# Oracle Fine Grained Access Control

*by*

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  - Oracle Magazine, Select Journal, DBAZine.com, SQLUpdate, Oracle Scene, TechJournal
- Presented at several conferences
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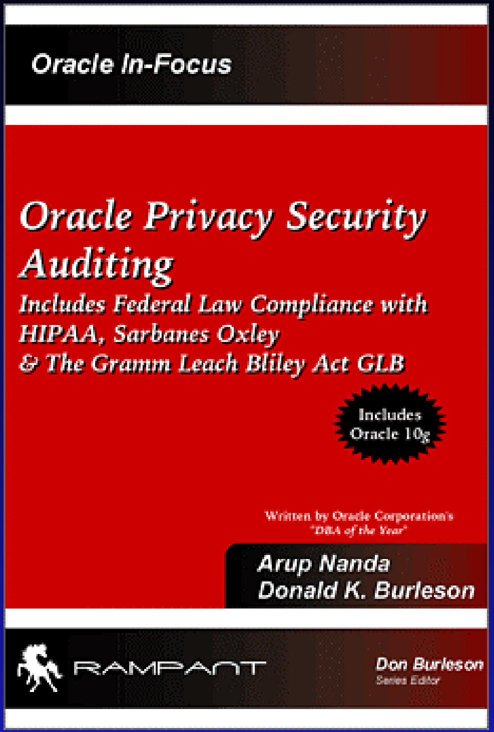
- Awarded *DBA of the Year* by Oracle.


Oracle In-Focus
Oracle Privacy Security Auditing
Includes Federal Law Compliance with HIPAA, Sarbanes Oxley & The Gramm Leach Bliley Act GLB
Includes Oracle 10g
Written by Oracle Corporation's "DBA of the Year"
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## Hospital Database

DOCTORS

| ID | Name | Group |
|---|---|---|
| 1 | DrAdam | 1 |
| 2 | DrBarb | 2 |
| 3 | DrCharlie | 2 |

PATIENTS

| ID | Doctor | Name | Disease |
|---|---|---|---|
| 1 | 1 | Larry | Ego |
| 2 | 1 | Bill | Control |
| 3 | 2 | Scott | Fickleness |
| 4 | 3 | Craig | LowVision |
| 5 | 3 | Lou | Greed |

# Patient Application

*Dr. Adam*
*Doctor ID = 1*

select * from patients

where doctor_id =
*<id of the doctor logged in>*

| ID | Doctor | Name | Disease |
|---|---|---|---|
| 1 | 1 | Larry | Ego |
| 2 | 1 | Bill | Control |
| 3 | 2 | Scott | Fickleness |
| 4 | 3 | Craig | LowVision |
| 5 | 3 | Lou | Greed |

# Hospital Database

DOCTORS

| ID | Name | Group |
|---|---|---|

PATIENTS

| ID | Doctor | Name | Disease |
|---|---|---|---|
| 3 | 2 | Scott | Fickleness |

Select * from PATIENTS

Select * from PATIENTS
Where DOCTOR_ID = 1

## Options

- Application Change
  - Add a predicate to each SQL statement
  - No security!
- Views
  - Automatic predicate
  - Selection on view; no access to base table
  - Too many views
  - Predicate has to be static
  - Difficult to determine accountability

## A Third Option

- Automatic application of predicate
- User's statement

```
SELECT * FROM PATIENTS
```

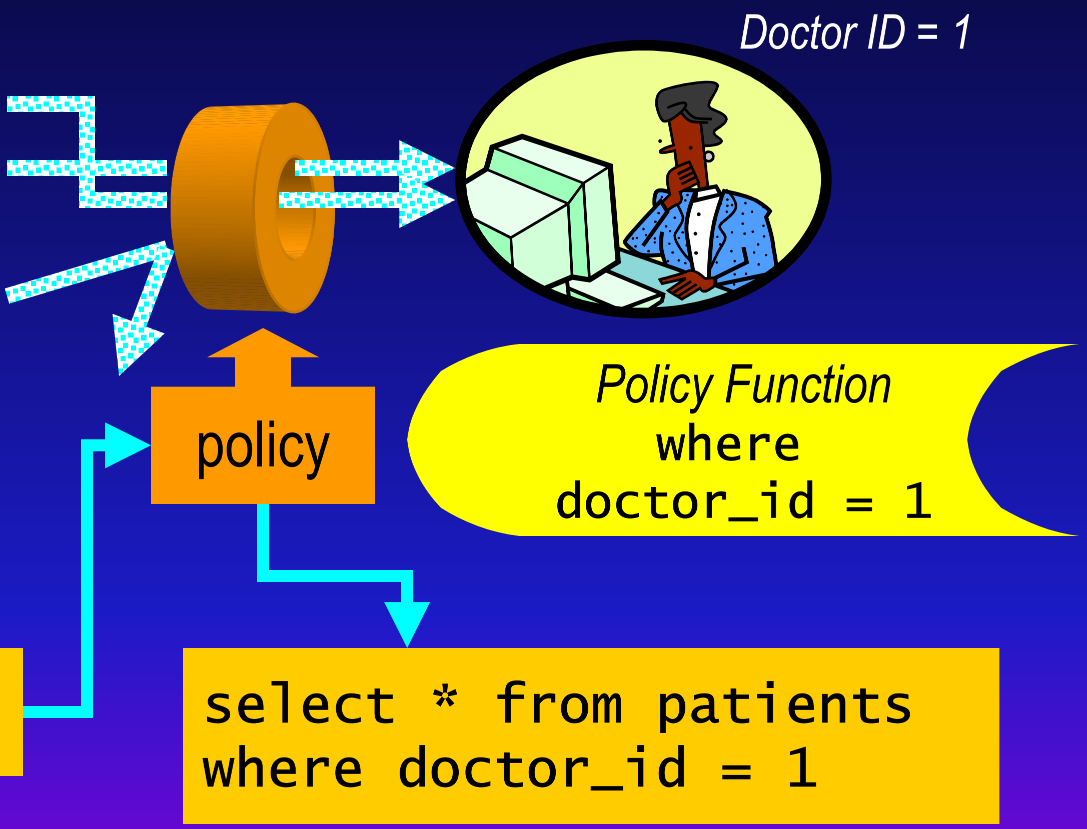
- Transformed to

```
SELECT * FROM PATIENTS
WHERE DOCTOR_ID = <ID>
```

- Predicate generated by a user defined policy function.

# Policy

| ID | Doctor | Name | Disease |
|---|---|---|---|
| 1 | 1 | Larry | Ego |
| 2 | 1 | Bill | Control |
| 3 | 2 | Scott | Fickleness |
| 4 | 3 | Craig | LowVision |
| 5 | 3 | Lou | Greed |



```
select * from patients;
```

```
select * from patients
where doctor_id = 1
```

## Policy Function

- Takes only two arguments
  - Table Owner
  - Table Name
- Must return a predicate that is to be applied, *without* the word WHERE.
- The predicate must be syntactically correct
  - *Correct*: doctor_id = (select doctor_id from doctors where doctor_name = USER)
  - *Incorrect*: doctor_id = (select USER from doctors)

## Policy Function

```
create or replace function get_doctor_id
(
   p_schema_name   in   varchar2,
   p_table_name   in   varchar2
)
return varchar2
is
   l_doctor_id   number;
begin
   select doctor_id
   into l_doctor_id
   from doctors
   where doctor_name = USER;
   return 'doctor_id = '||l_doctor_id;
end;
```

returns the currently logged in username

# Adding a Policy

```
begin
 dbms_rls.add_policy(
  object_schema   => 'HOSPITAL',
  object_name     => 'PATIENTS',
  policy_name     => 'PATIENT_VIEW_POLICY',
  policy_function => 'GET_DOCTOR_ID',
  function_schema => 'HOSPITAL',
  statement_types =>
          'SELECT, INSERT, UPDATE, DELETE',
  update_check    => true,
  enable          => true
   );
end;
```

the table on which the policy is defined

the owner and name of the policy function

Policy applied to all types of statements

## Query Transformation

Original Query

```
SELECT * FROM PATIENTS
```

Modified to

```
SELECT * FROM
(SELECT * FROM PATIENTS)
WHERE DOCTOR_ID = 1
```

## Insert/Update Check

User DRADAM allowed to see only DOCTOR_ID = 1

He tries to insert a record with DOCTOR_ID = 2

ORA-28115: policy with check option violation

He issues

```
update PATIENTS set DOCTOR_ID = 2;
```

ORA-28115: policy with check option violation, if update_check = TRUE

## Bypassing

```
create or replace function get_doctor_id
(
   p_schema_name   in   varchar2,
   p_table_name   in   varchar2
)
return varchar2
is
   l_doctor_id   number;
begin
   if (p_schema_name = USER) then
         return null;
   end if;
   select doctor_id
   into l_doctor_id
   from doctors
   where doctor_name = USER;
   return 'doctor_id = '||l_doctor_id;
end;
```

## Other Bypasses

- System Privilege
- EXEMPT ACCESS POLICY
- SYS and DBA roles have this by default.

## Other Dependent Tables

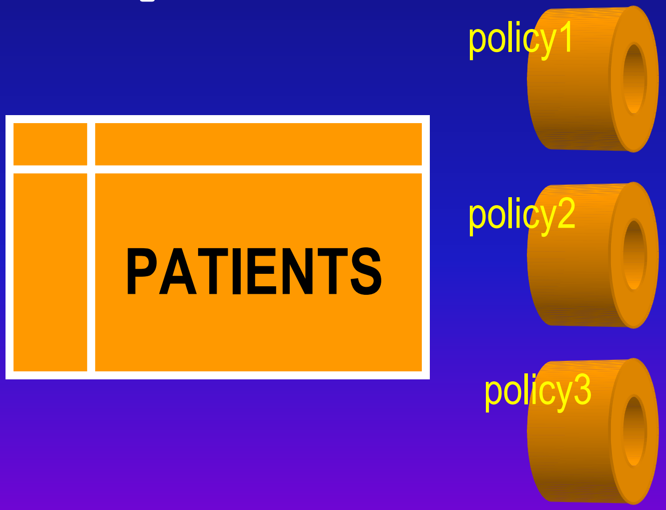
Applied predicate

WHERE PATIENT_ID IN (SELECT PATIENT_ID FROM PATIENTS)

# Multiple Policies

- Table can have multiple policies of the same type.
- Each policy applied with AND

```
select *
from patients
```



```
select *
from patients
where
DOCTOR_ID = 1
        AND
PROC_CODE != 'HIV'
        AND
TREATED = TRUE
```

## Extending the Functionality

Table for Authorized User

Table: USER_AUTHORITY

- USERNAME - the name of the user
- DOCTOR_ID – the DOCTOR_ID this user is allowed to see

Policy Function Change

```
select deptno into l_doctor_id
from user_authority where username = USER;
l_ret := ‘doctor_id = '||l_ doctor_id;
```

Table TREATMENTS (PATIENT_ID, TRATMENT_ID)

```
l_ret := ‘patient_id in (select patient_id from patients)';
```

## VPD and Other Oracle Tools

VPD is applied in Conventional Modes only.

Export DIRECT=Y

```
EXP-00079: Data in table "PATIENTS" is protected.
  Conventional path may only be exporting partial
  table.
. . exporting table            PATIENTS          3
  rows exported
```

SQL*Loader DIRECT=Y

```
SQL*Loader-951: Error calling once/load
  initialization
ORA-00604: error occurred at recursive SQL level
  1
ORA-28113: policy predicate has error
```

Direct Mode Load

```
insert /*+ APPEND */ into EMP;
ERROR at line 1:
ORA-28115: policy with check option violation
```

## Managing Policies

- View DBA_POLICIES
- Oracle Policy Manager
  - oemapp opm
- Applied Policies
  - V$VPD_POLICY

## Refreshing a Policy

```
dbms_rls.refresh_policy (
 object_schema => 'HOSPITAL'
 object_name   => 'PATIENTS',
 policy_name   => 'PATIENT_VIEW_POLICY'
);
```

Required when the parsed copy of the policy function needs to be changed.

Refreshing guarantees that. Recommended every time the policy or function is changed

Not required in 9i

## Dropping a Policy

```
dbms_rls.drop_policy (
 object_schema =>'HOSPITAL'
 object_name   =>'PATIENTS',
 policy_name   =>'PATIENT_VIEW_POLICY'
);
```

When the policy is not required anymore or the table should not be subjected to the restrictions.

## Enabling/Disabling a Policy

```
dbms_rls.enable_policy (
 object_schema => 'HOSPITAL'
 object_name   => 'PATIENTS',
 policy_name   => 'PATIENT_VIEW_POLICY',
 enable        => TRUE
);
```

When enabling a policy, just change parameter *enable* to TRUE and execute this function.

## Troubleshooting

- Most errors produce trace files
- Debugging

  alter session set events

  '10730 trace name context forever, level 12‘;

  Will produce the rewritten query in a trace file
- ORA-28110: Policy function or package has error

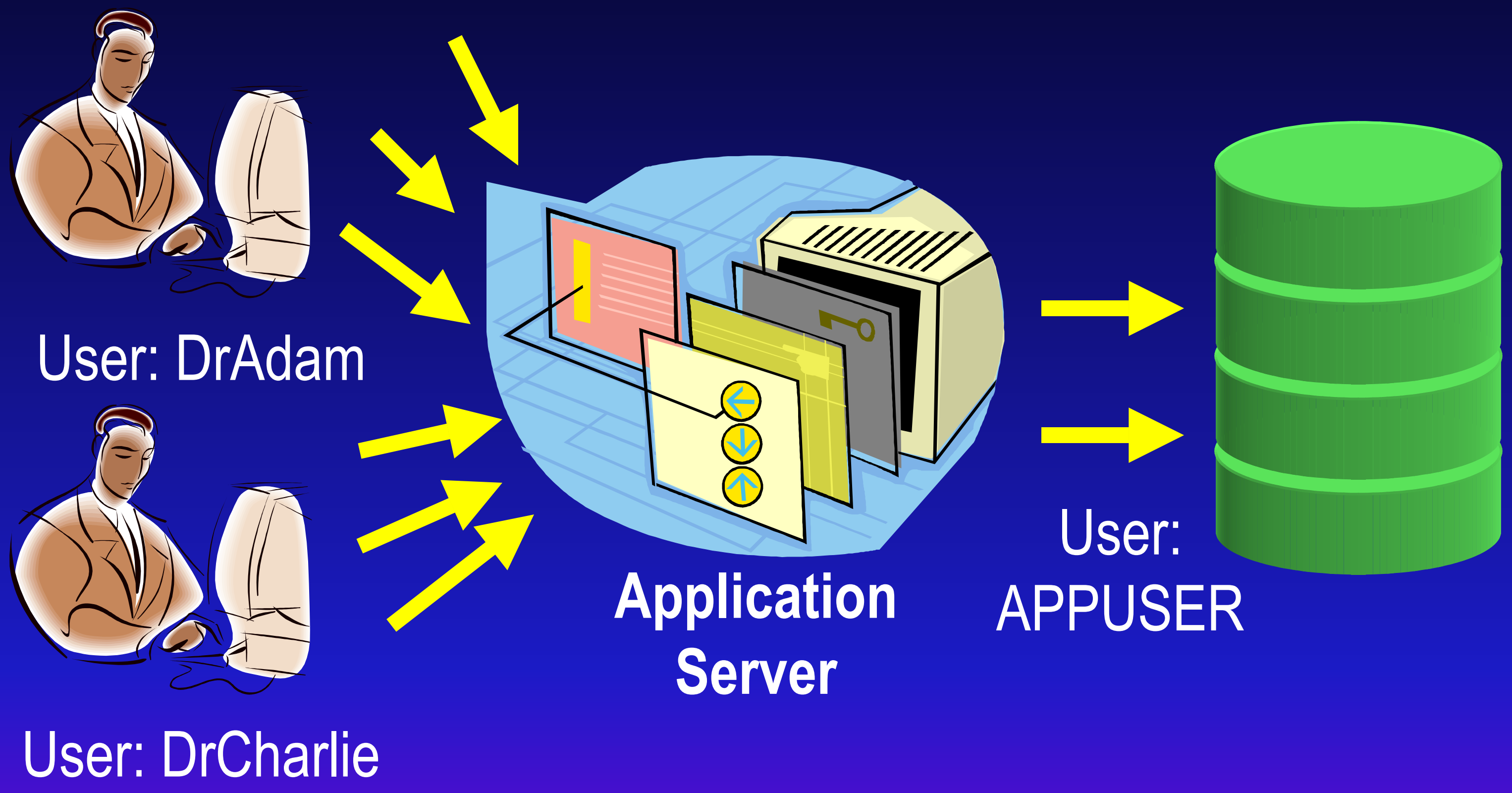
  Recompile the package
- ORA-28112: failed to execute policy function

  Some unhandled exception; check the trace file
- ORA-28116: insufficient privileges to do direct path access

  Conventional or Exempt User
- ORA-28113: policy predicate has error

  Check the trace file – SYNTAX Problem

# Application Users



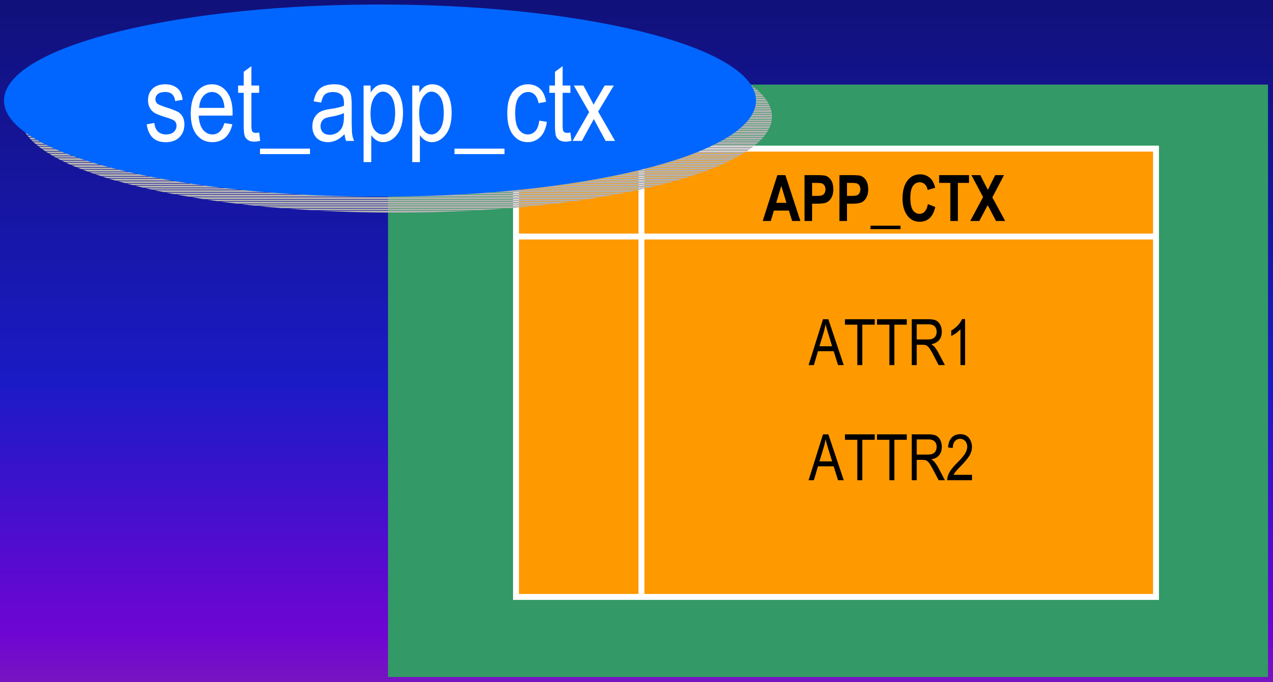
## Client Identifier

- Introduced in Oracle 9i
- dbms_session.set_identifier('<*identifier*>')
- CLIENT_ID in V$SESSION
- CLIENT_ID in Auditing
- sys_context('USERENV','CLIENT_IDENTIFIER')

# Application Context

Select USER from dual;

Select SYS_CONTEXT ('USERENV', 'CURRENT_USER') from dual;



## Oracle 10g Enhancements

Relevant Columns

SELECT COUNT(*) FROM PATIENTS

SELECT PATIENT_ID FROM PATIENTS

SELECT SOCIAL_SEC_NO FROM PATIENTS

Another parameter

```
dbms_rls.add_policy (
…
sec_relevant_cols => 'PATIENT_ID'
```

## Policy Types

- dynamic
- context_sensitive
- shared_context_sensitive
- static
- shared_static

## Conclusion

- Different view – on user
- Predicate applied automatically
- Predicate user generated
- 10g enhancements

Thank You!

*Questions?*

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