ANY INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES, INCLUDING, WITHOUT LIMITATION, LOST PROFITS OR LOSS OR DAMAGE TO DATA ARISING OUT OF THE USE OR INABILITY TO USE THIS MANUAL, EVEN IF CISCO OR ITS SUPPLIERS HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Cisco and the Cisco logo are trademarks or registered trademarks of Cisco and/or its affiliates in the U.S. and other countries. To view a list of Cisco trademarks, go to this URL: www.cisco.com/go/trademarks. Third-party trademarks mentioned are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (1110R)

Any Internet Protocol (IP) addresses and phone numbers used in this document are not intended to be actual addresses and phone numbers. Any examples, command display output, network topology diagrams, and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental.

© 2015 Cisco Systems, Inc. All rights reserved.



CHAPTER 1**Overview 1-1**

- Network Data 1-1
- Troubleshooting 1-2
- Related Topics 1-2

CHAPTER 2**Multi-Network Management 2-1**

- Active vs. Offline Networks 2-1
- Add Network 2-1
- View or Edit Networks 2-2
- Delete Networks 2-2
- Related Topics 2-2

CHAPTER 3**General Settings 3-1**

- Multi-Network Collection 3-1
- Application Data 3-1
 - Required Fields 3-1
- Data Collection 3-2
 - Required Fields 3-2
 - Optional Fields 3-3
 - Related Configurations 3-3
- Reports 3-3
- Related Topics 3-4

CHAPTER 4**Map Settings 4-1**

- Configure Traffic Panel 4-1
 - Traffic Widget Fields 4-2
- Configure Events Panel 4-2
 - Events Widget Fields 4-3
- Related Topics 4-3

CHAPTER 5

User-Defined Properties 5-1

Add Property Fields 5-1

Regular Expression Functions 5-2

CASE Statements 5-3

Expression Syntax 5-3

Related Topics 5-5



Overview

This guide is for administrators who are configuring and managing the WAE Live application. You must have an admin role assigned to configure WAE Live from the web UI.

- [Multi-Network Management](#)—Describes how to add, edit, and delete networks, as well as how to set their status to active or offline.
- [General Settings](#)—Describes how to configure WAE Live to get plan files from the Collector server, WAE Network Interface (NI) server, or an external archive, and how to set default interface types to use in reports.
- [Map Settings](#)—Describes how to configure the Map page, including its panels.
- [User-Defined Properties](#)—Describes how to create user-defined properties for use in Explore and Analytics.



Note

For information on configuring collection, see the *WAE Platform Configuration Guide*.



Note

`$WAE_ROOT` is directory in which the software is installed. On Linux, the default `$WAE_ROOT` is `/opt/cariden`. (`$WAE_ROOT` and `$CARIDEN_ROOT` are the same.) `$CARIDEN_HOME` is the directory in which the WAE Design, WAE Live, and WAE Collector executables and binaries are installed. On Linux, the default is `/opt/cariden/software/mate/current`.

Network Data

WAE Live data is collected from WAE Collector, which can include the creation and addition of a simulated demand traffic matrix. The data is stored in *plan files*. WAE Live uses two internal mechanisms, a time-series optimized datastore and an internal archive, to store this data and make available for use in the application. The Map component shows the visualization of these plan files in a weathermap layout. The Explore and Analytics components access the datastore.

To enhance the visualization of these plan files, you can create and edit multiple plan file *layouts* using the WAE Design GUI. After saving the plan file as a template back to WAE Live, it is applied to the most recently collected plan file and stored for use in the Map.

Troubleshooting

- Relevant log files are located in `$WAE_ROOT/logs/wae-live` and `$WAE_ROOT/logs/wae-web-server`, where `$WAE_ROOT` is the installation directory. By default, the installation directory is `/opt/cariden`. You can also access log files from the Statistics UI.
- There may be times when the collection status (accessed by clicking Check Status on the Settings > General Settings page) shows no errors, but the number of plan files being collected does not increase. To troubleshoot this and other plan file insertion issues, use the `ml_insert_ctl` tool. For information, see `ml_insert_ctl -help`.
- If you need to contact a support representative, use the `mate_tech_support` tool to create a tar file of support information. The output is put into the `/tmp/MATE_TS` directory by default. To change the directory in which the results are stored, use the `-tar-path` option.

Example: This creates a tar file of support information and puts the output into the `/troubleshooting` directory.

```
mate_tech_support -tar-path /troubleshooting
```

Related Topics

- *WAE Platform Configuration Guide*
- *WAE System Administration Guide*
- *WAE Network Visualization Guide*
- *WAE Live User Guide*
- *WAE Design Integration and Development Guide*
- *WAE Plan Table Schema and CLI Reference*



Multi-Network Management

Access: WAE Live > Settings

WAE Live supports multiple networks. If there is only one network, the Network list (top left) shows “default” as the name of the default network. If there are multiple networks, the name of the network that is in use shows.

To configure collections for a specific network, first create it and configure the Map archive and data collection source while that network is selected. For information, see the [General Settings](#) chapter.

Once you create a network, all users have access to its data through the Explore, Analytics, and Map components.

You must have an admin role to create and manage networks.

Active vs. Offline Networks

Each network is manually set to either an Active or Offline state.

- Active—Data can be collected for this network, and the network is visible to all users.
- Offline—Data cannot be collected for this network, and the network is not visible to users.

If you configure collection for an active network, set it to offline, and then later change it back to active, collection restarts automatically.

Add Network

If you have not run collections for a network and configured WAE Live to display the network’s information (on the General Settings page), any newly added networks have no data.

-
- Step 1** Click the Network icon located in the top left. Initially, this says “default.”
 - Step 2** Select Network Manager.
 - Step 3** Click Add.
 - Step 4** Enter a unique network to identify the network from which you are collecting.
 - If collecting from an external archive, this name does not have to be identical to the archive, but best practice is to use a name that identifies the network.

- If collecting from the use of `ml_insert_plan`, the network name must be the same as the one used in the `ml_insert_plan -network` option.
- Step 5** Optional: Enter a description of the network or other useful notes about the network.
- Step 6** Set the status, and then click Save.
-

View or Edit Networks

- Step 1** From the Settings page, select Network Manager from the list of available networks. A list of active and non-active networks appears.
- Step 2** Click the network name that you want to edit.
- Step 3** Enter your changes, and click Update.
-

Delete Networks

If you delete a network and add it back at a later time, you must reconfigure its collection.

- Step 1** From the Settings page, select Network Manager from the list of available networks. A list of active and non-active networks appears.
- Step 2** Click the network name that you want to delete.
- Step 3** Click Delete, and then click OK to confirm the deletion.
-

Related Topics

- [General Settings](#) chapter
- *WAE Platform Configuration Guide*



General Settings

Access: WAE Live > Settings and select General Settings tab

The General Settings page enables you to configure where the Map archive plan files are stored, how often to collect the data and from where, status of the latest data set collected, and which interface types are used in reports.



Note

For information on configuring collection, see the *WAE Platform Configuration Guide*.

Multi-Network Collection

The Application Data and Collection Data sections are applicable on a per-network basis. Prior to configuring or making changes to either of these sections, select the appropriate network from the Network list (top left).

Multi-network collection is only supported in the following instances.

- The Collection Source is External Archive wherein a snapshot was configured to use `archive_insert` to insert data into that external archive.
- The Collection Source is None wherein a snapshot was configured to use `ml_insert_plan` to insert data into the datastore and to use `archive_insert` to insert plan files into the Map archive.

For information on configuring multiple networks, see the [Multi-Network Management](#) chapter.

Application Data

Use the Application Data section to configure where to put plan files used by the Map component so that WAE Live can extract them.

Required Fields

- **Map Archive**—The local directory in which collected plan files and the template file (`template.pln`) are stored for display in the Map. You must configure a unique Map archive for each network, and it is required only if using the Map component for that network.

If you are manually inserting plan files into the Map archive, this must match the case-sensitive path used in the `MAP_ARCHIVE_INSERT` task (that calls `archive_insert`).

WAE Live automatically creates the `template.pln` file from the most recently collected plan file if no template exists. To create the visual elements of a template file and save it to this location, use the WAE Design GUI. (For information, see the *WAE Network Visualization Guide*.) If visual elements have not been applied, the plan file is visualized in the default, unprocessed state.

**Note**

If you are using an external archive for the collection method, the Map archive must be a different location than that of the external archive.

Data Collection

Data collection is the process of getting the plan files from WAE Collector and storing them in the internal datastore.

This area identifies the source and status of data collection. For the WAE Network Interface (NI) server, it also identifies the frequency of collection.

By default, WAE Live checks for a plan file every 30 seconds. The `Insertplan.Source.Pollfrequency` property in the Advanced Config feature sets this default. If none is defined, the default applies.

- If using the Collector server, WAE Live receives the plan file at this interval only if it has been updated with changes.
- If using the WAE NI server, WAE Live receives the plan file based on the value in the Frequency field regardless of whether it has changed.

**Note**

There may be times when the collection status (accessed by clicking Check Status) shows no errors, but the number of plan files being collected does not increase. To troubleshoot this and other plan file insertion issues, use the `ml_insert_ctl` tool. For information, see `ml_insert_ctl -help`.

Required Fields

You must select one of these source options.

- Server—Use a server to collect the data. This can be the Collector server or the WAE NI server. The server must be running.
 - Server URL—The location of the server. The format is `https://<server_IP>:<port>`. The default port for the Collector server is 8443, and the default port for the WAE NI server is 8086.
Example: `https://10.0.0.1:8086`
 - Username—An administrative username for the server.
 - Password—The password for the username of the server.

The Collector server username and password are set in the System > User Management page and require an admin role. For information, see the *WAE System Administration Guide*. For assistance with the WAE NI server password, contact your support representative.

- External Archive—Select this option if you are collecting data through an augmented snapshot or a manual snapshot. The archive must exist. That is, you must have created the archive using `archive_init` and that path and the one entered here must be the same. This must be a different location than the map archive.

If using external archives for multiple networks, each network must have a unique archive location.

- None—Do not collect data. If you are collecting data through snapshots and if you are manually inserting data into WAE Live using `ml_insert_plan`, select this option. For snapshots, however, the recommendation is to use the External Archive option.

Additionally, you must identify the frequency to check for and receive plan files, and whether you are using the WAE NI server.

- Continuous—Identifies whether to collect plan files from the WAE NI server or not.
- Frequency—The frequency, in minutes, in which WAE Live receives the plan file from the WAE NI server. WAE Live receives the plan file regardless of whether it has been updated. The value must be a factor of 60 (1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60). The recommended value is 15 minutes.

Optional Fields

- Check Status—Shows the status of the most recently collected data by WAE Live.
- Advanced Config—This is for advanced configuration editing only. Consult your support representative for assistance.

Related Configurations

Inventory

This page must be configured to collect the plan files containing topology and statistics for the same network used in the inventory collection process. WAE Live must get these plan files from the same server as does the inventory collection process.

Given the inventory collection process gets this same plan file (`collector_getplan`) and inserts the inventory into the same network (`ml_insert_ctl -network`), there are no required inventory configurations on the WAE Live Settings > General Settings page.



Note

These networks must be the same: the network for which WAE Live is configured to get plan files and the network into which the inventory is inserted.

Reports

In this section, specify the default interface type showing on the Explore Interface page. These can then be used in reports on selected interfaces of one or more types. Note that this is not configurable on a per-network basis.

- Individual physical interface—An interface that is not in a LAG and does not have an IP address. These interface names do not have a decimal.

Example: `so-0/2/2, g2/0/0`

- Individual logical interface—An interface with an IP address that is not in a LAG. These names might have a decimal.

Example: `et-0/1/2.0, g2/0/0`

- LAG logical interface—An interface with an IP address that contains member interfaces.

Examples: ae0.0, Bundle-Ether1, Port-Channel7

- LAG physical interface—The physical representation of an aggregated interface to which a LAG logical interface (such as ae0.0) is assigned.

Example: ae0 for Juniper interfaces

- LAG member interface—An interface that is in a LAG.

Example: g2/0/0

- Unknown—None of the above interface types.

Related Topics

- [Multi-Network Management](#) chapter
- [Map Settings](#) chapter
- [User-Defined Properties](#) chapter
- *WAE Platform Configuration Guide*
- *WAE Network Visualization Guide*
- *WAE System Administration Guide*



Map Settings

Access: WAE Live > Settings and select Map Settings tab

The Map Settings page enables you to configure the WAE Live Map panels, as well as set a default layout for the weathermap.

The Map Settings configurations are applicable to all networks and are not configurable for a specific network.

Configure Traffic Panel

The Traffic Widget section enables you to configure the Peering panel that appears on the Map page. This panel shows the highest traffic utilization per peer and per site. The far left column lists the peers, while each top column lists the associated sites. The icons in the panel represent the traffic flowing between the two.

For this panel to have data, you must configure the collection of BGP. For information on how to configure the collection of data, see the *WAE Platform Configuration Guide*.



Traffic Widget Fields

- **Enabled**—If selected, the panel shows in the Map page. If not selected, the panel does not appear.
- **Title**—Name of the panel to appear on the Map page.
- **Rows**—Configure the ASNs (external peers) used in the panel. Their names appear on the left side of the panel. Each ASN represents a row in the panel.
 - **Top ___ ASNs by Traffic Utilization**—The ASNs with the highest traffic utilization. Enter a whole number 1-20.
 - **Except**—To exclude specific ASNs that would be captured by the highest utilization, enter one or more ASNs separated by commas.
 - **Only These**—To use only a specific set of ASNs, regardless of their traffic utilization, enter one or more ASNs separated by commas.
- **Columns**—Configure the sites used in the panel. Their names appear across the top of the panel. Each site represents a column in the panel.
 - **Top ___ Sites by Traffic Utilization**—The sites with the highest traffic utilization. Enter a whole number 1-20.
 - **Only These**—To use only a specific set of sites, regardless of their traffic utilization, enter one or more site names separated by commas.
- **Advanced Config**—This is for advanced configuration editing only. Consult your support representative for assistance.

Configure Events Panel

The Events Widget section enables you to configure which events appear on the Map page. This panel tracks a set of current events and the number of changes since the last plan file was received.

Events	Count	Last Δ
Circuits down	600	+0 -0
Nodes down	11	+4/-3

Configuration of this panel is a combination of this UI and the `default_timeplot_summary_format.txt` file located in the `$CARIDEN_HOME/etc/matelive` directory.

For an event to appear, it must be configured in both locations. Combining the examples in this section would result in two events in the panel: Circuits down and Nodes down.

- `default_timeplot_summary_format.txt` file—Defines the metrics used for the events. Each metric is listed in the “Queries” section. For information on how to configure this file, see the comments at the end of the file, or refer to the *WAE Platform Configuration Guide*.

Example: This is an excerpt from the default file.

```
-----Queries-----
# Circuit Down
CircuitsDown SELECT Old_Name AS Details
CircuitsDown FROM Joined_Circuits
```

```
CircuitsDown WHERE ((Old_Name IS NOT NULL) AND (Name IS NULL)) OR ((Old_Active = 'T') AND
(Active = 'F'));

#Node Down
NodesDown SELECT Old_Name AS Details
NodesDown FROM Joined_Nodes
NodesDown WHERE ((Old_Name IS NOT NULL) AND (Name IS NULL)) OR ((Old_Active = 'T') AND
(Active = 'F'));
```

- **Events Widget UI**—This section lists the metrics and their display names. Each metric must match an event metric (query) that appears in the `default_timeplot_summary_format.txt` file.

Example:

Metric	Display Name
CircuitsDown	Circuits down
NodesDown	Nodes down

Events Widget Fields

- **Enabled**—If selected, the panel shows in the Map page. If not selected, the panel does not appear.
- **Title**—Name of the panel to appear on the Map page.
- **Add Metric**—Click to add a new event for display on the Map page.
 - **Metric**—The name of the event metric that appears in the `default_timeplot_summary_format.txt` file.
 - **Display Name**—The event name that appears in the panel on the Map page.
- **Edit (pencil icon)**—Edit the event metric name or the display name.
- **Delete (trash can icon)**—Delete a metric from the UI so that it no longer appears in the Events panel. There is no undo.
- **Advanced Config**—This is for advanced configuration editing only. Consult your support representative for assistance.

Related Topics

- `default_timeplot_summary_format.txt` configuration, see comments in the file or see the *WAE Platform Configuration Guide*
- [General Settings](#) chapter
- [User-Defined Properties](#) chapter



User-Defined Properties

Access: WAE Live > Settings and select User-Defined Properties tab

WAE Live acts on a set of objects (network elements) that are either discovered by WAE Collector or added via the snapshot process. For example, interfaces are discovered while demands can be created as part of the snapshot. Each object has a set of default properties (attributes) that are tracked in and retrieved from the datastore. For instance, an LSP's Shortest TE Path, a node's CPU, or an interface's Traffic In are all properties that are collected and stored by default. For a complete list of objects and properties, see the *WAE Live User Guide*.

Additionally, you can create user-defined properties to fit your specific needs. These user-defined properties are defined by and thus, derive their values from other properties. For example, rather than tracking incoming traffic (Traffic In) and outgoing traffic (Traffic Out), you might need to track the ratio of incoming to outgoing traffic ([Figure 5-1](#)).

As with default properties, these user-defined properties are available in the Explore and Analytics pages. These properties are available for all networks. That is, they are not configurable on a per-network basis.

Add Property Fields

Each user-defined property consists of an object, a user-specified name, and a user-created definition.

- Object—Select the object type to which the newly created property applies.
- Name—Enter a property name. Once the property is saved, this name appears as a selectable property for the given object in Explore and Analytics pages.
- Definition—Each definition is an expression using one or more default properties. A few rules apply, as follows.
 - Properties used in the definition must be default properties. That is, you cannot use user-defined properties in defining other user-defined properties.
 - Property names in the Definition field are not case-sensitive.
 - A user-defined property can be an integer, a double (floating point number), string, or boolean.
 - You can use any combination of the following in the definition. You can group any of these with parenthesis, which are executed in the order in which they appear.
 - Arithmetic expressions: +, -, *, /, and % ([Figure 5-1](#))
 - Relational operators: >, <, =, <=, and >=
 - Logical operators: AND, OR, and NOT

- Regular Expression Functions
- CASE Statements
- Edit (pencil icon)—Edit the user-defined property.
- Delete (trash can icon)—Delete a user-defined property. There is no undo.
- Preview—View the results that the object and definition together return.

**Note**

For two-word properties, use one word in the definition. For example, for the Remote Node property, use “remotenode.” For Traffic In and Traffic Out properties, use “traffin” and “traffout” in the definition.

Figure 5-1 Example of a User-Defined Property Definition Using Simple Arithmetic Expression

Object:	Interfaces
Name:	Traff Ratio
Definition:	TraffIn / TraffOut

Node ▲	Name ▲	TraffOut ▼	Traffin ▼	Traff Ratio ▼
<Filter>	<Filter>	<Filter>	<Filter>	<Filter>
MIL-BB1	ae2.0	1387.89	12817.79	9.24
BCN-BB1	ae0.0	1735.95	13477.29	7.76

Regular Expression Functions

In the Definition field you can use regular expressions to filter results using `regexp_extract` and `regexp` functions.

regexp_extract

regexp_extract Syntax

```
regexp_extract(formatted_result, identifier1, pattern1, identifier2, pattern2, ...)
```

This searches a string with a list of regular expressions to produce a formatted string result compiled from back references. Back references are the results of capturing groups from the regular expressions and referencing them in order by `$N`, where `N` is a number that is greater than or equal to 1. This `N` identifies the captured string returned by a back reference in the order it appears in the matching pattern. At a minimum, only three arguments are needed for `regexp_extract`. You can use any number of pairs of attributes and expressions.

Example: In this example, both captured groups (`$1` and `$2`) come from the regular expression for Description. The expression for Node does not have any capturing groups. It is used only as an additional filter. If any of the regular expressions fail to match, then the overall `regexp_extract` fails to match.

```
"regexp_extract('$1 ($2)', Description, ";interconnect to ([^(\)* \\([^\)]*\))\)", Name, "^(?!.*Io)")
```

regexp

boolean regexp Syntax

```
regexp(identifier1, pattern1)
```

This regexp syntax returns true, false, or null.

Example: If Node starts with 'palt', then sum the Traffic In and Traffic Out values. If the Node starts with something else, or is null, then no value is displayed.

```
case when regexp(node, '.*PALT.*') then traffin + traffout else null end
```

Example: If your node names include site names, this regexp syntax is useful for creating site properties for interfaces.

```
regexp_extract('$1', node, '([^-]+)-(.*)')
```

CASE Statements

The CASE statement allows conditional values based on a set of expressions. All result-expressions must be of the same type. That is, they can all be numeric or all be string, but they cannot be a mixture of both string and numeric.

CASE Statement Syntax

```
CASE WHEN <boolean-expression> THEN <result-expression>
```

```
[WHEN ...]
```

```
[ELSE <result-expression>]
```

```
END
```

Example: This example creates a user-defined property if a node name matches a remote node and if neither name is null.

```
case
```

```
when regexp_extract('$1', node, '(....)*\.(..)\. .*') isnull then null
```

```
when regexp_extract('$1', remotenode, '(....)*\.(..)\. .*') isnull then null
```

```
when regexp_extract('$1', node, '(....)*\.(..)\. .*') = regexp_extract('$1', remotenode, '(....)*\.(..)\. .*') then true else false end
```

Expression Syntax

Two syntaxes are used for the supported expressions: EBNF (Extended Backus–Naur Form) and a simpler query. Note that you can use one or multiple words for isNull and isNotNull.

- “isNull” can be represented by “is null”
- “isNotNull” can be represented by “is not null”

Simple Query

Following is the syntax for a simple query.

Simple Syntax

expression := value { +, -, *, /, %, IN, is [not] null, case } [expression]

when-expression := expression [{ AND, OR, NOT } when-expression]

case := CASE WHEN when-expression THEN expression [ELSE expression] END

value := { object-attribute, number, string, regexp(), regexp_extract() }

EBNF

Table 5-1 is the grammar in EBNF format.

Table 5-1 *SELECT Syntax in EBNF Format*

SELECT Rule	Syntax
expression	case logical
logical :=	relational { (OR, AND, SEMICOLON, COMMA) relational }
relational :=	additive { (<, <=, >, >=, =, ==, !=) additive }
additive :=	multiplicative { (+, -,) multiplicative }
multiplicative :=	unary { (*, /, %) unary }
unary :=	(!, not, ~, +, -) factor factor isnull factor
factor :=	NUMERIC STRING NULL TRUE FALSE ID regexp regexp_extract in_expr '(expression)'
regexp :=	REGEXP '(literal COMMA STRING)'
regexp_extract :=	REGEXP_EXTRACT '(STRING COMMA reg_arg_list)' opt-as
reg_arg_list :=	literal COMMA STRING
in_expr :=	IN '(string_list)'

Table 5-1 *SELECT Syntax in EBNF Format (continued)*

SELECT Rule	Syntax
string_list :=	STRING COMMA string_list STRING
case :=	CASE when when_list opt_else END
when_list :=	when when_list
when :=	WHEN expression THEN expression empty
opt_else :=	ELSE expression empty
opt_as :=	AS ID
literal :=	ID STRING

Related Topics

- [General Settings](#) chapter
- [Map Settings](#) chapter

