Debugging and Monitoring On-line Validation and Derivation Procedures in OC and RDC

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Validation/Derivation Procedure Focus Group

Session S16

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Debugging PL/SQL Code DBMS_OUTPUT

- Every developer, at one time or another, needs to debug code
- PL/SQL offers DBMS_OUTPUT.PUT_LINE.
  - Messages can be up to 255 characters long;
  - Messages are buffered in user memory
    - No history of messages
  - Messages are not displayed until the current statement completes
    - Can be problematic for long-running jobs
  - All message are created "equal"
    - A severe error message is treated the same as an "I am here" message
- DBMS_OUTPUT can be used to display messages in OC Validation and Derivation procedures

Debugging PL/SQL Code OPA_TRACE

- Oracle has developed the OPA_TRACE package which can:
  - Be enabled or disabled
  - Write messages to the screen
  - Write messages to a table (OPA_DEBUG)
  - Write messages depending on severity of the message
  - Write messages to a file
- Messages written to a table can be viewed (even from another session) the instant they are inserted
  - Autonomous transactions occur within the OPA_TRACE package
  - COMMITS in this package are separate from COMMITS in the session which is invoking the package
  - No waiting for a process to finish before reviewing some of the results
- OPA_TRACE can be used instead of DBMS_OUTPUT
- By utilizing OPA_TRACE in error handling routines, procedures, and functions and directing the output to an Oracle table, developers and support personnel can identify errors across the user community, and uncover errors which may have gone unnoticed

Agenda

- Simple Example of OPA_TRACE in PL/SQL
- Review opa_debug table
- Review OPA_TRACE's Procedures and Functions
- OPA_TRACE in a Derivation Procedure
- Getting Started with OPA_TRACE

Example using OPA_TRACE in PL/SQL Code

```
BEGIN
    opa_trace.debugon;
    opa_trace.tableon;
    <some pl/sql code>
    opa_trace.debugmsg(msgstring);
    <some pl/sql code>
EXCEPTION
    WHEN OTHERS THEN
        opa_trace.debugmsg(sqlerrm, proc name)
END;
```

Your PL/SQL code with some debug statements

View the messages created by OPA_TRACE

```
SELECT * FROM opa_debug WHERE sessionid = USERENV('SESSIONID');
```

Example using OPA_TRACE in PL/SQL Code

```
1  DECLARE
2    v_clinical_study_id clinical_studies.clinical_study_id%TYPE := 1;
3    v_study             clinical_studies.study%TYPE;
4    v_msgstring VARCHAR2(255);
5  BEGIN
6
7    opa_trace.debugon;
8    opa_trace.tableon;
9
10   SELECT study
11   INTO   v_study
12   FROM   clinical_studies
13   WHERE  clinical_study_id = v_clinical_study_id;
14
15   v_msgstring := 'the name of the study is ' || v_study;
16
17   opa_trace.debugmsg(v_msgstring);
18 EXCEPTION
19   WHEN OTHERS THEN
20     opa_trace.debugmsg('ANONYMOUS BLOCK', SQLERRM);
21 END;
22 /
23
```

Query Result | Statement Output

```
anonymous block completed
```

Example using OPA_TRACE in PL/SQL Code

```
24 SELECT *
25 FROM   opa_debug
26 WHERE sessionid = USERENV('sessionid')
```

Statement Output | Query Result

SQL | All Rows Fetched: 1 in 0.047 seconds

	DEBUG_ID	LINE_NO	DEBUG_TSMP	CREATED_BY	SESSIONID	SEVERITY_ID	DEBUG...	APPLICATION	UNITNAME	MESSAGE_TEXT
1	817	0	20-SEP-10...	TMS_LOAD	16630394	820	(null)	OCL	ANONYMOUS BLOCK	ORA-01403: no data found

OPA_DEBUG table

Oracle SQL Developer

File Edit View Navigate Run Versioning Tools Help

Connections

OPA
- Tables (Filtered)
  - APPLIED_RELEASES
  - OPA_ACCOUNTS
  - OPA_DEBUG
  - OPA_DEBUG_SESSIONS
  - OPA_DEF_EXCLUSION_TAGS
  - OPA_DEF_MODULE_EXCL
  - OPA_DEF_MODULE_EXEC
  - OPA_DEF_MODULE_PARS
  - OPA_DEF_MODULE_RELS
  - OPA_DEF_MODULE_SEC
  - OPA_DEF_MODULE_SEC_JN
  - OPA_DEF_PAR_DEPEND
  - OPA_DEF_PAR_GROUPS
  - OPA_DEF_PARAMETERS

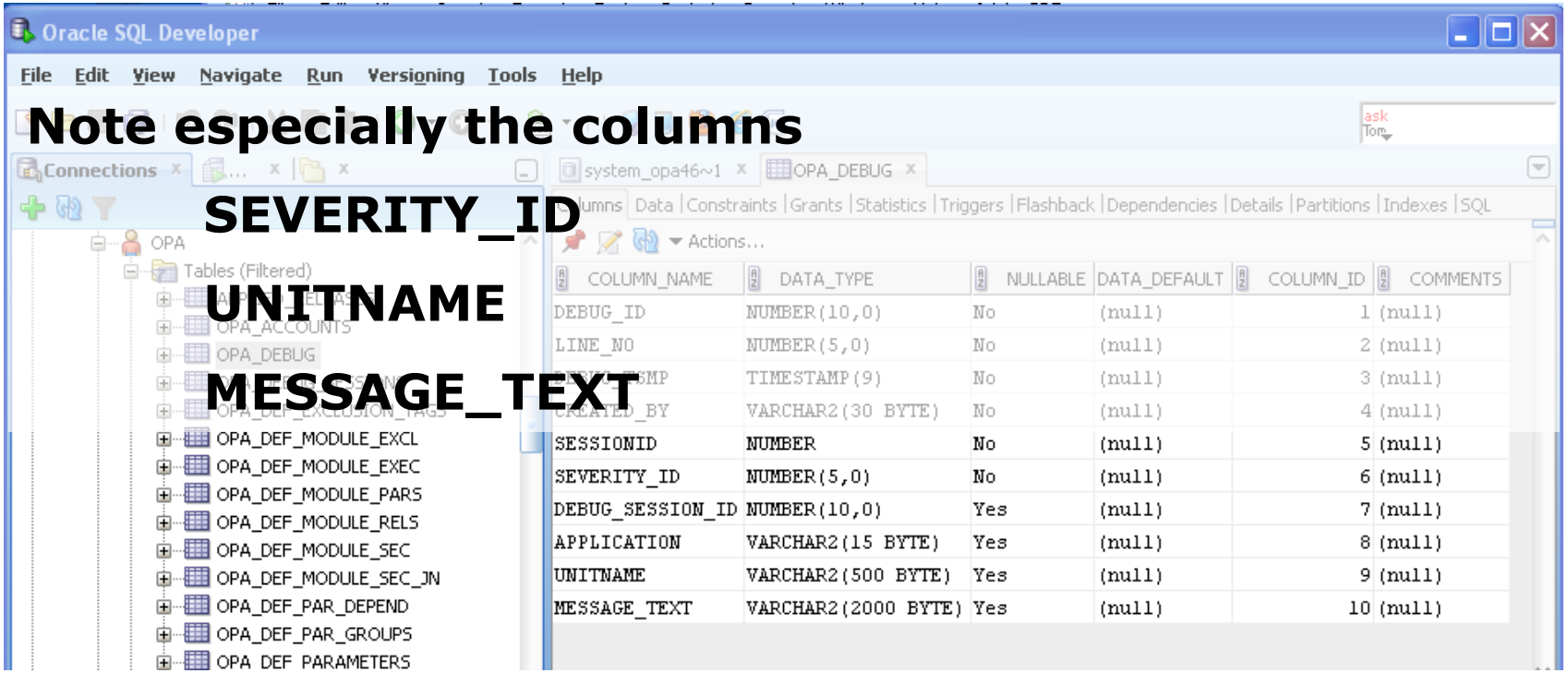
system_opa46~1 | OPA_DEBUG

Columns | Data | Constraints | Grants | Statistics | Triggers | Flashback | Dependencies | Details | Partitions | Indexes | SQL

Actions...

COLUMN_NAME	DATA_TYPE	NULLABLE	DATA_DEFAULT	COLUMN_ID	COMMENTS
DEBUG_ID	NUMBER(10,0)	No	(null)	1	(null)
LINE_NO	NUMBER(5,0)	No	(null)	2	(null)
DEBUG_TSMP	TIMESTAMP(9)	No	(null)	3	(null)
CREATED_BY	VARCHAR2(30 BYTE)	No	(null)	4	(null)
SESSIONID	NUMBER	No	(null)	5	(null)
SEVERITY_ID	NUMBER(5,0)	No	(null)	6	(null)
DEBUG_SESSION_ID	NUMBER(10,0)	Yes	(null)	7	(null)
APPLICATION	VARCHAR2(15 BYTE)	Yes	(null)	8	(null)
UNITNAME	VARCHAR2(500 BYTE)	Yes	(null)	9	(null)
MESSAGE_TEXT	VARCHAR2(2000 BYTE)	Yes	(null)	10	(null)

OPA_DEBUG table



Note especially the columns

SEVERITY_ID

UNITNAME

MESSAGE_TEXT

OPA_TRACE PACKAGE

- Schema OPA owns package OPA_TRACE
- CONSTANTS
- PROCEDURES/FUNCTIONS
  - Messages
  - Message Destination
  - Others

OPA_TRACE CONSTANTS

- The "debug level" constants provide a level of granularity to differentiate the severity levels of messages
  - ALL_MESSAGES – 0
  - FINEST – 300
  - FINER – 400
  - FINE – 500
  - CONFIG – 700
  - INFO – 800
  - DEBUG_LOW – 820
  - DEBUG_MEDIUM – 850
  - DEBUG_HIGH – 870
  - WARNING – 900
  - SEVERE – 1000
- These values can be placed in, and queried from, the OPA_DEBUG table
  - SELECT * FROM opa_debug where severity_id = <some value>;

OPA_TRACE Messages

- **Procedure <u>DebugMsg</u> Overloaded versions**
  - pMessage
  - pMessage, pSeverity
  - pUnitName, pMessage
  - pUnitName, pMessage, pSeverity
  - pApplication, pUnitName, pMessage
  - pApplication, pUnitName, pMessage, pSeverity

  - **Parameters**
    - pMessage – content of message
    - pSeverity – relative severity – defaults to DEBUG_LOW
    - pUnitName – name of program/procedure
    - pApplication – name of application

OPA_TRACE Message Destination

Debug Messages are written to either:

- **File**
  - PROCEDURE FileOn
    - pDirectory, pFilename
  - PROCEDURE FileOff
  - FUNCTION Filing (returns Boolean)
- **Table (opa_debug)**
  - PROCEDURE TableOn
  - PROCEDURE TableOff
  - FUNCTION Tabling
- **Screen (set serveroutput on)**

OPA_TRACE Other Parameters

- **Procedure DebugOn**
  - No parameters
  - pBufferSize (optional parameter)

```
BEGIN
  opa_trace.debugon(1000000);
  REM more code…
END;
```

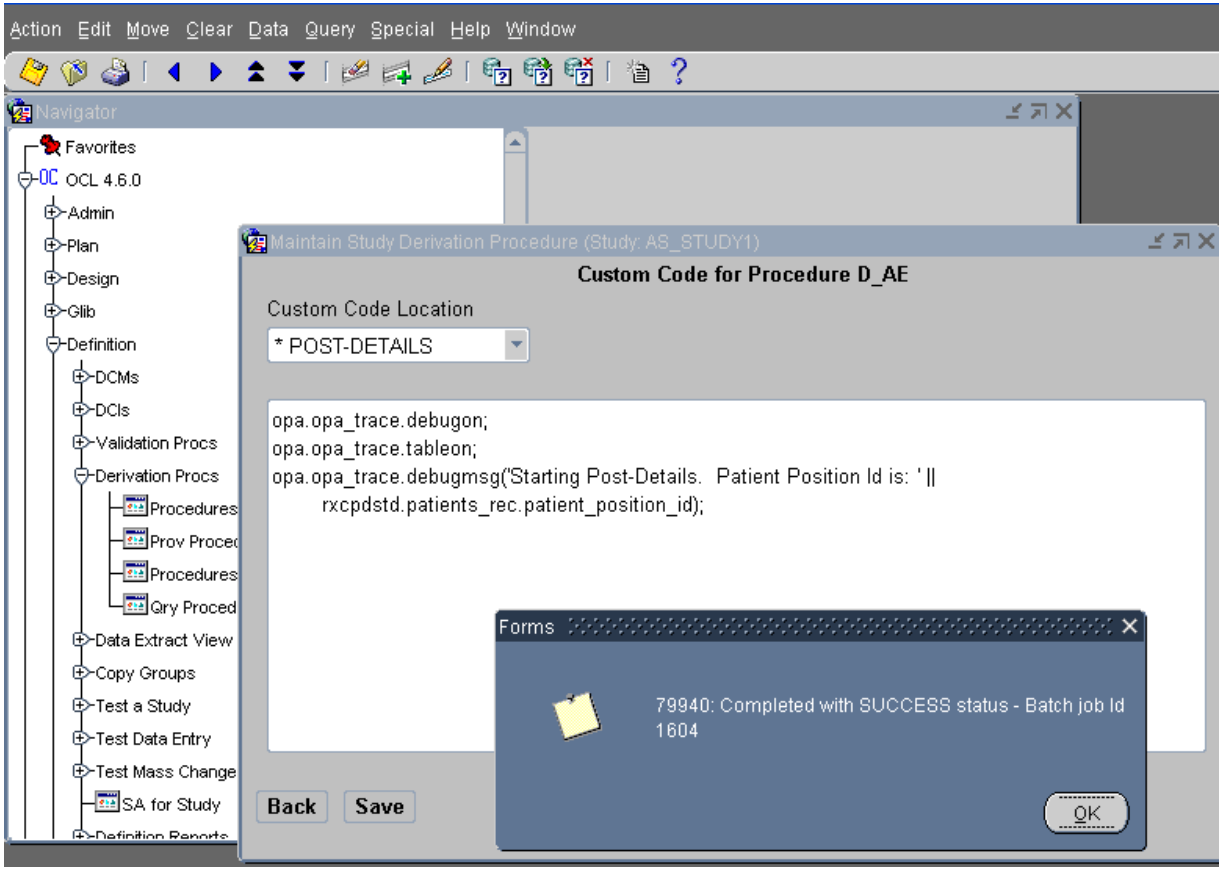
- **Procedure DebugOff**
- **Procedure SetSeverity**
  - pSeverity
    - Sets severity – all messages that have a severity >= this value will be logged
- **FUNCTION getSeverity**

OPA_TRACE – Other Parameters

- **PROCEDURE setMultiLineOn**
  - No argument
  - pLineLength
- **PROCEDURE setMultiLineOff (default)**
- **FUNCTION Debugging (returns boolean)**
- **PROCEDURE registerDebugSession**
  - pAppSessionId
    - Will call tableOn and setMultiLineOn
- **PROCEDURE PurgeDebugTable**
  - No arguments
  - pForUser
  - pForSession
  - pBeforeDate
- **PROCEDURE setDebugErrorMsgOn**
- **PROCEDURE setDebugErrorMsgOff**
- **FUNCTION getDebugErrorMsg**

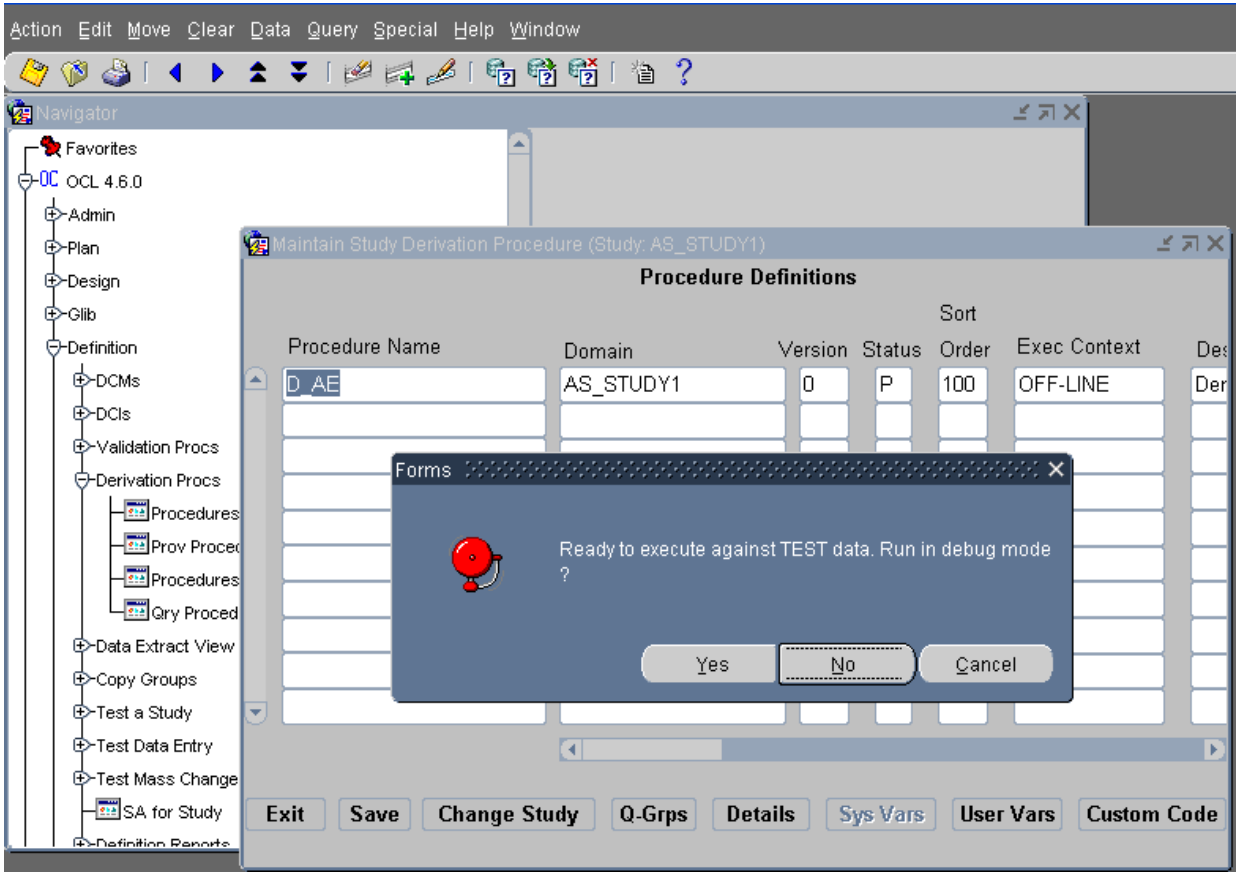
OPA_TRACE in a Derivation Procedure

- Example: Debug being turned on in a post-details procedure



OPA_TRACE in a Derivation Procedure

- Now let's execute the procedure in test mode



OPA_TRACE in a Derivation Procedure

- Messages in opa_debug table

```
4 select * from opa_debug where debug_tsmp > sysdate - 1
```

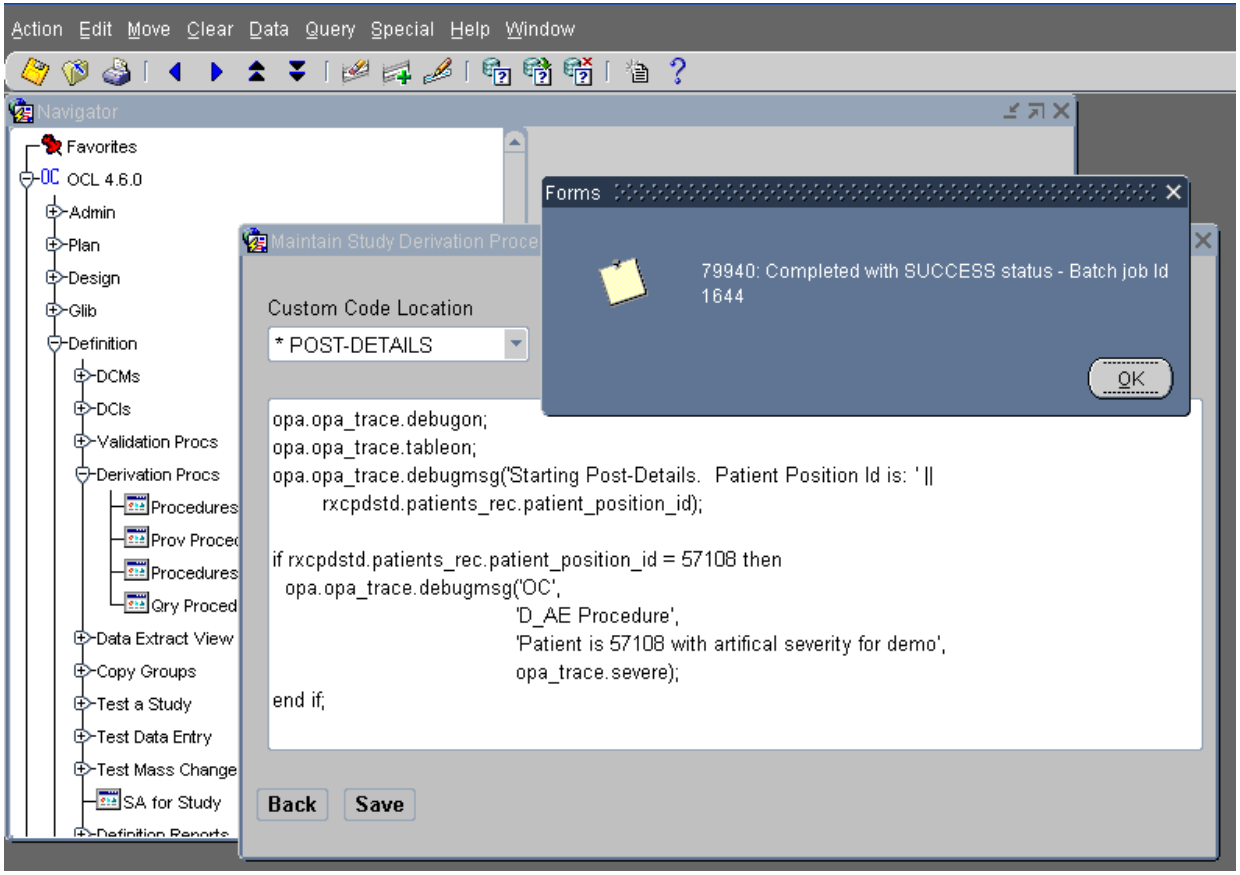
Query Result

SQL | All Rows Fetched: 8 in 0.047 seconds

	EBUG_ID	LIN...	DEBUG_TSMP	CREATE...	SESSIONID	SEVE...	DEBUG_SESSION_ID	APP...	UNI...	MESSAGE_TEXT
1	843	0	23-SEP-10 10.39.44...	OPS$OPAPPS	18620394	820	(null)	OCL	(null)	Starting Post-Details. Patient Position Id is: 57108
2	844	0	23-SEP-10 10.39.44...	OPS$OPAPPS	18620394	820	(null)	OCL	(null)	* Mark_Pat.APPLY 1 *
3	845	0	23-SEP-10 10.39.44...	OPS$OPAPPS	18620394	820	(null)	OCL	(null)	* In Mark_Pat.APPLY, calling ocl_flex_assessment.proces
4	846	0	23-SEP-10 10.39.44...	OPS$OPAPPS	18620394	820	(null)	OCL	(null)	* Mark_Pat.APPLY 2 *
5	847	0	23-SEP-10 10.39.44...	OPS$OPAPPS	18620394	820	(null)	OCL	(null)	Starting Post-Details. Patient Position Id is: 57208
6	848	0	23-SEP-10 10.39.44...	OPS$OPAPPS	18620394	820	(null)	OCL	(null)	* Mark_Pat.APPLY 1 *
7	849	0	23-SEP-10 10.39.44...	OPS$OPAPPS	18620394	820	(null)	OCL	(null)	* In Mark_Pat.APPLY, calling ocl_flex_assessment.proces
8	850	0	23-SEP-10 10.39.44...	OPS$OPAPPS	18620394	820	(null)	OCL	(null)	* Mark_Pat.APPLY 2 *

OPA_TRACE in a Derivation Procedure

- Demonstrate a severe message



OPA_TRACE in a Derivation Procedure

Messages in opa_debug table

Note the Severity 1000

```
4 select * from opa_debug where debug_tsmp > sysdate - 1
```

Query Result

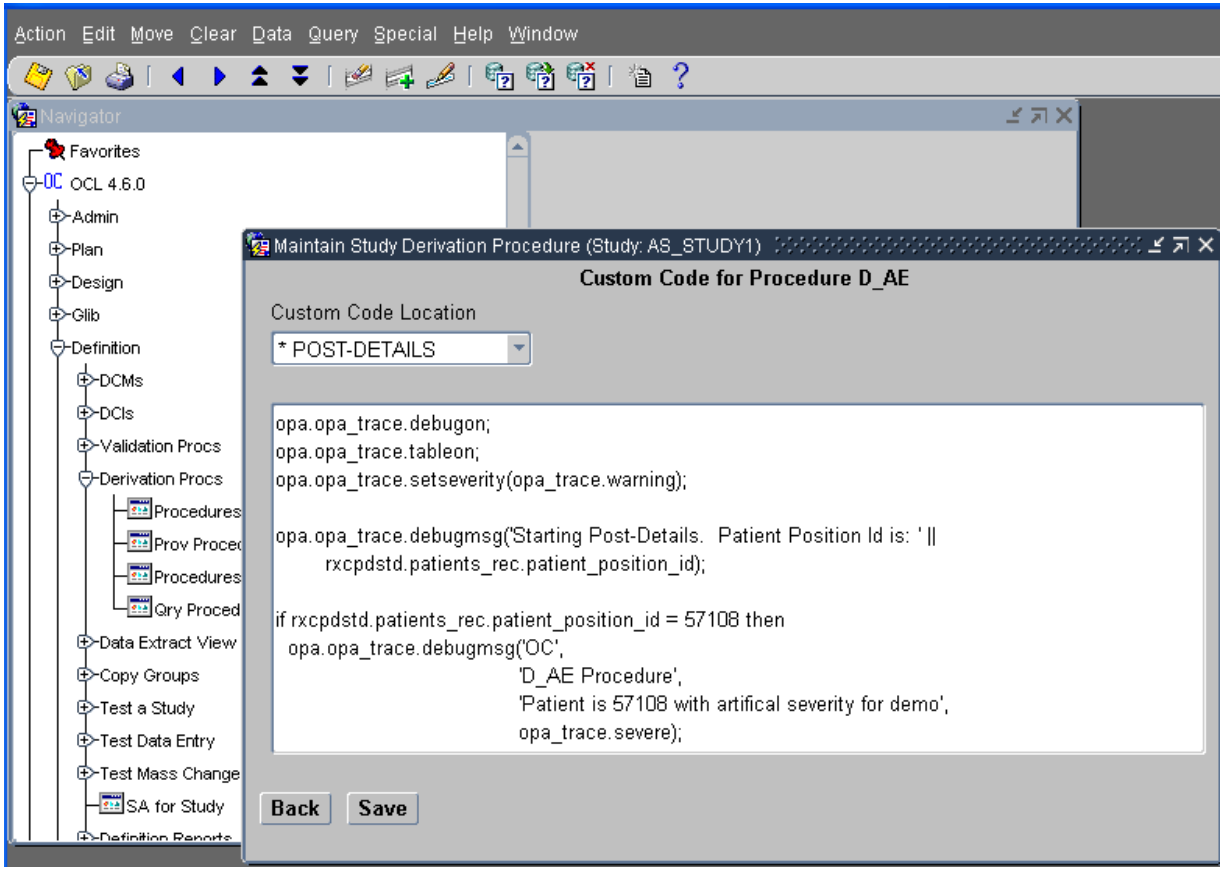
SQL | All Rows Fetched: 9 in 0.047 seconds

	DEBUG_ID	...	DEBUG_TSMP	CREATED_BY	SESSIONID	SEVERI...	DEBU...	APPLI...	UNITNAME	MESSAGE_TEXT
1	851	0	23-SEP-10 11.37...	OPS$OPAPPS	18630404	820	(null)	OCL	(null)	Starting Post-Details. Patient Position Id is: 57108
2	852	0	23-SEP-10 11.37...	OPS$OPAPPS	18630404	1000	(null)	OC	D_AE Procedure	Patient is 57108 with artifical severity for demo
3	853	0	23-SEP-10 11.37...	OPS$OPAPPS	18630404	820	(null)	OCL	(null)	* Mark_Pat.APPLY 1 *
4	854	0	23-SEP-10 11.37...	OPS$OPAPPS	18630404	820	(null)	OCL	(null)	* In Mark_Pat.APPLY, calling ocl_flex_assessment.processl
5	855	0	23-SEP-10 11.37...	OPS$OPAPPS	18630404	820	(null)	OCL	(null)	* Mark_Pat.APPLY 2 *
6	856	0	23-SEP-10 11.37...	OPS$OPAPPS	18630404	820	(null)	OCL	(null)	Starting Post-Details. Patient Position Id is: 57208
7	857	0	23-SEP-10 11.37...	OPS$OPAPPS	18630404	820	(null)	OCL	(null)	* Mark_Pat.APPLY 1 *
8	858	0	23-SEP-10 11.37...	OPS$OPAPPS	18630404	820	(null)	OCL	(null)	* In Mark_Pat.APPLY, calling ocl_flex_assessment.processl
9	859	0	23-SEP-10 11.37...	OPS$OPAPPS	18630404	820	(null)	OCL	(null)	* Mark_Pat.APPLY 2 *

OPA_TRACE in a Derivation Procedure

One last example

Set the severity level to 'warning'



OPA_TRACE in a Derivation Procedure

Messages in opa_debug table

After severity was set to "warning"

```
4 select * from opa_debug where debug_tsmp > sysdate - 1
```

Query Result

SQL | All Rows Fetched: 1 in 0.062 seconds

	DEBUG_ID	LINE_NO	DEBUG_TSMP	CREATED_BY	SESSIONID	SEVERITY_ID	DEBUG_SESSION_ID	APPLICATION	UNITNAME	MESSAGE_TEXT
1	860	0	23-SEP-10 11.48.11.317000000 PM	OPS$OPAPPS	18630421	1000	(null)	OC	D_AE Procedure	Patient is 57108 with ar

The other messages are not written to the opa_debug table

Getting Started with OPA_TRACE

- Start now in development. Replace DBMS_OUTPUT.PUT_LINE with OPA_TRACE.DEBUGMSG.
  - Benefit immediately by removing the 255 character limit
  - Ability to write records to tables for viewing during processing (from a different session).
- Develop standards for "WHEN OTHERS" clauses
  - Record any error raised by any user in a table.
  - Daily review of the table may help identify problems you didn't know that you had

Getting Started with OPA_TRACE

- **Establish standards regarding OPA_TRACE**
  - Define severity levels
  - Include package and procedure name for pUnitName argument
  - Include data values in error messages (so that problems can be replicated)
- **Create your own PL/SQL "wrapper" package which can**
  - Enforce standards regarding messages and debugging
  - Ensure severe errors are captured
  - Protect you from changes to OPA_TRACE
- **Advanced Ideas**
  - Provide the ability to turn on debug for a given user or session
  - Provide the ability to "watch" for certain procedures and only turn on debug for them

Conclusions

- OPA_TRACE provides the functionality of DBMS_OUTPUT.
- OPA_TRACE ALSO provides the ability to write messages to an Oracle table and get instantaneous information regarding long-running processes
- Debugging in development is useful – but why stop there?
- Potential to leverage debugging in a production environment to assist users in troubleshooting specific problems without capturing "every thing from every user."
- Potential to leverage debugging in a production environment to record error messages from custom code for any user or any process

Question and Answers

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- Sunil is a Global Oracle Health Sciences deployment expert for DBMS Consulting. He has been an active member of the OCUG community since 1996 and is extremely grateful for this opportunity to makes these presentations at OCUG 2010.

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- Bill has over 20 years experience working with the Oracle RDBMS and has worked in the pharmaceutical industry since the early 1990s as an Oracle developer, technical team leader, and project manager.