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DBMS_HEAT_MAP

The DBMS_HEAT_MAP package provides an interface to externalize heatmaps at various levels of storage including block, extent, segment, object and tablespace. A second set of subprograms externalize the heatmaps materialized by the background for top N tablespaces.

This chapter contains the following topics:

- Overview
- Security Model
- Summary of DBMS_HEAT_MAP Subprograms

> **See Also:**
>
> - Heat Map in *Oracle Database VLDB and Partitioning Guide*
> - DBMS_ILM
> - DBMS_ILM_ADMIN

DBMS_HEAT_MAP Overview

To implement your ILM strategy, you can use Heat Map in Oracle Database to track data access and modification. You can also use Automatic Data Optimization (ADO) to automate the compression and movement of data between different tiers of storage within the database.

The Heat Map tracks modification times at the block level, and multiple access statistics at the segment level. Objects in the SYSTEM and SYSAUX tablespaces are not tracked. DBMS_HEAT_MAP gives you access to the Heat Map statistics at various levels - block, extent, segment, object, and tablespace.

DBMS_HEAT_MAP Security Model

The execution privilege is granted to PUBLIC. Procedures in this package run under the caller security. The user must have ANALYZE privilege on the object.

Summary of DBMS_HEAT_MAP Subprograms

This table lists and briefly describes the DBMS_HEAT_MAP package subprograms.

Table 96-1 DBMS_HEAT_MAP Package Subprograms

Subprogram	Description
BLOCK_HEAT_MAP Function	Returns last modification time for each block in a table segment

Table 96-1 (Cont.) DBMS_HEAT_MAP Package Subprograms

Subprogram	Description
EXTENT_HEAT_MAP Function	Returns the extent level Heat Map statistics for a table segment
OBJECT_HEAT_MAP Function	Returns the minimum, maximum and average access times for all the segments belonging to the object
SEGMENT_HEAT_MAP Procedure	Returns the heatmap attributes for the given segment
TABLESPACE_HEAT_MAP Function	Returns the minimum, maximum and average access times for all the segments in the tablespace

BLOCK_HEAT_MAP Function

This table function returns the last modification time for each block in a table segment. It returns no information for segment types that are not data.

Syntax

```
DBMS_HEAT_MAP.BLOCK_HEAT_MAP (
   owner             IN VARCHAR2,
   segment_name      IN VARCHAR2,
   partition_name    IN VARCHAR2 DEFAULT NULL,
   sort_columnid     IN NUMBER DEFAULT NULL,
   sort_order        IN VARCHAR2 DEFAULT NULL)
RETURN hm_bls_row PIPELINED;
```

Parameters

Table 96-2 *BLOCK_HEAT_MAP Function Parameters*

Parameter	Description
owner	Owner of the segment
segment_name	Table name of a non-partitioned table or (sub)partition of partitioned table. Returns no rows when table name is specified for a partitioned table.
partition_name	Defaults to NULL. For a partitioned table, specify the partition or subpartition segment name.
sort_columnid	ID of the column on which to sort the output. Valid values 1..9. Invalid values are ignored.
sort_order	Defaults to NULL. Possible values: ASC, DESC

Return Values

Table 96-3 *BLOCK_HEAT_MAP Function Return Values (Output Parameters)*

Parameter	Description
owner	Owner of the segment
segment_name	Segment name of the non-partitioned table
partition_name	Partition or subpartition name

Table 96-3 (Cont.) *BLOCK_HEAT_MAP Function Return Values (Output Parameters)*

Parameter	Description
tablespace_name	Tablespace containing the segment
file_id	Absolute file number of the block in the segment
relative_fno	Relative file number of the block in the segment
block_id	Block number of the block
write time	Last modification time of the block

EXTENT_HEAT_MAP Function

This table function returns the extent level Heat Map statistics for a table segment. It returns no information for segment types that are not data. Aggregates at extent level, including minimum modification time and maximum modification time, are included.

Syntax

```
DBMS_HEAT_MAP.EXTENT_HEAT_MAP (
   owner             IN VARCHAR2,
   segment_name      IN VARCHAR2,
   partition_name    IN VARCHAR2 DEFAULT NULL,
RETURN hm_els_row PIPELINED;
```

Parameters

Table 96-4 *EXTENT_HEAT_MAP Function Parameters*

Parameter	Description
owner	Owner of the segment
segment_name	Table name of a non-partitioned table or (sub)partition of partitioned table. Returns no rows when table name is specified for a partitioned table.
partition_name	Defaults to NULL. For a partitioned table, specify the partition or subpartition segment name.

Return Values

Table 96-5 *EXTENT_HEAT_MAP Function Return Values (Output Parameters)*

Parameter	Description
owner	Owner of the segment
segment_name	Segment name of the non-partitioned table
partition_name	Partition or subpartition name
tablespace_name	Tablespace containing the segment
file_id	Absolute file number of the block in the segment
relative_fno	Relative file number of the block in the segment
block_id	Block number of the block

Table 96-5 (Cont.) *EXTENT_HEAT_MAP Function Return Values (Output Parameters)*

Parameter	Description
blocks	Number of blocks in the extent
bytes	Number of bytes in the extent
min_writetime	Minimum of last modification time of the block
max_writetime	Maximum of last modification time of the block
avg_writetime	Average of last modification time of the block

OBJECT_HEAT_MAP Function

This table function returns the minimum, maximum and average access times for all the segments belonging to the object.

The object must be a table. The table function raises an error if called on object tables other than table.

Syntax

```
DBMS_HEAT_MAP.OBJECT_HEAT_MAP (
   object_owner      IN VARCHAR2,
   object_name       IN VARCHAR2)
 RETURN hm_object_table PIPELINED;
```

Parameters

Table 96-6 *OBJECT_HEAT_MAP Function Parameters*

Parameter	Description
object_owner	Tablespace containing the segment
object_name	Segment header relative file number

Return Values

Table 96-7 *OBJECT_HEAT_MAP Function Return Values (Output Parameters)*

Parameter	Description
segment_name	Name of the top level segment
partition_name	Name of the partition
tablespace_name	Name of the tablespace
segment_type	Type of segment as in DBA_SEGMENTS.SEGMENT_TYPE
segment_size	Segment size in bytes
min_writetime	Oldest write time for the segment
max_writetime	Latest write time for the segment
avg_writetime	Average write time for the segment
min_readtime	Oldest read time for the segment

Table 96-7 (Cont.) *OBJECT_HEAT_MAP Function Return Values (Output Parameters)*

Parameter	Description
max_readtime	Latest read time for the segment
avg_writetime	Average write time for the segment
min_lookuptime	Oldest index lookup time for the segment
max_lookuptime	Latest index lookup time for the segment
avg_lookuptime	Average index lookup time for the segment
min_ftstime	Oldest full table scan time for the segment
max_ftstime	Latest full table scan time for the segment
avg_ftstime	Average full table scan time for the segment

SEGMENT_HEAT_MAP Procedure

This procedure returns the heatmap attributes for the given segment.

Syntax

```
DBMS_HEAT_MAP.SEGMENT_HEAT_MAP (
   tablespace_id          IN  NUMBER,
   header_file            IN  NUMBER,
   header_block           IN  NUMBER,
   segment_objd           IN  NUMBER,
   min_writetime          OUT DATE,
   max_writetime          OUT DATE,
   avg_writetime          OUT DATE,
   min_readtime           OUT DATE,
   max_readtime           OUT DATE,
   avg_readtime           OUT DATE,
   min_lookuptime         OUT DATE,
   max_lookuptime         OUT DATE,
   avg_lookuptime         OUT DATE,
   min_ftstime            OUT DATE,
   max_ftstime            OUT DATE,
   avg_ftstime            OUT DATE);
```

Parameters

Table 96-8 *SEGMENT_HEAT_MAP Procedure Parameters*

Parameter	Description
tablespace_id	Tablespace containing the segment
header_file	Segment header relative file number
header_block	Segment header block number
segment_objd	DATAOBJ of the segment

Return Values

Table 96-9 *SEGMENT_HEAT_MAP Procedure Return Values (Output Parameters)*

Parameter	Description
min_writetime	Oldest write time for the segment
max_writetime	Latest write time for the segment
avg_writetime	Average write time for the segment
min_readtime	Oldest read time for the segment
max_readtime	Latest read time for the segment
avg_writetime	Average write time for the segment
min_lookuptime	Oldest index lookup time for the segment
max_lookuptime	Latest index lookup time for the segment
avg_lookuptime	Average index lookup time for the segment
min_ftstime	Oldest full table scan time for the segment
max_ftstime	Latest full table scan time for the segment
avg_ftstime	Average full table scan time for the segment

TABLESPACE_HEAT_MAP Function

This table function returns the minimum, maximum and average access times for all the segments in the tablespace.

Syntax

```
DBMS_HEAT_MAP.TABLESPACE_HEAT_MAP (
    tablespace_name      IN VARCHAR2)
  RETURN hm_tablespace_table PIPELINED;
```

Parameters

Table 96-10 *TABLESPACE_HEAT_MAP Procedure Parameters*

Parameter	Description
tablespace_name	Name of the tablespace

Return Values

Table 96-11 *TABLESPACE_HEAT_MAP Procedure Return Values (Output Parameters)*

Parameter	Description
segment_count	Total number of segments in the tablespace
allocated_bytes	Space used by the segments in the tablespace
min_writetime	Oldest write time for the segment
max_writetime	Latest write time for the segment

Table 96-11 (Cont.) *TABLESPACE_HEAT_MAP Procedure Return Values (Output Parameters)*

Parameter	Description
avg_writetime	Average write time for the segment
min_readtime	Oldest read time for the segment
max_readtime	Latest read time for the segment
avg_writetime	Average write time for the segment
min_lookuptime	Oldest index lookup time for the segment
max_lookuptime	Latest index lookup time for the segment
avg_lookuptime	Average index lookup time for the segment
min_ftstime	Oldest full table scan time for the segment
max_ftstime	Latest full table scan time for the segment
avg_ftstime	Average full table scan time for the segment