

# **GENESYS**

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## Stat Server User's Guide

Formula

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#### Overview

Starting with the 8.5.106 release, Stat Server supports statistical category Formula.

Formulas (defined in SQL-like language) allow you to calculate statistics that could not be calculated using hard-coded categories. With formulas you can:

- Use/combine statistical Aggregates
- Perform Rank Computations
- Do Sorting and Branching
- Apply Mathematical, String and Key-Value List functions
- Use Action Attributes and System Variables

Historical custom formula aggregates (COUNT, SUM, AVG, MIN, MAX, and so on) are only updated in the following two situations:

- Upon reset
- Upon action or status end (depending on the Subject parameter of the statistic)

Historical aggregates in hard-coded categories are also updated while status is in progress.

#### Important

- In addition to the Growing aggregation interval, supported in the 8.5.106 release, starting with the 8.5.107 release, Stat Server supports Sliding, Selection, and SinceLogin aggregation intervals.
- Sliding and Selection aggregation intervals are applicable to the DNAction subject only.
- Formulas serialization into/from the backup file is supported.
- The logical NOT (~) character does not work with aliases for the group of actions, such as CallWait on mediation DNs. To exclude the whole group, each member should be excluded explicitly. For example:
  - \*,~CallWaitUnknown,~CallWaitConsult,~CallWaitInbound,~CallWaitOutbound

## Examples

The formula itself has to be specified in the Expression option:

Category=Formula Objects=<objects> Expression=<formula expression> Subject=<subject> <business attribute name>=<business attribute value>

| Stat Type   | Description   |
|---|---|
| Category = Formula<br>Subject = DNAction<br>Objects = Queue<br>Expression = @COUNT(CallWait; duration > 10)               | A statistic with this Stat Type, requested for a Queue,<br>returns the current number of calls on this Queue with<br>duration more than 10 seconds.   |
| Category = Formula<br>Subject = DNAction<br>Objects = Agent<br>Expression = AVG(CallInbound; kvnum(udata,<br>"Priority")) | A statistic with this Stat Type, requested for an Agent,<br>returns an average value of the "Priority" User Data key<br>of received by this Agent inbound calls (CallInbound<br>actions generated). |

## Options for Formula Stat Type

| Option     | Applicability | Comments   |
|------------|---------------|--|
| Category   | Mandatory     | Has to be set to Formula.  |
| Objects    | Mandatory     | See the Stat Type Configuration<br>Options table for the description<br>of the Objects option.   |
| Subject    | Mandatory     | See the Stat Type Configuration<br>Options table for the description<br>of this option.  |
| Expression | Mandatory     | The formula has to be specified<br>in this option. Stat Server Actions<br>from the Expression are used<br>for the Selection time profile if<br>MainMask and RelMask are<br>absent.                       |
| MainMask   | Special       | Applicable only for the<br>Selection time profile if the<br>RelMask is absent and ignored in<br>all other cases. See the Stat Type<br>Configuration Options table for<br>the description of this option. |
| RelMask    | Special       | Applicable only for the<br>Selection time profile and<br>ignored in all other cases. See   |

| Option                             | Applicability | Comments  |
|------------------------------------|---------------|---|
|                                    |               | the Stat Type Configuration<br>Options table for the description<br>of this option.           |
| <business attribute=""></business> | Optional      | See the Stat Type Configuration<br>Options table for the description<br>of this option.       |
| UseSourceTimeStamps                | Optional      | See the Stat Type Configuration<br>Options table for the description<br>of this option.       |
| ApplyFilterAtActionEndOnly         | Optional      | See the Stat Type Configuration<br>Options table for the description<br>of this option.       |
| Description                        | Optional      | See the Stat Type Configuration<br>Options table for more<br>information.                     |
| DynamicOverloadPolicy              | Optional      | Defines actions that Stat Server<br>may apply to a given statistic to<br>reduce the overload. |
| JavaSubCategory                    | N/A           | Not applicable.   |
| ReasonStartOverridesStatusStart    | N/A           | Not applicable.   |
| Formula                            | N/A           | Not applicable.   |

#### Important

- TimeRanges, if needed, should be included as conditions in the Expression.
- Filters, TimeProfile, Object name are included in a New API Statistic request.

#### Aggregates

Using formulas, users can create customized versions of the existing hard-coded categories, combine different statistical aggregates, and so on. Aggregates are the basis of any formula and provide the way of calculating values:

| Aggregates |   |   |   |
|------------|---|---|---|
| Aggregator | Parameters  | Description   | Example   |
| @COUNT     | <ol> <li>action_types_list<br/>Mandatory. Comma<br/>separated list of Stat<br/>Server actions or<br/>statuses</li> <li>condition Optional.<br/>Boolean expression,</li> </ol> | Current aggregator that<br>returns current number<br>of actions or statuses<br>listed in<br>action_types_list that<br>matches the condition if<br>provided. | @COUNT(CallInternal,<br>CallInbound,<br>CallConsult;<br>kvexists(udata,<br>"Language", "English"))<br>- returns current<br>number of actions/ |

| Aggregator | Parameters  | Description   | Example  |
|------------|---|---|--|
|            | depending on action/<br>status attributes,<br>interval attributes and<br>system variables   |   | statuses listed, that<br>have "Language",<br>"English" key-value pair<br>in attached UserData.   |
| @SUM       | <ul> <li>1. action_types_list<br/>Mandatory. Comma<br/>separated list of Stat<br/>Server actions or<br/>statuses</li> <li>2. expression<br/>Mandatory. Numeric<br/>expression, depending<br/>on action/status<br/>attributes, interval<br/>attributes and system<br/>variables</li> <li>3. condition Optional.<br/>Boolean expression,<br/>depending on action/<br/>status/st attributes,<br/>interval attributes and<br/>system variables</li> </ul> | Current aggregator that<br>returns current sum of<br>numeric expressions,<br>computed for each<br>action or status,<br>satisfying the condition.        | @SUM(CallWait;<br>kvnum(global_udata,<br>"amount", -1)) – returns<br>current sum of the last<br>value in each CallWait<br>action of "amount" key<br>in attached UserData.              |
| @AVG       | <ul> <li>1. action_types_list<br/>Mandatory. Comma<br/>separated list of Stat<br/>Server actions or<br/>statuses</li> <li>2. expression<br/>Mandatory. Numeric<br/>expression, depending<br/>on action/status<br/>attributes, interval<br/>attributes and system<br/>variables</li> <li>3. condition Optional.<br/>Boolean expression,<br/>depending on action/<br/>status attributes,<br/>interval attributes and<br/>system variables</li> </ul>    | Current aggregator that<br>returns current average<br>of numeric expressions,<br>computed for each<br>action or status,<br>satisfying the condition.    | @AVG(CallOutbound;<br>duration; duration > 0 &<br>duration < 5) - returns<br>current average<br>duration of<br>CallOutbound actions/<br>statuses with duration<br>less than 5 seconds. |
| @MIN       | <ul> <li>1. action_types_list<br/>Mandatory. Comma<br/>separated list of Stat<br/>Server actions or<br/>statuses</li> <li>2. expression<br/>Mandatory. Numeric<br/>expression, depending<br/>on action/status<br/>attributes, interval<br/>attributes and system<br/>variables</li> <li>3. condition Optional.<br/>Boolean expression,</li> </ul>   | Current aggregator that<br>returns current<br>minimum of numeric<br>expressions, computed<br>for each action or<br>status, satisfying the<br>condition. | @MIN(WaitForNextCall;<br>duration) - returns<br>current minimum<br>duration of<br>WaitForNextCall action/<br>status  |

| Aggregator | Parameters   | Description  | Example   |
|------------|--|--|---|
|            | depending on action/<br>status attributes,<br>interval attributes and<br>system variables  |  |   |
| @MAX       | <ul> <li>1. action_types_list<br/>Mandatory. Comma<br/>separated list of Stat<br/>Server actions or<br/>statuses</li> <li>2. expression<br/>Mandatory. Numeric<br/>expression, depending<br/>on action/status<br/>attributes, interval<br/>attributes and system<br/>variables</li> <li>3. condition Optional.<br/>Boolean expression,<br/>depending on action/<br/>status attributes,<br/>interval attributes and<br/>system variables</li> </ul> | Current aggregator that<br>returns current<br>maximum of numeric<br>expressions, computed<br>for each action or<br>status, satisfying the<br>condition.      | @MAX(NotReadyForNextCa<br>duration;<br>kvexists(reasons,<br>"ReasonCode", "Break"))<br>- returns current<br>maximum duration of<br>NotReadyForNextCall<br>action/status with<br>"ReasonCode" =<br>"Break"   |
| COUNT      | <ol> <li>action_types_list<br/>Mandatory. Comma<br/>separated list of Stat<br/>Server actions or<br/>statuses</li> <li>condition Optional.<br/>Boolean expression,<br/>depending on action/<br/>status attributes,<br/>interval attributes and<br/>system variables</li> </ol>   | Historical aggregator<br>that returns total<br>number of actions or<br>statuses listed in<br>action_types_list that<br>matches the condition if<br>provided. | COUNT(CallInternal,<br>CallInbound,<br>CallConsult;<br>kvexists(udata,<br>"Language", "English"))<br>- returns total number<br>of actions/statuses<br>listed, that have<br>"Language" = "English"<br>key-value pair in<br>attached UserData.                |
| SUM        | <ol> <li>action_types_list<br/>Mandatory. Comma<br/>separated list of Stat<br/>Server actions or<br/>statuses</li> <li>expression<br/>Mandatory. Numeric<br/>expression, depending<br/>on action/status<br/>attributes, interval<br/>attributes and system<br/>variables</li> <li>condition Optional.<br/>Boolean expression,<br/>depending on action/<br/>status attributes,<br/>interval attributes and<br/>system variables</li> </ol>          | Historical aggregator<br>that returns sum of<br>numeric expressions,<br>computed for each<br>action or status,<br>satisfying the condition.                  | SUM (CallInternal,<br>CallInbound,<br>CallConsult; duration;<br>kvnum(udata,<br>"amount", -1) < 100) –<br>returns sum of actions/<br>statuses duration if this<br>action/status has last<br>value of "amount" key<br>in attached UserData<br>less than 100. |
| AVG        | <b>1. action_types_list</b><br>Mandatory. Comma<br>separated list of Stat  | Historical aggregator<br>that returns average of<br>numeric expressions,   | AVG(CallWait; duration;<br>duration >= 10) -<br>returns average   |

| Aggregator | Parameters   | Description   | Example   |
|------------|--|---|---|
|            | Server actions or<br>statuses<br><b>2. expression</b><br>Mandatory. Numeric<br>expression, depending<br>on action/status<br>attributes, interval<br>attributes and system<br>variables<br><b>3. condition</b> Optional.<br>Boolean expression,<br>depending on action/<br>status attributes,<br>interval attributes and<br>system variables  | computed for each<br>action or status,<br>satisfying the condition.   | duration of CallWait<br>action if action duration<br>was more than or equal<br>to 10 seconds.   |
| MIN        | <ul> <li>1. action_types_list<br/>Mandatory. Comma<br/>separated list of Stat<br/>Server actions or<br/>statuses</li> <li>2. expression<br/>Mandatory. Numeric<br/>expression, depending<br/>on action/status<br/>attributes, interval<br/>attributes and system<br/>variables</li> <li>3. condition Optional.<br/>Boolean expression,<br/>depending on action/<br/>status attributes,<br/>interval attributes and<br/>system variables</li> </ul> | Historical aggregator<br>that returns minimum of<br>numeric expressions,<br>computed for each<br>action or status,<br>satisfying the condition. | MIN(AgentActive;<br>duration) - returns<br>minimum duration of<br>AgentActive action.   |
| MAX        | <ol> <li>action_types_list<br/>Mandatory. Comma<br/>separated list of Stat<br/>Server actions or<br/>statuses</li> <li>expression<br/>Mandatory. Numeric<br/>expression, depending<br/>on action/status<br/>attributes, interval<br/>attributes and system<br/>variables</li> <li>condition Optional.<br/>Boolean expression,<br/>depending on action/<br/>status attributes,<br/>interval attributes and<br/>system variables</li> </ol>          | Historical aggregator<br>that returns maximum<br>of numeric expressions,<br>computed for each<br>action or status,<br>satisfying the condition. | MAX(CallInbound;<br>kvmax(udata,<br>"amount");<br>kvexists(udata,<br>"Language", "English"))<br>- returns maximum<br>value of "amount" key<br>in UserData of<br>CallInbound actions/<br>statuses for which key-<br>value pair "Language" =<br>"English" also be<br>presented in UserData. |

## Action Attributes

The following attributes are used in expression and condition parameters of aggregators:

| Attributes   |  |  |
|--------------|--|--|
| Attribute    | Description  |  |
| duration     | A duration of Stat Server action/status.   |  |
| start        | A timestamp of the start time of Stat Server action/ status.   |  |
| end          | A timestamp of the end time of Stat Server action/ status.   |  |
| udata        | UserData key-value list. List of data that is used in key-value pair functions as the first argument.        |  |
| global_udata | Global UserData key-value list. List of data that is used in key-value pair functions as the first argument. |  |
| reasons      | Reasons key-value list. List of data that is used in key-value pair functions as the first argument.         |  |
| extensions   | Extensions key-value list. List of data that is used in key-value pair functions as the first argument.      |  |
| system       | System key-value list. List of data that is used in key-value pair functions as the first argument.          |  |

## System Variable Attributes

The aggregation interval parameter can be used in current Formulas (those, containing only current aggregates) with the interval != Growing. Current Formulas do not aggregate across the Selection interval.

The following parameter is available for current statistics:

#### System Variables

| Attribute | Description  |
|-----------|--|
| \$istart  | An aggregation interval start. For example, when interval=Sliding the @SUM( CallInternal; end-greatest(start,\$istart) ) adjusts the duration of all current actions to the start of the window. |

## Mathematical Functions

The table below lists mathematical functions that are used in the expression and condition parameters of aggregators as well as in independent clauses:

#### Mathematical Functions

| Function | Description                             |
|----------|---|
| abs      | Absolute value                          |
| ceil     | Ceiling of the value                    |
| floor    | Floor of the value                      |
| log      | Logarithm of the value                  |
| exp      | Exponent of the value                   |
| sqrt     | Square root of the value                |
| sin      | Sinus of the value                      |
| COS      | Cosinus of the value                    |
| pow      | Power of the value                      |
| %        | Module (for example, 5%2=1, and 64%4=0) |

All mathematical functions have one float argument, except for the pow and % functions, which have two float arguments.

## String Functions

String functions are applicable to set parameters, for example, "Language" and values returned by the kvstr function: kvstr(udata, "Language"). The table below lists string functions:

#### String Functions

| Function                   | Description  |
|----------------------------|--|
| sub                        | Substring  |
| upper                      | Conversion to upper case   |
| lower                      | Conversion of lower case   |
| concatenation (operator +) | Concatenation of strings   |
| convert                    | String conversion to a numeric value. For example, <i>convert</i> ("32.58") returns the 32.58 numeric value. |

All string functions have a single argument of the type string, except for the concatenation (+) function, which combines two strings.

#### Key-Value List Operations

The key-value list functions are similar to those presented in the UserData Properties. The following collections are taken as the first parameter:

- udata
- global\_udata
- reasons
- extensions
- system

The functions below can be applied to collections:

#### Key-Value List Functions

| Function | Description   | Similar Operator in UserData<br>Properties |
|----------|---|--|
| kvstr    | A string extraction from the key-<br>value list.  | GetString                                  |
| kvlist   | An embedded key-value list extraction from the key-value list.  | GetList                                    |
| kvnum    | A number extraction from the key-value list.  | GetNumber                                  |
| kvsum    | A Sum of numbers in the key-<br>value list.   | GetSum                                     |
| kvmin    | A minimum value for a given key in the key-value list.  | GetMin                                     |
| kvmax    | A maximum value for a given key in the key-value list.  | GetMax                                     |
| kvavg    | An average value for a given key in the key-value list.   | GetAver                                    |
| kvexists | True if a given key or pair<br><key, value=""> exists in the key-<br/>value list. False otherwise.</key,> | PairExists                                 |

## Rank Computations

Ranking functions (see the table below) are used in conditions of aggregators to rank Stat Server actions by some parameters. There are two arguments for rank functions: a function of actions attributes, and a positive integer (rank).

| Ranking Functions |  |  |
|-------------------|--|--|
| Function          | Description  |  |
| rank_lt           | True, if the rank of an action, according to a condition, is less than the predefined number.    |  |
| rank_gt           | True, if the rank of an action, according to a condition, is greater than the predefined number. |  |

#### Example

If you want to calculate the (current) average duration of the 5 longest waiting calls in queue use the following expression:

@AVG( CallWait; duration; rank\_lt( duration, 6 ) )

#### Sorting

Sorting functions:

- greatest the greatest value in a list.
   greatest(x1, x2, ..., xN), where x1, ..., xN are numbers.
- least the least value in a list.
   least(x1, x2, ..., xN), where x1, ..., xN are numbers.

can take any numeric values (including aggregators) as arguments. Unlike other functions, sorting functions have variable number of comma separated arguments.

#### Example

Find the largest number of the current Inbound, Outbound or Consult calls:

```
greatest( @COUNT(CallInbound), @COUNT(CallOutbound), @COUNT(CallConsult) )
```

#### Branching

You can use the branching construction (<conditions> ? <expression if condition is true> : <expression if condition is false>) in aggregator, num\_expr, and condition parts of a formula. However for aggregators, Genesys recommends that you not use kvexists(), ranking computations, or string operations with the branching operator.

Branching <boolean expression> ? < num\_expr1> : <num\_expr2> means that if the <boolean expression> is true, then <num\_expr1> is returned, if the <boolean expression> is false <num\_expr2> is returned.

#### Operators and their Priorities

Operators and their priority (see the table below) can be used in any part of the formula expression.

| Operator        | Priority | Associativity (which operator occurrence is applied first when the same priority operators appear in a row) |
|-----------------|----------|---|
| ^               | 10       | Left  |
| - (unary minus) | 9        | None  |

| Operator | Priority | Associativity (which operator occurrence is applied first when the same priority operators appear in a row) |
|----------|----------|---|
| ~        | 8        | Right   |
| *        | 7        | Left  |
| /        | 7        | Left  |
| %        | 7        | Left  |
| +        | 6        | Left  |
| -        | 6        | Left  |
| <        | 5        | Left  |
| >        | 5        | Left  |
| <=       | 5        | Left  |
| >=       | 5        | Left  |
| =        | 5        | Left  |
| !=       | 5        | Left  |
| &        | 4        | Left  |
| 1        | 3        | Left  |
| :        | 2        | Right   |
| ?        | 1        | Right   |