# Technical Note

## Managing Optimizer Statistics for PeopleSoft on Oracle (11g or higher)

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Technical Note

[http://www.go-faster.co.uk/GFCPSSTATS11.manual.pdf](http://www.go-faster.co.uk/gfc_pspart.manual.pdf)

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### Introduction

I have been considering how to collects optimizer statistics for a PeopleSoft system running on an Oracle 11g database. Despite 11g being several years old, most of my current customers are still using 10g, though some are looking at the upgrade to 11g. I believe a slightly different approach is required.

In 2009, I wrote a series of blog postings[[1]](#footnote-1) on the subject of collecting statistics. However these were all based on Oracle 10g. I proposed a PL/SQL package[[2]](#footnote-2) that would use meta-data in a database table to determine how to collect statistics on a table, or deliberate supress collection of statistics.

I also recommended that statistics on tables created for use as temporary records in Application Engine programs should have their statistics deleted and locked[[3]](#footnote-3) to prevent system-wide jobs refreshing their statistics.

***Update 4.2.2015:*** *Since I first wrote this document I have implemented this technique in PeopleSoft systems at two customer site, so I think we are now beyond the experimental stage. I would still welcome any feedback, and the opportunity to work with someone on a PeopleSoft system on Oracle 11g.*

#### New Features in 11g

Oracle considerably enhanced the delivered DBMS\_STATS package in 11g. It became possible to specify default values for parameters in the *dbms\_stats.gather\_table\_stats* program for for each table.

Partitioning is not used by default in PeopleSoft, but if you have introduced it then you will be glad that some of the problems with global statistics have been corrected in 11g[[4]](#footnote-4). There is a new feature in 11g called incremental statistics that produces better global statitics on partitioned tables by maintaining additional data called synopses.

### Collecting Statistics on Oracle 11g

The guiding principle in 11g, and one that is not specific to PeopleSoft, is that instead of calling *dbms\_stats.gather\_table\_stats* with the desired parameters, we should set table preferences with the desired parameters and then just call *dbms\_stats* without table specific parameters. We can then just leave the default database and schema-wide procedures get on with the job of collecting statistics.

Statistics on working storage tables cannot be maintained by scheduled jobs because the data in the table will have changed by the process that uses them. Statistics on such tables should be deleted and locked so they are omitted from schema and database-wide statistics maintenance processes. Thus, unless the process itself collects statistics, overriding the lock, there will not be any statistics on the table and Oracle will use Optimizer Dynamic Sampling. However, where the process does collect statistics, table preferences can still apply.

#### Collecting Statistics in PeopleSoft on Oracle 11g

When it comes to applying this principle in PeopleSoft, we have a few challenges to overcome, but nothing that is impossible.

When using PeopleSoft’s Application Designer to migrate it is typical to rebuild a table in order to add or change a column. Any related objects will be lost. Application Designer will rebuild the indexes. However, auditing triggers will be lost. The same is true for table statistics preferences that are lost when a table is dropped. So we need to hold the preferences as meta-data in a table. Then we can apply the preferences to the tables as they are created using a DDL trigger.

PeopleSoft temporary records can correspond to many tables that are used as non-shared temporary working storage tables. The same table preferences will need to be applied to all the temporary table instances. So the meta-data needs to be held for each record.

The *%UpdateStats* macro is used to collect statistics during Application Engine programs. This uses the DDL model to call the *dbms\_stats* PL/SQL procedure. The simplistic approach would be to change the delivered DDL model to remove the *sample\_size* and *method\_opt* parameters but to specify *force=>TRUE*. However, I have retained the functionality developed in the original *wrapper* package to optionally suppress collection of statistics, or only to collect statistics when they are stale.

In the case of COBOL programs, the %UpdateStats macro is put into stored statements. These can be changed to call the same PL/SQL package as the DDL models.

I generally recommend increasing the setting of the Oracle initialisation parameter OPTIMIZER\_DYNAMIC\_SAMPLING from the default of 2 to 4. However, I have experienced some problems with nVision where there can be hundreds of predicates. In that specific case I would revert to the default level of 2.

I have created a new packaged procedure GFCPSSTATS11, although it is based on the wrapper package that I produced for 10g.

#### Oracle’s PSCBO\_STATS package

I can’t discuss collecting statistics for PeopleSoft without discussing Oracle’s CBO\_STATS package. Oracle published document [1322888.1](https://support.oracle.com/epmos/faces/DocContentDisplay?id=1322888.1) “*pscbo\_stats - Improving Statistics in Oracle RDBMS for PeopleSoft Enterprise*”. It takes a similar approach to the package I proposed in the second edition of PeopleSoft for the Oracle DBA. A PL/SQL package is used to collect statistics. A number of tables control whether and how statistics are collected on each record. The package is also intended to be used to collect schema-wide statistics.

The PSCBO\_STATS package is a valiant attempt to solve a genuine problem, and it has continued to evolve since its initial release. However, I have a number of objections to it.

* It is fundamentally a 10g solution. It does not use 11g table preferences.
* It does use the Oracle automatic sample size in 11g if histograms are not to be collected. Otherwise, it defaults to the previous behaviour of either using 100% sample size for when called by %UpdateStats with the ‘high’ sample size, or a variety of fixed sampe sizes based on internal rules and the number of rows in the table.
  + In 11g, automatic sample size produces better values, and if necessary a specific sample size can be set with a table preference.
* The package contains a procedure that collects statistics on all objects in the schema that also refreshes statistics that are not stale but which have not been refreshed for a period of time determined by the size of the table.
  + In 11g, this can be handled by setting a table specific stale threshold. A low threshold might be appropriate for larger tables.
* When it collects histograms it always sets the maximum bucket size of 254. This may not always be desirable for height balanced histograms.
  + In 11g, the collection of histograms can be controlled via the METHOD\_OPT table preference.
* There is no support for collecting aggregated or incremental statistics on partitioned objects.
  + In 11g, table preferences for granularity and incremental statistics can be set.

I think that the 11g table preferences offer better and finer control over the collection of statistics.

# Appendix

### Implementation

All of the scripts are available on Github at <https://github.com/davidkurtz/gfcpsstats>

1. Create metadata table PS\_GFC\_STATS\_OVRD, and index, using script [gfcpsstats11\_metadata.sql](https://github.com/davidkurtz/gfcpsstats/blob/master/gfcpsstats11_metadata.sql).
   1. You may also choose to create a record in PeopleSoft Application Designer to correspond to this table.
2. Create PL/SQL packaged procedure SYSADM.PS\_GFC\_STATS\_OVRD using <gfcpsstats11.sql>.
3. Update PeopleSoft DDL models 4 and 5 for Oracle to call the new package instead of DBMS\_STATS.GATHER\_TABLE\_STATS using
   1. Either data mover script [ddlora-gfcpsstats11.dms](https://github.com/davidkurtz/gfcpsstats/blob/master/gfcpsstats11_metadata.sql)
   2. Or SQL script ddlora-gfcstats11.sql

Now, other scripts to lock statistics from <https://github.com/davidkurtz/psscripts> can be implemented

1. Run [locktemprecstats.sql](https://github.com/davidkurtz/psscripts/blob/master/locktemprecstats.sql) to lock and delete statistics on all PeopleSoft temporary records.
2. Run [gfc\_locktemprecstats\_triggerjob.sql](https://github.com/davidkurtz/psscripts/blob/master/gfc_locktemprecstats_triggerjob.sql) to create DDL trigger to submit a job to Oracle job scheduler to call procedure that locks and deletes statistics on tables associated with PeopleSoft temporary records as soon as they are created.
   1. This can be tested with gfc\_locktemprecstats\_triggerjob\_test.sql
3. Run [deltempstats.sql](https://github.com/davidkurtz/psscripts/blob/master/deltempstats.sql) to create a trigger on table PS\_AETEMPTBLMGR to lock and delete statistics on a temporary table as it is allocated to an Application Engine program.

### Meta-Data

#### PS\_GFC\_STATS\_OVRD

This table contains the meta-data that will be used to create the table preferences. It is keyed on record name. A record will only have table preferences created if a row exists in this table.

This table also controls whether the PS\_STATS program in the GFCPSSTATS11 procedure will refresh statistics on a table.

The table is structured in line with PeopleTools so that it could also be created by defining a record in Application Designer and creating it like any other table in a PeopleSoft system.

|  |  |  |
| --- | --- | --- |
| **Column** | **Datatype** | **Description** |
| RECNAME\* | VARCHAR2(15) | PeopleSoft Record Name |
| GATHERS\_STATS | VARCHAR2(1) | This parameter controls the behaviour of the PS\_STATS procedure (see page 12) that is designed to be called from the DDL models that are invoked by the *%UpdateStats* macro  G=Gather statistics. This is effectively the same behaviour as the default DDL model.  R=Refresh statistics. The *ps\_stats* package will only gather statistics if they are marked as stale on the database.  N=Don’t Gather statistics |
| ESTIMATE\_PERCENT | VARCHAR2(30) | Value passed to ESTIMATE\_PERCENT table preference.  If blank, any existing table override will be removed and Oracle will revert to default behaviour. |
| BLOCK\_SAMPLE | VARCHAR2(1) | This does not correspond to a table preference. This value is passed to dbms\_stats.gather\_table\_stats when it called by PS\_STATS program.  Y=TRUE  N=FALSE |
| METHOD\_OPT | VARCHAR2(1000) | Value passed to METHOD\_OPT table preference.  If blank, any existing table override will be removed and Oracle will revert to default behaviour. |
| GRANULARITY | VARCHAR2(30) | Value passed to GRANULARITY table preference.  If blank, any existing table override will be removed and Oracle will revert to default behaviour. |
| INCREMENTAL | VARCHAR2(5) | Value passed to INCREMENTAL table preference.  If blank, any existing table override will be removed and Oracle will revert to default behaviour. |
| STALE\_PERCENT | NUMBER | Value passed to STALE\_PERCENT table preference.  If blank, any existing table override will be removed and Oracle will revert to default behaviour. |

#### Example Meta-Data

##### Example Time & Labor Meta-Data

This the meta-data I defined for a Time & Labor system where excessive amounts of time were spent collecting statistics during TL\_TIMEADMIN, the main T&L calculation process. We first tried to suppress statistics collection in all Application Engine processes and use only Optimizer Dymanic Sampling. We found that we still needs statistics, though not histograms, on certain tables.

|  |  |  |
| --- | --- | --- |
| **RECNAME** | **GATHER\_STATS** | **METHOD\_OPT** |
| **TL\_IPT1** | G | FOR ALL COLUMNS SIZE 1 |
| **TL\_MTHCD** | G | FOR ALL COLUMNS SIZE 1 |
| **TL\_PMTCH1\_TMP** | G | FOR ALL COLUMNS SIZE 1 |
| **TL\_PMTCH2\_TMP** | G | FOR ALL COLUMNS SIZE 1 |
| **TL\_PMTCH\_TMP2** | G | FOR ALL COLUMNS SIZE 1 |
| **TL\_PROF\_WRK** | G | FOR ALL COLUMNS SIZE 1 |
| **TL\_RESEQ2\_WRK** | G | FOR ALL COLUMNS SIZE 1 |
| **TL\_RESEQ5\_WRK** | G | FOR ALL COLUMNS SIZE 1 |
| **TL\_WRK01\_RCD** | G | FOR ALL COLUMNS SIZE 1 |
| **WRK\_SCHRS\_TAO** | G | FOR ALL COLUMNS SIZE 1 |
| **TL\_FRCS\_PYBL\_TM** | R |  |
| **TL\_ST\_PCHTIME** | R |  |
| **TL\_VALID\_TR** | R |  |
| **All other temporary records in TL\_TIMEADMIN** | N |  |

This data can be loaded into the meta-data table with the script *gfcpsstats11\_metadata.sql*.

#### DDL Models

This data mover script replaces DDL model 4 and 5 which are called from the Application Engine %UpdateStats macro. Note that both models are the same so it does not matter if the HIGH or LOW parameter is specified.

-- \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

-- ddlora-gfcpsstats11.dms (c) Go-Faster Consultancy 2012

-- ReLoads the PeopleTools DDL tables for Analyze statements for Oracle

-- calling gfcpsstats11 package

-- \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

SET LOG DDLORA.LOG;

DELETE FROM PSDDLMODEL

WHERE PLATFORMID=2

AND STATEMENT\_TYPE IN (4,5)

;

INSERT INTO PSDDLMODEL (

STATEMENT\_TYPE,

PLATFORMID,

SIZING\_SET,

PARMCOUNT,

MODEL\_STATEMENT)

VALUES(

:1,

:2,

:3,

:4,

:5)

\

$DATATYPES NUMERIC,NUMERIC,NUMERIC,NUMERIC,CHARACTER

4,2,0,0,$long

gfcpsstats11.ps\_stats(p\_ownname=>[DBNAME],p\_tabname=>[TBNAME],p\_verbose=>TRUE);

//

5,2,0,0,$long

gfcpsstats11.ps\_stats(p\_ownname=>[DBNAME],p\_tabname=>[TBNAME],p\_verbose=>TRUE);

//

/

#### Updating Statistics in COBOL

PeopleSoft COBOL programs also collect statistics on working storage tables. The stored statements appear to use the UpdateStats macro, but in fact this invokes a hard coded routine in the COBOL that calls DBMS\_STATS.

STORE PSPLDTL2\_U\_STATIST

%UPDATESTATS(PS\_PY\_PYBL\_TM\_WRK)

;

However, these steps can be changed to call a PL/SQL procedure.

STORE PSPLDTL2\_U\_STATIST

BEGIN gfcpsstats11.ps\_stats(p\_ownname=>user,p\_tabname=>'PS\_PY\_PYBL\_TM\_WRK'); END;;

One option would be to manually change the delivered scripts that are loaded into the database using Data Mover.

Stored statements that have already been loaded can be updated as follows:

UPDATE ps\_sqlstmt\_tbl

SET stmt\_text = 'BEGIN gfcpsstats11.ps\_stats(p\_ownname=>user,p\_tabname=>'''

|| SUBSTR(stmt\_text,14,LENGTH(stmt\_text)-14)

|| '''); END;;'

WHERE stmt\_text LIKE '%UPDATESTATS(%)'

/

A trigger can be used to convert the stored statements as they are loaded by data mover (see Trigger GFC\_STAT\_OVRD\_STORED\_STMT on page 16).

### Packaged Procedure GFCPSSTATS11

The GFCPSSTATS11 package contains a number of public procedures that can be called extermally.

* PS\_STATS
* REFRESH\_STATS
* SET\_TABLE\_PREFS
* SET\_RECORD\_PREFS
* GENERATE\_METADATA

NB: This procedure calls the PSFTAPI package; [www.go-faster.co.uk/scripts.htm#psftapi.sql](http://www.go-faster.co.uk/scripts.htm#psftapi.sql).

#### PS\_STATS Procedure

This procedure is designed to be called from the DDL model for %UpdateStats by Application Engine processes and from within Cobol Stored Statements. It collects statistics on the named table according to the meta-data and table preferences.

Syntax

ps\_stats

(p\_ownname IN VARCHAR2 /\*owner of table\*/

,p\_tabname IN VARCHAR2 /\*table name\*/

,p\_verbose IN BOOLEAN DEFAULT FALSE /\*if true print SQL\*/

);

Parameters

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Data Type** | **Description** |
| p\_ownname | VARCHAR2 | Table Owner |
| p\_tabname | VARCHAR2 | Table Name |
| p\_verbose | BOOLEAN | If true print debug messages |

#### REFRESH\_STATS Procedure

This procedure refreshs unlocked stale statistics on physical tables, partitions and subpartitions and any global statistics.

Syntax

set\_defaults(

(p\_ownname IN VARCHAR2 /\*owner of table\*/

,p\_tabname IN VARCHAR2 /\*table name\*/

,p\_block\_sample IN BOOLEAN DEFAULT FALSE /\*if true block sample stats\*/

,p\_force IN BOOLEAN DEFAULT FALSE

,p\_verbose IN BOOLEAN DEFAULT FALSE /\*if true print SQL\*/

);

Parameters

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Data Type** | **Description** |
| p\_ownname | VARCHAR2 | Table Owner |
| p\_tabname | VARCHAR2 | Table Name |
| p\_block\_sample | BOOLEAN | Same as block\_sample from *dbms\_stats.gather\_table\_stats*. Whether or not to use random block sampling instead of random row sampling. |
| p\_force | BOOLEAN | Same as force from *dbms\_stats.gather\_table\_stats*. Gather statistics even if locked. |
| p\_verbose | BOOLEAN | If true print debug messages |

#### SET\_TABLE\_PREFS Procedure

This procedure sets table preferences on named tables according to the meta-data in PS\_GFC\_STATS\_OVRD.

Syntax

set\_table\_prefs

(p\_tabname IN VARCHAR2 /\*table name\*/

,p\_recname IN VARCHAR2 DEFAULT NULL /\*record of table if known\*/

);

Parameters

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Data Type** | **Description** |
| p\_tabname | VARCHAR2 | Table Name |
| p\_recname | VARCHAR2 | PeopleSoft Record Name |

#### SET\_RECORD\_PREFS Procedure

This procedure to set table preferences on tables relating to named record to values specified in the meta-data. If there is no meta-data for the record the preferences are removed.

Syntax

set\_record\_prefs

(p\_recname IN VARCHAR2 /\*record name\*/

);

Parameters

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Data Type** | **Description** |
| p\_recname | VARCHAR2 | PeopleSoft Record Name |

#### GENERATE\_METADATA Procedure

This procedure updates PS\_GFC\_STATS\_OVRD so that the meta-data matches the actual table preferences.

Syntax

generate\_metadata;

### Triggers

A number of triggers have been used to automate the application of table preferences.

##### Required Privileges

The triggers require that the following privileges are granted explicitly to the SYSADM schema.

REM gfcpsstats11\_privs.sql

REM (c) Go-Faster Consultancy 2008-2012

GRANT EXECUTE ON dbms\_scheduler TO sysadm;

GRANT CREATE JOB TO sysadm;

#### GFC\_STATS\_OVRD\_METADATA

This trigger submits database jobs to reapply the table preferences when the metadata is updated.

CREATE OR REPLACE TRIGGER gfc\_stats\_ovrd\_metadata

AFTER INSERT OR UPDATE OF RECNAME, ESTIMATE\_PERCENT, METHOD\_OPT, DEGREE, GRANULARITY, INCREMENTAL, STALE\_PERCENT

OR DELETE ON ps\_gfc\_stats\_ovrd

FOR EACH ROW

DECLARE

l\_cmd VARCHAR2(100) := '';

l\_jobno NUMBER;

BEGIN

IF DELETING THEN

dbms\_job.submit(l\_jobno,'gfcpsstats11.unset\_record\_prefs('''||:old.recname||''');');

ELSE

IF :new.recname != :old.recname THEN

dbms\_job.submit(l\_jobno,'gfcpsstats11.unset\_record\_prefs('''||:old.recname||''');');

END IF;

dbms\_job.submit(l\_jobno,'gfcpsstats11.set\_record\_prefs('''||:new.recname||''');');

END IF;

END gfc\_stats\_ovrd\_metadata;

/

Setting and deleting table preferences include an implicit commit. Therefore, I have used DBMS\_JOB to submit the jobs because the job is only executed when the trigger issues a commit. Thus, the procedure can just directly read the meta-data from the table. There will be a small lag between commiting meta-data changes, and the table preference being applied.

#### GFC\_STATS\_OVRD\_CREATE\_TABLE

This trigger applies table preferences to the table as it is created. A database job is used because otherwise the trigger fires while the table is being created but it exists.

CREATE OR REPLACE TRIGGER gfc\_stats\_ovrd\_create\_table

AFTER CREATE ON sysadm.schema

BEGIN

IF ora\_dict\_obj\_type = 'TABLE' THEN

--submit one-time job to set table preferences as table will not have been created by time trigger runs

sys.dbms\_scheduler.create\_job

(job\_name => 'SET\_PREFS\_'||ora\_dict\_obj\_name

,job\_type => 'PLSQL\_BLOCK'

,job\_action => 'BEGIN gfcpsstats11.set\_table\_prefs(p\_tabname=>'''||ora\_dict\_obj\_name||'''); END;'

,start\_date => SYSTIMESTAMP --run job immediately

,enabled => TRUE --job is enabled

,auto\_drop => TRUE --request will be dropped when complete

,comments => 'Set table preferneces on table '||ora\_dict\_obj\_owner||'.'||ora\_dict\_obj\_name

);

END IF;

END;

/

#### GFC\_STAT\_OVRD\_STORED\_STMT

This trigger changes COBOL stored statements to call GFCPSSTATS11 instead of the internal routine that calls DBMS\_STATS.

CREATE OR REPLACE TRIGGER gfc\_stat\_ovrd\_stored\_stmt

BEFORE INSERT ON ps\_sqlstmt\_tbl

FOR EACH ROW

WHEN (new.stmt\_text LIKE '%UPDATESTATS(%)')

BEGIN

:new.stmt\_text := 'BEGIN gfcpsstats11.ps\_stats(p\_ownname=>user,p\_tabname=>'''

||SUBSTR(:new.stmt\_text,14,LENGTH(:new.stmt\_text)-14)||'''); END;;';

END;

/

#### Delivered Files

|  |  |
| --- | --- |
| File Name | Description |
| gfcpsstats11.doc | This document. |
| gfcpsstats11.sql | Script that contains packaged procedure and triggers. |
| gfcpsstats11\_privs.sql | Script to grant privileges to SYSADM schema. |
| gfcpsstats11\_metadata.sql | Sample T&L metadata. |
| gfcpsstats11\_testdata.sql | Script to test behaviour package. |
| ddlora-gfcpsstats11.dms | Data Mover script to replace DDL Models 4 and 5. |

1. ss Controlling How %UpdateStats Collects Optimizer Statistics <http://blog.psftdba.com/2009/06/controlling-how-updatestats-collects.html> [↑](#footnote-ref-1)
2. <http://www.go-faster.co.uk/scripts.htm#wrapper848meta.sql> [↑](#footnote-ref-2)
3. Statistics Management for PeopleSoft Temporary Records in Application Engine Programs <http://blog.psftdba.com/2009/04/statistics-management-for-peoplesoft.html>. [↑](#footnote-ref-3)
4. Gathering Aggregated Cost-Based Optimiser Statistics on Partitioned Objects in Oracle 11gR2 <http://www.go-faster.co.uk/docs.htm#Partition.Statistics.11g> [↑](#footnote-ref-4)