



# IBM Tivoli Netcool Performance Manager for Wireless 9.1.2

## *Report aggregation basics*



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IBM Tivoli Netcool® Performance Manager for Wireless 9.1.2 report aggregation basics

## Assumptions

- Before attempting this module, you should already know how to use IBM Tivoli Netcool Performance Manager for Wireless 9.1.2 software to perform the following tasks :
  - ▶ Create a basic report definition
  - ▶ Open a report result
- If you can not perform these tasks, you can learn how to do them by taking a Tivoli Netcool Performance Manager for Wireless user course

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If you can not perform these tasks, you can learn how to do them by taking an IBM Tivoli Netcool Performance Manager for Wireless 9.1.2 User course.

## Objectives

- Upon completion of this module, you should be able to:
  - ▶ Describe the concept of aggregation
  - ▶ Define time and entity aggregation semantics
  - ▶ Explain how aggregation is applied in report results

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## Aggregation defined

- Aggregation is an arithmetical operation applied to the data retrieved from the database for viewing in report results
- Typical Key Performance Indicator (KPI) aggregation types are:
  - ▶ Sum
  - ▶ Average
  - ▶ Maximum
- Aggregation type assignment dictates data presentation to the user

Aggregation is an arithmetical operation applied to the KPI data retrieved from the database for viewing in report results.

In this module a Key Performance Indicator (KPI) is defined as any PEG, Primitive Calculation (PCalc), or User-Defined Calculation (UDC) supported in the application.

Typical KPI aggregation types are:

- Sum: For example, the total of a KPI for a specified time.
- Average: For example, the average of a KPI, per cell.
- Maximum: For example, the maximum of a KPI, per cell and per day.

Every KPI is assigned an aggregation type. The aggregation type assigned to a KPI dictates how the data is presented to the user in a report result.

## Aggregation type dimensions

Each aggregation type has two dimensions:

- Aggregation by Time
- Aggregation by Entity

Each aggregation type has two dimensions:

- Aggregation by Time: Arithmetical operations are applied by time slices, regardless of the element
- Aggregation by Entity: Arithmetical operations are applied by element, regardless of the time slices (hours, days)

## Aggregation types

### Aggregation naming convention:

- ▶ Naming convention is structured to support the two dimensions of aggregation
- ▶ If the aggregation type over time and entity are the same, the aggregator name is shortened to a single value
- ▶ If the time and entity aggregator are different, the name is combination of the individual aggregation type names

Aggregation naming convention:

To support the two dimensions of aggregation the following naming convention is used:

*<aggregation over time><aggregation over entity>*

If the aggregation type is the same over time and entity dimensions then the aggregator name is shortened to a single short name.

For example, aggregator Average means average over time and average over entity.

If the aggregation type over time and entity are different, the name is combination of the individual aggregation type names

For example, aggregator SumAvg means sum over time and average over element.

## Applying aggregation in Tivoli Netcool Performance Manager for Wireless

Aggregation is used in Tivoli Netcool Performance Manager for Wireless:

- ▶ To support Group By and Rollup Levels in report results
- ▶ To support daily, weekly, and monthly summary tables

Aggregation is used in TNPMW:

To support Group By and Rollup Levels in report results

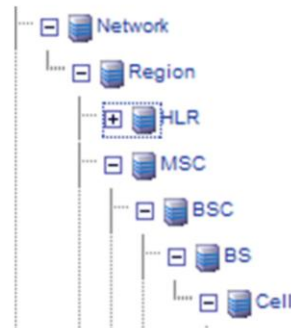
Applying the available rollup levels in a report means applying the available KPI aggregators to the report result view over time and entity.

To support daily, weekly, and monthly summary tables

Applying aggregation types to a KPI stores the applicable sum, average, minimum, or maximum value in the summary table for the KPI

## Analytics: Understanding rollup

- Entity relationships are hierarchical
- Where a simple Cell KPI, total\_calls could be presented:
  - ▶ Cell report with detailed 15-minute period displayed in a report
  - ▶ Time Aggregation, at Cell level
  - ▶ Entity Aggregation, at Network level
  - ▶ Time and Entity Aggregation, at Network level



In wireless networks network elements entity relationships are hierarchical. For example, in a Global System for Mobile Communications (GSM) network, a Cell has a parent Base Station (BS). A BS has a parent Base Station Controller (BSC) with a hierarchical relationship to the top most node, Network.

Where can a simple Cell KPI, total\_calls be presented in a report result:

- At the Cell level, where total\_calls per 15-minute period is displayed.
- Time Aggregation Roll Up, at the Cell level, where total\_calls per 15-minute period is aggregated to the hour or day for display in a report.
- Entity Aggregation Roll Up, at the Network level, where the total\_calls **across all Cells** is displayed for each hour or day.
- Time and Entity Aggregation, at the Network level, where the total\_calls is aggregated **across all Cells and day**. A single value is displayed for the sum of total\_calls across all the hours and Cells to Network level.



## Aggregation example 1

BS ID	Cell ID	timestamp	KPI total calls
BS1	BS1/Cell1	08:00	45
BS1	BS1/Cell1	08:15	5
BS1	BS1/Cell1	08:30	65
BS1	BS1/Cell1	08:45	79
BS1	BS1/Cell2	08:00	102
BS1	BS1/Cell2	08:15	110

Maximum KPI by cell: 79 (Cell1); 130 (Cell2)

Average KPI by time: 82

Total KPI by cell: 194 (Cell1); 462 (Cell2)

Minimum KPI by time: 5

Total KPI by time: 656

Displayed are a few examples of how aggregation is applied in a report result.

The table in the slide shows the number of calls performed for two cells for each 15-minute period for one hour of the day. An entire network report for many cells and all 15-minute periods for the day returns a large amount of rows. Analyzing a large number of rows can be overwhelming.

By using reporting Group By, Roll Up levels, and the KPI aggregation type, the results can be presented in a condensed view for analysis. Displayed are values for the Total Calls KPI based on various Group By, Roll Up, aggregation types. For example:

- The maximum number of calls, calculated per cell, during the measurement period
- The total number of calls, calculated per cell, during the measurement period
- The average number of calls, during the hour, regardless of the cell
- The total number of calls during the hour, regardless of the cell
- The minimum number of calls during the hour, regardless of the cell

## Aggregation example 2

BS ID	Cell ID	timestamp	KPI total_calls
BS1	BS1/Cell1	08:00	45
BS1	BS1/Cell1	08:15	5
BS1	BS1/Cell1	08:30	65
BS1	BS1/Cell1	08:45	79
BS1	BS1/Cell2	08:00	102
BS1	BS1/Cell2	08:15	110
BS1	BS1/Cell2	08:30	120
BS1	BS1/Cell2	08:45	130



Entity and Time Aggregation - sum over hour and Cell to BS			
BS1	NULL	08:00	656

This example demonstrates KPI results rolled up over time and element to give a total for the parent element, BS1.

The total\_calls KPI is totaled over the hour and BS1, giving the total number of calls during that hour for all cells under BS1.

Notice that the Cell\_ID is equal to NULL. NULL is another valid aggregation type. The Cell\_ID can not be aggregated. The total\_calls KPI results are now associated with a BS and not a particular Cell.

## Overriding aggregation types

- When creating a UDC or using a PCalc the following rules apply:
  - ▶ The UDC or PCalc expression is calculated when the report is run
  - ▶ Core TNPMW 9.1.2 release
    - Time aggregation dimension of the component KPIs cannot be overridden
    - Element aggregation dimension assigned to the new UDC is applied
  - ▶ Core TNPMW 9.1.2 with Fix Patch IF003
    - Global variables to enhance aggregation implementation

UDC and PCalc values are not typically stored for any reporting period. This implementation restricts the presentation options of report results for both simple and complex UDC and PCalc expressions.

For this module:

- A simple UDC expression is defined as a UDC based on a single PEG
- A complex UDC or PCalc expression is defined as an arithmetical operation on two or more PEGs, PCalcs, or UDCs.
  - Examples of complex expression are: PegA - PegB or PegA + PegB

The initial release of TNPMW restricted the use of aggregation types when creating a UDC. Only the element aggregation dimension of the UDC was applied when presenting rolled up or grouped element results for simple and complex KPIs.

TNPMW Fix Patch IF003 implemented two global variables to add flexibility when applying aggregation semantics to UDC and PCalc expressions.

The first global variable is called **ForceOverrideCounterTimeAggregation**. This global variable is used when evaluating simple KPIs. When this variable value is set to **True**, the UDC time aggregation is applied to the component KPI.

The second global variable is called **ForceSumSummarization**. When this variable is set to **True**, all aggregators are ignored for component KPIs, and **Sum** is applied to both time and element. This sum override aggregation applies to report results and applicable stored complex KPI summaries.

## Overriding aggregation types: Simple UDC expression

BS ID	Cell ID	Timestamp	PegA	UDCA Core Release	UDCA Core Release with Patch
BS1	BS1/Cell1	8:00	45	45	45
BS1	BS1/Cell1	8:15	5	5	5
BS1	BS1/Cell1	8:30	65	65	65
BS1	BS1/Cell1	8:45	79	79	79
BS1	BS1/Cell2	8:00	102	102	102
BS1	BS1/Cell2	8:15	110	110	110
BS1	BS1/Cell2	8:30	120	120	120
BS1	BS1/Cell2	8:45	130	130	130
<b>Time Aggregation - over hour</b>					
BS1	BS1/Cell1	8:00	194	194	5
BS1	BS1/Cell2	8:00	462	462	102
<b>Entity and Time Aggregation - over hour and over Cell to BS</b>					
BS1		8:00	656	194	5
PegA is a simple counter with an aggregation type of Sum.					
UDCA is defined as PegA with the Min aggregation type assigned.					

The following example demonstrates the use of the **ForceOverrideCounterTimeAggregation** variable on a simple UDC expression.

In this example PegA has an aggregation type of **Sum** (sum over time and element).

UDCA (based on PegA) has an aggregation type of **Min** (minimum over time and element).

The UDC aggregation type is applied to the report results in the following manner:

In the core TNPMW 9.1.2 release with no fix patch, the following aggregation semantics are applied:

The time aggregation of PegA (Sum) is applied to all UDCA rolled up time aggregated results.

The element aggregation of the UDCA (Min) is applied to all UDCA rolled up element aggregated results.

In the core TNPMW 9.1.2 release with Fix Patch IF003, the following aggregation semantics are applied:

The time aggregation of UDCA (Min) is applied to all UDCA rolled up time aggregated results.

The element aggregation of the UDCA (Min) is applied to all UDCA rolled-up element aggregated results.

As demonstrated, overriding the time aggregation of the UDC's underlying KPI component is a powerful option for use in network performance analysis.

## Overriding aggregation types: Complex UDC expression

Example:

$$UDCA = PegB - PegC$$

3 steps:

1. Individually aggregate each cell PEG to the hour using sum
2. Individually aggregate cell hourly values using sum from Cell to BS
3. Compute the expression by applying the BS totals for  $PegB - PegC = UDCA$

BS_ID	Cell_ID	Timestamp	PegB	PegC	UDCA= PegB- PegC
BS1	BS1/Cell1	8:00	45	42	3
BS1	BS1/Cell1	8:15	5	5	0
BS1	BS1/Cell1	8:30	65	64	1
BS1	BS1/Cell1	8:45	79	77	2
BS1	BS1/Cell2	8:00	102	100	2
BS1	BS1/Cell2	8:15	110	107	3
BS1	BS1/Cell2	8:30	120	120	0
BS1	BS1/Cell2	8:45	130	100	30
<b>1. Time Aggregation - over hour</b>					
BS1	BS1/Cell1	8:00	194	188	6
BS1	BS1/Cell2	8:00	462	427	35
<b>2. Entity Aggregation - over hour and over Cell to BS</b>					
BS1		8:00	656	615	41
<b>3. Compute the expression for the UDC</b>					
BS1		8:00			41

PegB and PegC are simple counters with an aggregation type of Avg.  
UDCA is defined as PegB- PegC but with forced aggregation type of Sum.

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Report aggregation basics

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The example presented in the slide demonstrates the use of the **ForceSumSummarization** variable on a complex UDC expression.

The example complex expression is  $UDCA = PegB - PegC$ . The aggregation type for both Pegs is average. When the variable **ForceSumSummarization** is set to **true** the component KPI aggregation type is ignored. All resulting summaries are forced to use sum aggregation semantics. The underlying peg aggregation type of average is ignored.

For the Core release 9.1.2 with Fix Patch IF003, the expression is evaluated using the following steps:

1. Individually aggregate each Cell Peg to the hour using sum aggregation
2. Individually aggregate each Cell Pegs' hourly value to the BS using sum aggregation
3. Compute the expression of  $PegB - PegC$  from the individually aggregated Pegs, (sum PegB - sum PegC)

The slide depicts how the complex expression is computed for BS1 with all of its reporting cells and one hour of data.

## Summary

- You should now be able to:
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  - ▶ Explain how aggregation is applied in report results

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