



Version 5.10

Data Lifecycle Management

Manual

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1 Concept

FORCAM FORCE™ provides the ability to automatically delete or archive unnecessary and obsolete data. The Data Lifecycle Management offers tools to optimize the database storage space:

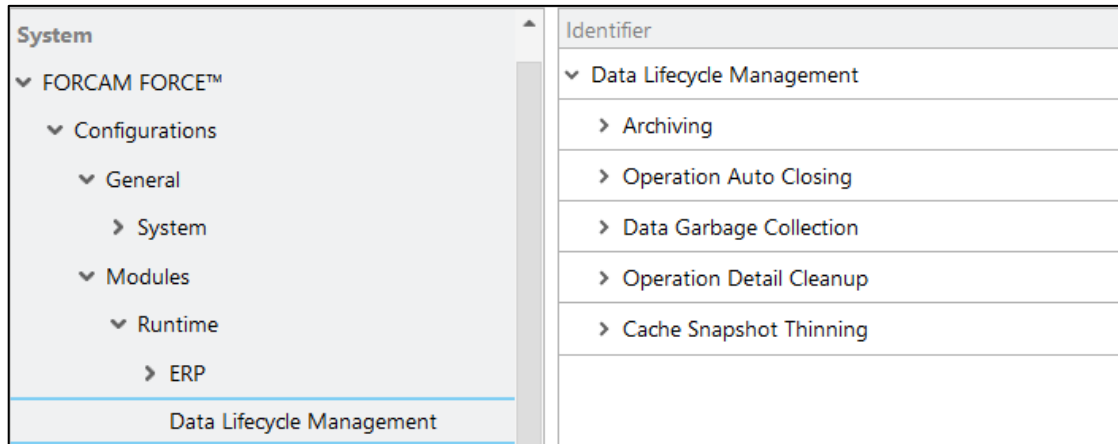



Fig. 1: Data Lifecycle Management in the System Configuration

- Archiving
During archiving, the necessary data sets are archived according to a defined set of rules. Archiving is designed to store information that is relevant in the long term. The archiving limit is not workplace-specific, but generally valid.
- Operation Auto Closing
Operation Auto Closing closes operations that have not already been closed by the customer. All data is retained. Only internal resources are released.
- Data Garbage Collection
The Data Garbage Collection function permits all operation-related data to be deleted automatically at desired intervals. The number of days in the past to which the data cleansing should refer is specified. By default, this period is deliberately set high in order not to endanger data after an unconscious activation of this service.
 Data Garbage Collection is a final deletion and cannot be undone.
- Operation Detail Cleanup
This service removes operation-dependent data such as literals that are no longer required for reports and other applications. Reporting-relevant data is still retained.
- Cache Snapshot Thinning
Cache Snapshot Thinning is a technical measure to reduce the number of snapshots as needed.

Archiving is the most important service and its configuration is essential to release the necessary data and to avoid data loss at the same time. The concept of archiving is therefore explained in detail.

1.1 Archiving Function

The system comprises two essential areas:

- Work area
 - High level of detail of data (event-based)
 - Editable
 - Requires limitation in time (affects memory and performance)
- Archive area
 - Low level of detail of data (interval-based)
 - Conditionally editable (direct database update)
 - Geared to storing the information that is relevant in the long term

The Archiving tool transfers selected data from the work area to the archive area. The archiving limit separates these two areas. It is defined by a precise point in time and requires a precisely defined system status (archive point, see below).

The correction window must not be left (i.e. the correction window is always within the work area). The correction window is a time window which specifies how long past data can still be corrected/edited. For example, if you want to be able to make corrections to data from the past 90 days, the correction window must be 90 days.

In the archiving process, the following data are deleted since they are usually obsolete:

- Cache snapshots
- Base intervals and related elements
- Events

Archiving requires a clear-cut separation of all data at the delimitation line between archived and working data. This makes it possible to work with data from the work area without using data from the archive area. This separation line is the archive point. Archive points are created periodically and provide the basis for archiving. Each archive point is defined with a separation time stamp.

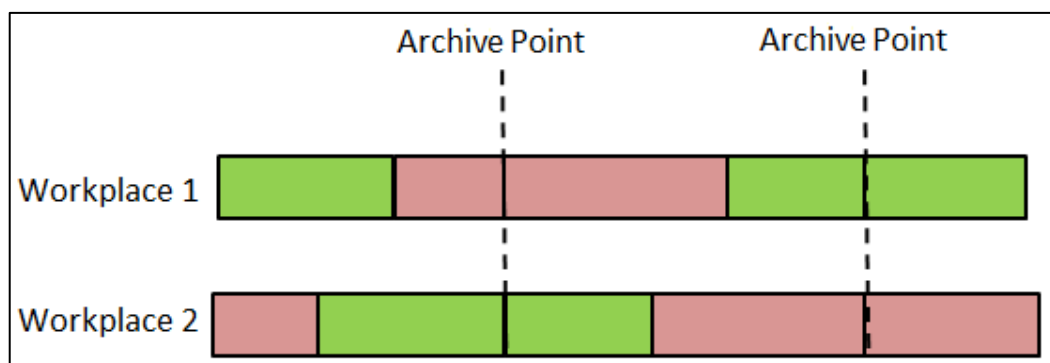


Fig. 2: Archive points across several workplaces

The following occurs at an archive point:

- Creation of cache snapshots of the rule engine (with archive point time stamp)
- Sections of all intervals (at the archive point time stamp)

The following interval types must be separated at an archive point:

- MachineStatusTLE
- WorkplaceStatusTLE
- WorkplaceBaseTLE
- WorkplaceAttributeTLE
- OperationBaseTLE
- OperationAttributeTLE

1.2 Archiving Implementation

An archive point is created by an update command (SetArchivePointCommand). A service (Archive-PointGenerator) generates this command periodically.

In the real-time processing area, the command is translated into an event (SetArchivePointEvent) and made persistent accordingly. In the downstream area, the appropriate rule engines initiate an interval change of all relevant intervals (DownstreamInterpretationPersister call) and create a cache snapshot.

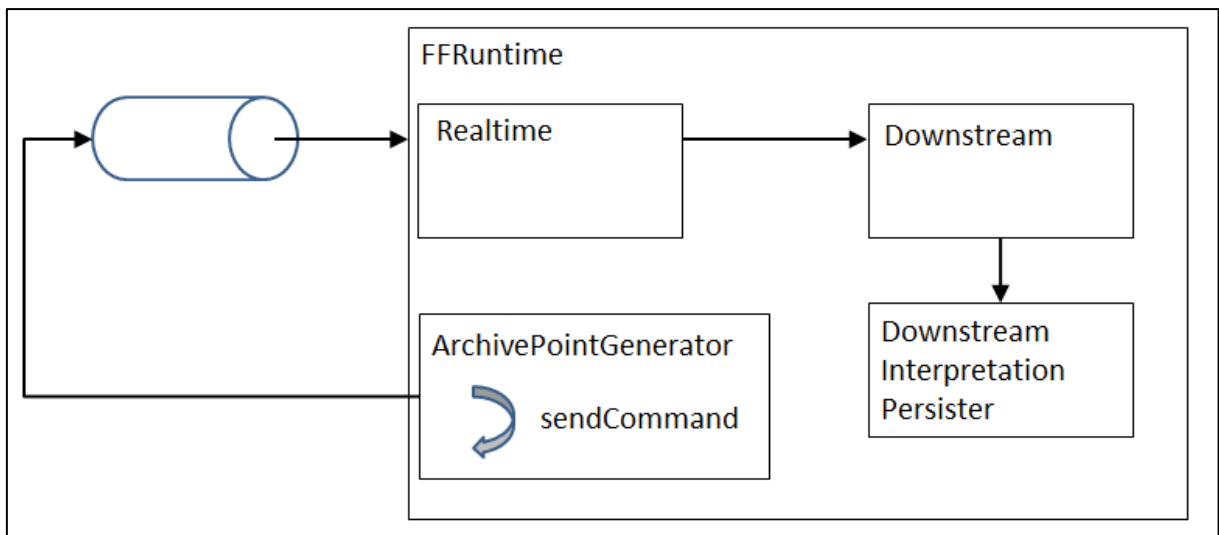


Fig. 3: Creating an archive point by an update command

The FFRuntime module generates entries in the report base tables that reflect timelines from posting messages (events). The report base tables comprise the following tables:

- Interval tables reflecting the status development over time
- Event tables containing data on quantities and strokes with references to the interval tables

At present, interval tables as well as quantity and stroke messages exist for the domain classes of **Workplace** and **Operation**.

The report base tables are condensed by shifts using aggregated views (in Oracle: materialized views). This means that the durations of the intervals as well as the quantity and stroke messages are added up for each shift and entered in the aggregated views. However, since only those data can exist in the aggregated views which have entries in the report base tables, archive tables are provided. They have the same column layout as the aggregated views.

In order to reflect a consistent historical development, historical union views are used to link the aggregated views to the archive tables. The historical union views provide the basis for all other views for reporting.

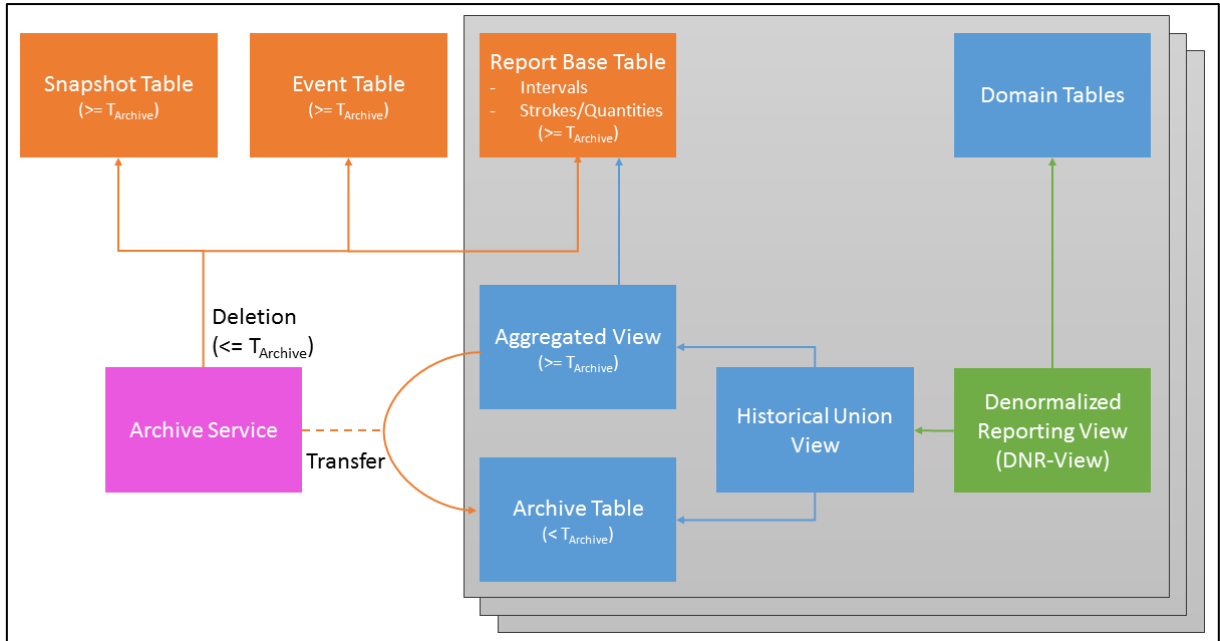


Fig. 4: Archiving process flow

An archiving process involves archive tables, report base tables and various FFRuntime tables. Archiving starts periodically (see section 2) and involves the following process:

- Determining the new potential archiving limit:
Obtained by subtracting the correction time window from the time stamp of the current call.
- Determining the actual archiving limit:
Results from the time stamp of the penultimate archive point before the potential archiving limit --> TS_AG
- Deleting and copying data based on TS_AG:
Copying View=SQL select instruction matching archive table:
 - WORKPLACE_BASE_SUM (with end time stamp < TS_AG) --> WORK-PLACE_BASE_ARC_SUM
 - WORKPLACE_QUANTITY_SUM (with start time stamp < TS_AG) --> WORK-PLACE_QUANTITY_ARC_SUM
 - WORKPLACE_STROKE_SUM (with start time stamp < TS_AG) --> WORK-PLACE_STROKE_ARC_SUM
 - OPERATION_BASE_SUM (with end time stamp < TS_AG) -->
 - OPERATION_BASE_ARC_SUM
 - OPERATION_QUANTITY_SUM (with start time stamp < TS_AG) --> OPERA-TION_QUANTITY_ARC_SUM
 - OPERATION_STROKE_SUM (with start time stamp < TS_AG) --> OPERA-TION_STROKE_ARC_SUM
 Deleting obsolete data:
 - Events with event time stamp (FR_EVT_* tables) < TS_AG
 - Cache snapshots (FR_CORE_CACHE_SNAPSHOT table) with time stamp < TS_AG
 - SAP log entries (FR_DS_SAP_LOG table) with change time stamp < TS_AG
 - Interval entries with change time stamp < TS_AG

- FR_DS_MACHINE_STATUS_TL
- FR_DS_WORKPLACE_STATUS_TL
- FR_WORKPLACE_BASE_TL
- FR_DS_WORKPLACE_ATTRIB_TL
- FR_DS_WORKPLACE_STROKE_LE
- FR_DS_WORKPLACE_QUANTITY_LE
- FR_DS_OPERATION_BASE_TL
- FR_DS_OPERATION_ATTRIB_TL
- FR_DS_OPERATION_STROKE_LE
- FR_DS_OPERATION_QUANTITY_LE
- Updating the materialized views (Oracle only):
 - OPERATION_BASE_SUM
 - OPERATION_QUANTITY_SUM
 - OPERATION_STROKE_SUM
 - WORKPLACE_BASE_SUM
 - WORKPLACE_QUANTITY_SUM
 - WORKPLACE_STROKE_SUM
- Setting the new correction time limit TS_AG:
Table: FR_MD_SYSTEM_DATA, "CORRECTION_TIME_LIMIT" key

2 Configuration

2.1 Archiving

Archiving can be configured both in the database and in the Workbench system settings.

2.1.1 Configuration in the Database

Both the archive point generator and the archive service can be configured in the database:

```
<Archiving>
  <doArchivePoints>false</doArchivePoints>
  <archivePointsCronExpression>33 33 8 ? * MON</archivePointsCronExpression>
  <doArchiving>false</doArchiving>
  <start>0</start>
  <end>0</end>
  <cronExpression>0 30 23 ? * SUNL</cronExpression>
  <correctionWindow>600000</correctionWindow>
  <doDataGarbageCollecting>false</doDataGarbageCollecting>
  <dataGarbageCollectingCronExpression>0 45 23 ? * SUNL</dataGarbageCollectingCronExpression>
  <dataGarbageCollectingWindow>10950</dataGarbageCollectingWindow>
  <doOperationAutoClose>false</doOperationAutoClose>
  <operationAutoCloseCronExpression>0 15 23 ? * SUNL</operationAutoCloseCronExpression>
  <operationAutoClosePreservingWindow>30</operationAutoClosePreservingWindow>
</Archiving>
```

Fig. 5: Configuring the archiving process in the database

The following table describes the tags for the configuration shown in Fig. 5. The syntax of the Cron expressions is described in section 2.3.

Table 1: Description of tags for configuration

Tag	Meaning
doArchivePoints	Set archive points? (true or false)
archivePointsCronExpression	When do you want to create archive points? (Cron expression)
doArchiving	Do you want to execute archiving runs? (true or false)
start	Earliest start of an archiving run
end	End of archiving runs
cronExpression	When do you want to have archiving runs executed? (Cron expression)
correctionWindow	Correction time window (in ms)

Tag	Meaning
doDataGarbageCollecting	Activate garbage collection? (true or false)
dataGarbageCollectingCronExpression	When do you want to execute the garbage collection? (Cron expression)
dataGarbageCollectingWindow	Number of days in the past whose data you want to delete
doOperationAutoClose	Activate the auto-close function? (true or false)
operationAutoCloseCronExpression	When do you want to execute the auto-close function? (Cron expression)
operationAutoClosePreservingWindow	The number of days an operation is already finished

2.1.2 Configuration in the Workbench

Path: Configuration > System > FORCAM FORCE™ > Configurations > Modules > Runtime > Data Lifecycle Management

Table 2: Archiving configuration parameters

Parameter	Description	
Archive Points	Activate Service	If a check mark is set, archive points are created.
	Cron Expression	Cron expression for the time of creation of archiving points
Activate Service	If a check mark is set, archiving is activated.	
Start of archiving	Earliest start of an archiving run	
End of archiving	End of the archiving run	
Cron Expression	Cron expression specifying the archiving time	
Blocking Period (in days)	Correction window specifying how long past data can still be corrected/edited	

2.2 Additional Services for Storage Space Optimization

Each Data Lifecycle service can be configured using the same three parameters, but additional parameters are added in the archiving. The following table explains the recurring parameters:

Identifier	Value
▼ Data Lifecycle Management	
> Archiving	
▼ Operation Auto Closing	
Activate Service	<input type="checkbox"/>
Cron-Expression	0 0 2 ? * *
Blocking Period (in days)	180
▼ Data Garbage Collection	
Activate Service	<input type="checkbox"/>
Cron-Expression	0 45 23 ? * SUNL
Blocking Period (in days)	10,950
▼ Operation Detail Cleanup	
Activate Service	<input type="checkbox"/>
Cron-Expression	0 0 4 ? * *
Blocking Period (in days)	31
▼ Cache Snapshot Thinning	
Activate Service	<input type="checkbox"/>
Cron-Expression	0 0 4 ? * *
Blocking Period (in days)	31

Fig. 6: Services for optimizing storage space in the Workbench

Table 3: Configuration parameters of the services

Parameter	Description
Activate Service	If a check mark is set, the service is activated.
Cron Expression	Time control of the service via a Cron expression
Blocking Period (in days)	Period of time in days that should remain unaffected by the service

2.3 Cron Expression

The point in time for archiving and data clean-up is specified as a Cron expression.

Cron is a task scheduler executing repetitive tasks in the background with low consumption of resources. A Cron expression contains periodic time specifications such as "every 2 hours" or "every third Sunday of each month". Once the expression has been created, archiving or data clean-up runs automatically at the specified times.

- i** The web site www.cronmaker.com is a useful platform for converting time specifications to Cron expressions.

A Cron expression consists of 6 or 7 fields delimited by blanks. Example of a Cron expression:

0 15 20 10 JAN ? 2017

```

| | | | | |
| | | | | | L -> Year
| | | | | | L -> Day of week
| | | | | | L -> Month
| | | | | | L -> Day of month
| | | | | | L -> Hours
| | | | | | L -> Minutes
| | | | | | L -> Seconds

```

This expression defines the following archiving task:

Archiving starts at 20:15 o'clock (0 seconds) on 10th January on any day of week in the year 2017.

The following rules apply to the individual fields:

Table 4: Syntax of Cron expressions

Field	Required	Allowed values	Allowed special characters
Seconds	Yes	0-59	, - * /
Minutes	Yes	0-59	, - * /
Hours	Yes	0-23	, - * /
Day of month	Yes	1-31	, - * ? / L W
Month	Yes	1-12 or JAN-DEC	, - * /
Day of week	Yes	1-7 or SUN-SAT	, - * ? / L #
Year	No	Blank or 1970-2099	, - * /

- i** For months and days of week, the first three letters of the English word are used. This is case-insensitive. A week always starts on Sunday.
The year is an optional value. If you omit the year, any year is true.

The following table describes the functions of the special characters listed in Table 4:

Table 5: Functions of special characters in Cron expressions

Special character	Function
,	Separator. Used to separate several items in a field. Example: MON,TUE,WED specified for day of week means: "on Mondays, Tuesdays, Wednesdays".
-	Range of values Example: 6-8 specified for hours means: "hours 6, 7 and 8".
*	All values of a field Example: * specified for minutes means: "every minute".
?	Any value. Used if the value of a field is unimportant. Example: 8 specified for days of month and ? specified for days of week means: "on the 8th of the month on any day of week".
/	Specifies step values and the initial value. Example: 0/10 specified for seconds means: "every 10 seconds, beginning in second 0". 1/4 specified for day of month means: "every 4 days, beginning on the 1st day of the month".
L	"Last". Used to specify the last day of the month or week. Example: L specified for day of month means "last day of month" (the value depends on the month). L specified for day of week means: "7" or "Saturday". L may follow the value (e.g. 6L for day of week, indicating "the last Friday of the month") or precede the value (e.g. L-4 for day of month, indicating "the 4th to last day of the month").
W	"Day of week" (workdays from Monday to Friday). Used to specify the weekday (Monday-Friday) nearest the given day. Example: 12W specified for day of month means: "the weekday nearest the 12th of the month". If the 12th is a Saturday, archiving starts on Friday 11th. If the 12th is a Tuesday, it starts on the same day since this is a workday. W does not 'jump' over the boundary of a month's days. If 1W was specified and the 1st day of the month is a Saturday, archiving starts on Monday 3rd.
#	Used to specify the n-th day of week of the month. The number preceding # indicates the day of week (1 = Sunday, etc.), the number following it indicates a multiple of this day. Example: 4#3 specified for day of week means: "the third Wednesday of the month". If you specify an invalid multiple (e.g. "the fifth Friday of the month" when a month has only four Fridays), archiving is not activated.

i **L** and **W** may be combined in the **Day of month** field.
Example: **LW** indicates "the last workday of the month".

Table 6: Examples of Cron expressions

Cron expression	Meaning
0 0 12 * * ?	Daily at 12 o'clock (noon)
0 15 10 ? * *	Daily at 10:15 o'clock
0 0 */2 ? * *	Every two hours on the hour
0 5 */4 ? * *	Every four hours at 5 minutes after the full hour
0 30 11 ? * MON-FRI	Monday to Friday always at 11:30 o'clock
0 30 11 ? * MON,FRI	Monday and Friday always at 11:30 o'clock
0 15,45 14 ? 3 WED	At 14:15 and 14:45 o'clock on every Wednesday in March
0 30 23 * * ? 2017	Daily at 23:30 o'clock in the year 2017

3 Annex

3.1 Terms and Abbreviations

Table 7: Abbreviations used

Abbreviation	Description
HH:MM:SS	Hours:Minutes:Seconds
L	Last
ms	Milliseconds
W	Weekday (workday). Refers to a weekday within a workweek from Monday to Friday.

Table 8: Terms used

Term	Description
Cache snapshot	State of the cache at a particular point in time
Cron Expression	Cron is a task scheduler executing repetitive tasks in the background with low consumption of resources. A Cron expression contains periodic time specifications such as "every 2 hours" or "every third Sunday of each month".
Event	Posting message
Navigator	Main user control area on the left of the screen arranged in a tree structure. For information on how to configure the Navigator, refer to the Master Data and System Administration User Manual.
Oracle	Database application of Oracle Corporation
Persistent data	Data saved in non-volatile storage (typically in a database) so that they are preserved without any change even after restarting the software or rebooting the computer.
T_{Archive}	Time of archiving
Workbench	Multilingual web-based application designed for configuring the master data and other terminal-specific settings. The Workbench is used for configuring FORCAM FORCE™.

3.2 Conventions and Navigation

Table 9: Document conventions


Convention	Description
Bold type	Button names and table and field titles are printed in bold type.
Icons	A function shown as an icon involves a reference to the icon as an object.
Path	All paths specified relate to the Navigator in the Workbench.
Note	Notes are identified by  .

Table 10: Navigation in the Workbench

Navigation	Description
Close icon	You can close any content opened in the Navigator by clicking on the close icon at the right of the screen.
Breadcrumb bar	If subpages or additional screens are available, a breadcrumb bar appears at the top edge of the screen. Clicking on the first element will close all subpages.
Direct editing	You can edit most of the cells displayed in tables either directly or via the context menu (right-click or dropdown menu).
Disabled columns	Columns with a grey background (viewing fields) cannot be edited.
Refresh	Since the Workbench is a web-based application, refreshing in the browser will cause the Workbench to log off.
Error message	Error messages appear at the bottom left of the screen.