

Calculating the 'Average Time Difference' in the Format of HH:MM:SS on the Fly



Applies to:

SAP BW 3.5 & BI 7.0. For more information, visit the [Business Intelligence homepage](#).

Summary

This paper discusses how to calculate the Average Time Difference in the format of HH:MM:SS between transfer order's creation date/creation time and confirmation date/confirmation time dynamically during the query execution.

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Created on: 18 August 2009

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Business Scenario:

In Warehouse Management Module, transfer orders will be created and confirmed at different particular timings. Each transfer order will have creation date, creation time and confirmation date, confirmation time (if it is closed). We can easily calculate the Number of days between the creation date and confirmation date for a particular transfer order in the query designer. But for example, if the user wants to know 'Average Time Difference' between the creation date/time and confirmation date/time in the format of HH:MM:SS at warehouse number (or) source storage type (or) source storage bin (or) destination storage type (or) destination storage bin levels etc.

For example I have the data like below format in the source system. Each transfer order has the creation date and time, when it was created and if the transfer order is confirmed by the responsible resource then that transfer order will also have the confirmation date and time. Moreover, each transfer order will be picked once (or) twice (or) more at a particular storage type (or) storage bin levels. That means, transfer order will also have the 'Number Of Picks' like how many times it was picked and finally confirmed.

Warehouse Number	Storage Type	Transfer Order	Creation Date	Creation Time	Confirmation Date	Confirmation Time	Number Of Picks	Average Time
WN1	ST1	TO1	2001.07.01	4:35:28	2001.07.02	0:33:21	1	
WN1	ST1	TO2	2001.07.01	4:45:31	2001.07.02	0:30:33	1	
WN1	ST1	TO3	2001.07.01	10:55:32	2001.07.02	22:19:45	1	
WN1	ST1	TO4	2001.07.01	11:35:30	2001.07.02	0:23:41	1	
WN1	ST1	TO5	2001.07.01	8:05:34	2001.07.01	18:23:30	1	
WN1	ST1		2001.07.01	8:05:34	2001.07.01	18:23:37	1	
WN1	ST1	TO6	2001.07.01	8:05:34			0	
WN1	ST1	TO7	2001.07.01	4:40:32	2001.07.02	0:31:49	1	
WN1	ST1	TO8	2001.07.01	14:40:37			0	

In the above table, there is a Warehouse Number (WN1) and under this there is also a Storage Type(ST1). These warehouse number and storage type has total eight transfer orders. Some of the transfer orders (TO1, TO2, TO3, TO4, TO5 and TO7) are create and confirmed at some particular timings. But the transfer orders (TO6 and TO8) are created at some particular timing, but still they are not confirmed. That means, still now no once picked these transfer orders from that particular storage type (ST1) under the warehouse number (WN1). Moreover, the transfer order (TO5) was picked (or) confirmed two times from that storage type.

Now the user wants the Average Time Difference in HH:MM:SS format between the transfer order's creation date/time and confirmation date/time under a specific storage type(ST1) of warehouse number(WN1) to know how many number of picks happen for that particular transfer order and its average time to confirm it .

Each transfer order will be picked or confirmed either at the storage bin (or) storage type levels of a particular Warehouse Number.

Solution:

This issue was solved mainly in two major steps. Like

Calculating the Time Stamp Difference between Creation Date/Creation Time and Confirmation Date/Time during the transformations

Calculating the Average Time Difference on the fly by using the Virtual Key Figure

Calculating Time Stamp Difference:

First, I created a new Info Object 'Timestamp Difference (ZTIMEDIFF) of Number data type. This Info Object is used to have the 'Timestamp Difference' in seconds between the creation date/creation time and confirmation date/confirmation time of the transfer order during the transformations.

Display Key Figure ZTIMEDIFF: Details

Key Figure: ZTIMEDIFF

Long description: TimeStamp Difference

Short description: TimeStamp Difference

Version: Active Saved

Object status: Active, executable

Type/Data Type

Amount Number Date

Quantity Integer Time

Data Type: DEC - Counter or amount field with comma a

Currency/unit of measure

Fixed currency:

Fixed Unit of Meas.:

Now I included this 'Timestamp Difference' Info Object in the second level Data Store Object. Please see the below figure

DataStore Object		Techn. name / value	Fu...	O...	Data ...	L	Key Fi...	C...	N...	Ag...	Ex...
Test2		ZTEST2									
Object Information											
Version	In Process										
Save	Not saved										
Revised Version	Active Version										
Object Status	Active, executable										
Settings											
Key fields											
Data Fields											
Transfer Order Creation Date	ZBDATU	DATS	08								
Transfer Order Creation Time	ZBZEIT	TIMS	06								
Transfer Order Confirmation Date	ZQDATU	DATS	08								
Transfer Order Confirmation Time	ZQZEIT	TIMS	06								
Number Of Picks Per Transfer Orders	ZCONFIRTO	DEC	09	Numb...	<input checked="" type="checkbox"/>	<input type="checkbox"/>	SUM	SUM			
TimeStamp Difference	ZTIMEDIFF	DEC	09	Numb...	<input checked="" type="checkbox"/>	<input type="checkbox"/>	SUM	SUM			
Average Time Difference(HH:MM:SS)	ZAVERTIME	DEC	09	Time	<input checked="" type="checkbox"/>	<input type="checkbox"/>	MAX	MAX			

Then I wrote the ABAP code for this Info Object in the transformations for calculating the TimeStamp Difference between the creation date/creation time and confirmation date/confirmation time.

Rule Details

Description:

Target InfoObjct: ZTIMEDIFF TimeStamp Difference

Rule Type: Routine

Aggregation: Overwrite

Source Fields of Rule:

InfoObject	Ic...	Long Description	Type	Lng...	Conv...	IOAssgnmnt	Lon
ZBDATU		Transfer Order Creation Date	DATS	8			
ZBZEIT		Transfer Order Creation Time	TIMS	6			
ZCONFIRTO		Number Of Picks Per Transfer Order	DEC	9			
ZQDATU		Transfer Order Confirmation Date	DATS	8			

Target Fields of Rule:

InfoObject	Ic...	Long Description	Type	Lng...	Conv...
ZTIMEDIFF		TimeStamp Differer	DEC	9	

Transfer Values

Rule Group: Standard Group

Rule	Rule Name	Posi	Key	InfoObject	Icor	Descript.
	ZBDATU	4		ZBDATU		Transfer Order Creation Date
	ZBZEIT	5		ZBZEIT		Transfer Order Creation Time
	ZQDATU	6		ZQDATU		Transfer Order Confirmation
	ZQZEIT	7		ZQZEIT		Transfer Order Confirmation
	ZCONFIRTO	8		ZCONFIRTO		Number Of Picks Per Transte
	ZTIMEDIFF	9		ZTIMEDIFF		TimeStamp Difference
	ZAVERTIME	10		ZAVERTIME		Average Time Difference(HH

The ABAP Code

The below ABAP Code was created in the above transformation for calculating 'Timestamp Difference' in seconds between the Creation Date/Creation Time and Confirmation Date/Confirmation Time .

```

DATA: TIMESTAMP1 TYPE TZNTSTMP,
      TIMESTAMP2 TYPE TZNTSTMP,
      TIMESTAMP_DIFFERENCE TYPE I,
      TIMESTAMP_1 TYPE TZNTIMESTP,
      TIMESTAMP_2 TYPE TZNTIMESTP.

DATA : HOURS   TYPE I,
      MINUTES  TYPE I,
      TIME(10) TYPE C,
      HOURS_C(10) TYPE C,
      MINUTES_C(2) TYPE C,
      TIME_N(10) TYPE P DECIMALS 2 .

*****CONVERTING CREATION DATE/CREATION TIME INTO TIMESTAMP1*****
CALL FUNCTION 'RSSM_GET_TIME'
EXPORTING
  I_DATUM_LOC          = SOURCE_FIELDS-/BIC/ZBDATU
  I_UZEIT_LOC         = SOURCE_FIELDS-/BIC/ZBZEIT

IMPORTING
  E_TIMESTAMPS        = TIMESTAMP1

EXCEPTIONS
  FAILED              = 1
  OTHERS              = 2.

IF SY-SUBRC <> 0.
  MESSAGE ID SY-MSGID TYPE SY-MSGTY NUMBER SY-MSGNO
  WITH SY-MSGV1 SY-MSGV2 SY-MSGV3 SY-MSGV4.
END IF.

*****CONVERTING CONFIRMATION DATE/CONFIRMATION TIME INTO TIMESTAMP*****
CALL FUNCTION 'RSSM_GET_TIME'
EXPORTING
  I_DATUM_LOC          = SOURCE_FIELDS-/BIC/ZQDATU
  I_UZEIT_LOC         = SOURCE_FIELDS-/BIC/ZQZEIT

IMPORTING
  E_TIMESTAMPS        = TIMESTAMP2

EXCEPTIONS
  FAILED              = 1
  OTHERS              = 2.

```

```

IF SY-SUBRC <> 0.
MESSAGE ID SY-MSGID TYPE SY-MSGTY NUMBER SY-MSGNO
WITH SY-MSGV1 SY-MSGV2 SY-MSGV3 SY-MSGV4 .
ENDIF .

WRITE : TIMESTAMP1 to TIMESTAMP_1,
      TIMESTAMP2 to TIMESTAMP_2.
*****DIFFERENCE BETWEEN THE ABOVE TWO TIMESTAMPS*****

IF TIMESTAMP_2 > TIMESTAMP_1.

CALL FUNCTION 'CCU_TIMESTAMP_DIFFERENCE'
EXPORTING
TIMESTAMP1 = TIMESTAMP_2
TIMESTAMP2 = TIMESTAMP_1
IMPORTING
DIFFERENCE = TIMESTAMP_DIFFERENCE.
ENDIF.

```

So now we got the 'Timestamp Difference' in seconds between the creation date/creation time and confirmation date/confirmation time for all confirmed transfer orders.

Calculating the Average Time Difference by using Virtual Key Figure:

Here we are going to calculate the Average Time Difference in HH:MM:SS format between the transfer order's creation date/time and confirmation date/time under a specific storage type(ST1) of a particular warehouse number(WN1) to know how many number of picks happen for a particular transfer order and its average time to confirm it .

The formula for Average Time Difference is,

$$\text{Average Time Difference} = \text{Timestamp Difference} / \text{Number of Picks}$$

This formula will be calculated dynamically on the fly during the query execution by using the Virtual Key Figure.

Timestamp Difference: - It is a difference between the transfer order's creation date/creation time and confirmation date/confirmation time in seconds. This difference was calculated during the transformations by using some function modules.

Number of Picks: - If the transfer order has confirmation date and confirmation time then that transfer order has been picked (or) confirmed. A transfer order can be picked (or) confirmed either once or more times. Virtual Key Figures are the normal key figures, but calculated dynamically during the query execution by using the standard user exists. Although the virtual key figures are not actually populated in the database, they are incorporated into an Info Cube data model so that info objects can be selected when designing a query.

Now create a Virtual Key Figure in the Data Warehouse Workbench for having the Average Time Difference.

Change Key Figure ZAVERTIME: Detail

Grid Undo Redo Copy Paste Print Logs... Metadata

Version Comparison Business Content

Key Figure: **ZAVERTIME** ◀◀ ▶▶

Long description: **Virtual Key Figure For Average Time Difference(HH:MM:SS)**

Short description: Average Time Differe

Version: Active Saved

Object status: Active, executable

Type/unit Aggregation Additional Properties

Type/Data Type

Amount Number Date
 Quantity Integer Time

Data Type: DEC - Counter or amount field with comma a ⓘ

Currency/unit of measure

Fixed currency:

Fixed Unit of Meas.:

Then include this 'Average Time Difference(HH:MM:SS)' Virtual Key Figure Info Object into the Info Cube (or) DSO for holding the data which is going to be calculated on the fly during the query execution

Techn. name / value	Fu...	O...	Data ...	L	Key Fi...	C...	N...
InfoCube							
Test3							
Object Information							
Version	◇ New						
Save	☐ Not saved						
Object Status	⊖ Inactive, not exec...						
Settings							
Dimensions							
Data Package	ZTEST3P						
Time	ZTEST3T						
Unit	ZTEST3U						
Warehouse Number	ZTEST31						
Storage Type	ZTEST32						
Dates	ZTEST33						
Transfer Order Creation Date	ZBDATU		DATS	08			
Transfer Order Creation Time	ZBZEIT		TIMS	06			
Transfer Order Confirmation Date	ZQDATU		DATS	08			
Transfer Order Confirmation Time	ZQZEIT		TIMS	06			
Navigation Attributes							
Key Figures							
Number Of Picks Per Transfer Orders	ZCONFIRTO		DEC	09	Numb...	<input checked="" type="checkbox"/>	<input type="checkbox"/>
TimeStamp Difference	ZTIMEDIFF		DEC	09	Numb...	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Average Time Difference(HH.MM.SS)	ZAVERTIME		DEC	09	Time	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Then include this Info Object in to the corresponding query.

Number O...	TimeStam...	Average Time Difference(Virtual Key Figure)
a-Wareho...	a-Storage ...	
b-Storage ...		
b-Wareho...	a-Storage ...	
b-Storage ...		

The ABAP Code

The ABAP program for populating the virtual key figure values dynamically during the query execution has been segregated into three parts.

Declaring the global values for each virtual characteristic and key figure (program ZXRSRTOP:- Here in this example, we need to get information about Timestamp Difference(calculated in the transformations) and Number of Picks for each confirmed transfer order record in the fact table. The syntax for this insertion is

```
g_pos_<InfoCube>_<object> type i.
```

So in this program we are defining the Timestamp Difference and Number of Picks as global variables by using the above syntax.

```
DATA: g_pos_ZTEST3_ZTIMEDIFF  TYPE I, "Timestamp Difference Key Figure
      g_pos_ZTEST3_ZCONFIRTO  TYPE I, "Number of Picks
      g_pos_ZTEST3_ZAVERTIME  TYPE I, "Virtual Key figure
```

Note:- Program ZXRSRTOP also contains other global data for later processing such as definition of an internal table to hold cost prices.

- I. **Making the virtual field settings in program ZXRSRU02:-** This program inserts the virtual key figures (or) characteristics into the predefined tables. These predefined tables are processed only when the query is changed or activated. Moreover, if we required any other field from the Info Cube during the user exist processing, then those fields also need to be insert in to this program. The characteristics are stored in the table **E_T_CHANM** and Key Figures are stored in the table **E_T_KYFNM**.

In our example, the 'Timestamp Difference', 'Number of Picks' and 'Average Time Difference' Key Figures are appended to the table **E_T_KYFNM** in the program ZXRSRU02:

```
WHEN 'ZTEST3'. *****INFOCUBE*****

*****Key Figure to be used during the calculation*****
APPEND 'ZTIMEDIFF' TO E_T_KYFNM.
APPEND 'ZCONFIRTO' TO E_T_KYFNM.

*****Key Figure to be Changed in Cube*****
APPEND 'ZAVERTIME' to E_T_KYFNM.

END CASE.
```

When the query is activated, BI will goes through the ABAP Code which was stored in the program ZXRSRU02 and compares the characteristics and key figures used in the query with the characteristics and key figures stored in ZXRSRU02. If the query contains the characteristic that can be changed or key figure that exists in the program ZXRSRU02, then that query will be marked to execute the user exist to calculate the virtual key figure or characteristic .

Calculating the Virtual Key Figure per record in the program ZXRSRZZZ:- This program contains the user exist to calculate the virtual key figure dynamically on the fly during the query execution .

In our example, the virtual key figure (Average Time Difference) will be calculated as,

$$\text{Timestamp Difference} / \text{Number of Picks}$$

```
FORM USER_ZTEST3
  USING I_S_RKB1D TYPR RSR_S_RKB1D CHANGING C_S_DATA TYPE ANY.
```

FIELD-SYMBOLS: <ZTIMEDIFF>, "Timestamp Difference Input
<ZCONFIRTO> , "Number of picks
<ZAVERTIME>, "Average Time Difference Virtual Key Figure

ASSIGN:

COMPONENT g_pos_ZTEST3_ZTIMEDIFF OF STRUCTURE C_S_DATA TO <ZTIMEDIFF>,
COMPONENT g_pos_ZTEST3_ZCONFIRTO OF STRUCTURE C_S_DATA TO <ZCONFIRTO>,
COMPONENT g_pos_ZTEST3_ZAVERTIME OF STRUCTURE C_S_DATA TO <ZAVERTIME>,

IF NOT <ZTIMEDIFF> IS INITIAL AND NOT <ZCONFIRTO> IS INITIAL.

<ZAVERTIME> = <ZTIMEDIFF> / <ZCONFIRTO>.

ELSE.

<ZAVERTIME> = 0.

ENDIF.

ENDFORM.

Result

So after calculating the 'Average Time Difference' between the transfer orders creation date/creation time and confirmation date/confirmation time, the Info Cube data will be look like below (see for Average Time in below table)

Warehouse Number	Storage Type	Transfer Order	Creation Date	Creation Time	Confirmation Date	Confirmation Time	Number Of Picks	Average Time
WN1	ST1	TO1	2001.07.01	4:35:28	2001.07.02	0:33:21	1	19:57:53
WN1	ST1	TO2	2001.07.01	4:45:31	2001.07.02	0:30:33	1	19:45:02
WN1	ST1	TO3	2001.07.01	10:55:32	2001.07.02	22:19:45	1	11:24:13
WN1	ST1	TO4	2001.07.01	11:35:30	2001.07.02	0:23:41	1	12:48:11
WN1	ST1	TO5	2001.07.01	8:05:34	2001.07.01	18:23:30	1	10:17:56
WN1	ST1					18:23:37	1	10:18:03
WN1	ST1	TO6	2001.07.01	8:05:34			0	0:00:00
WN1	ST1	TO7	2001.07.01	4:40:32	2001.07.02	0:31:49	1	19:51:17
WN1	ST1	TO8	2001.07.01	14:40:37			0	0:00:00

Now if the user wants to see how many number of picks was happen and their average time for picking at storage type level(ST1) of warehouse number(WN1) in the query then the data look likes below,

Warehouse Number	Storage Type	Number Of Picks	Average Time
WN1	ST1	7	14:54:39

Virtual Key Figure Limitations

There are some issues related to setting up and running queries like the one in the above example that you should be aware of.

- Virtual Key Figures do not work with aggregates, because aggregates may not contain all relevant fields necessary to support them in the user exit. In the above example, for instance, the Timestamp difference information is critical. So if BW selects data from an aggregate lacking that information, it is impossible to calculate the Average Timestamp Difference values in the user exit. Using virtual key figures does not prevent you from operating with aggregates. You can still create and use them as long as queries do not contain virtual key figures.
- Cache functionality should be avoided when using virtual key figures. With caching employed, the system attempts to reuse extracted data rather than rereading from InfoCube each time during the query execution.
- Because the query makes calculations every time it is executed, system performance could degrade when using virtual characteristics and key figures. Apply some performance improvement tips from the service.sap.com to the query and aggregates.
- We should also be aware that the ABAP programming is required, virtual characteristics and key figures can only be done for one Info Cube at a time. Additional code is required even if the same functionality is being reused with another Info Cube. If you make sure that your ABAP syntax is structured in such a way that does not require many extra programming lines, it takes only a few hours to implement and test the same functionality for another Info Cube.

Related Content

For more information, visit the [Business Intelligence homepage](#).

<https://forums.sdn.sap.com/thread.jspa?forumID=131&threadID=102069&messageID=1130752#1130752>

<https://forums.sdn.sap.com/thread.jspa?threadID=29226>

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