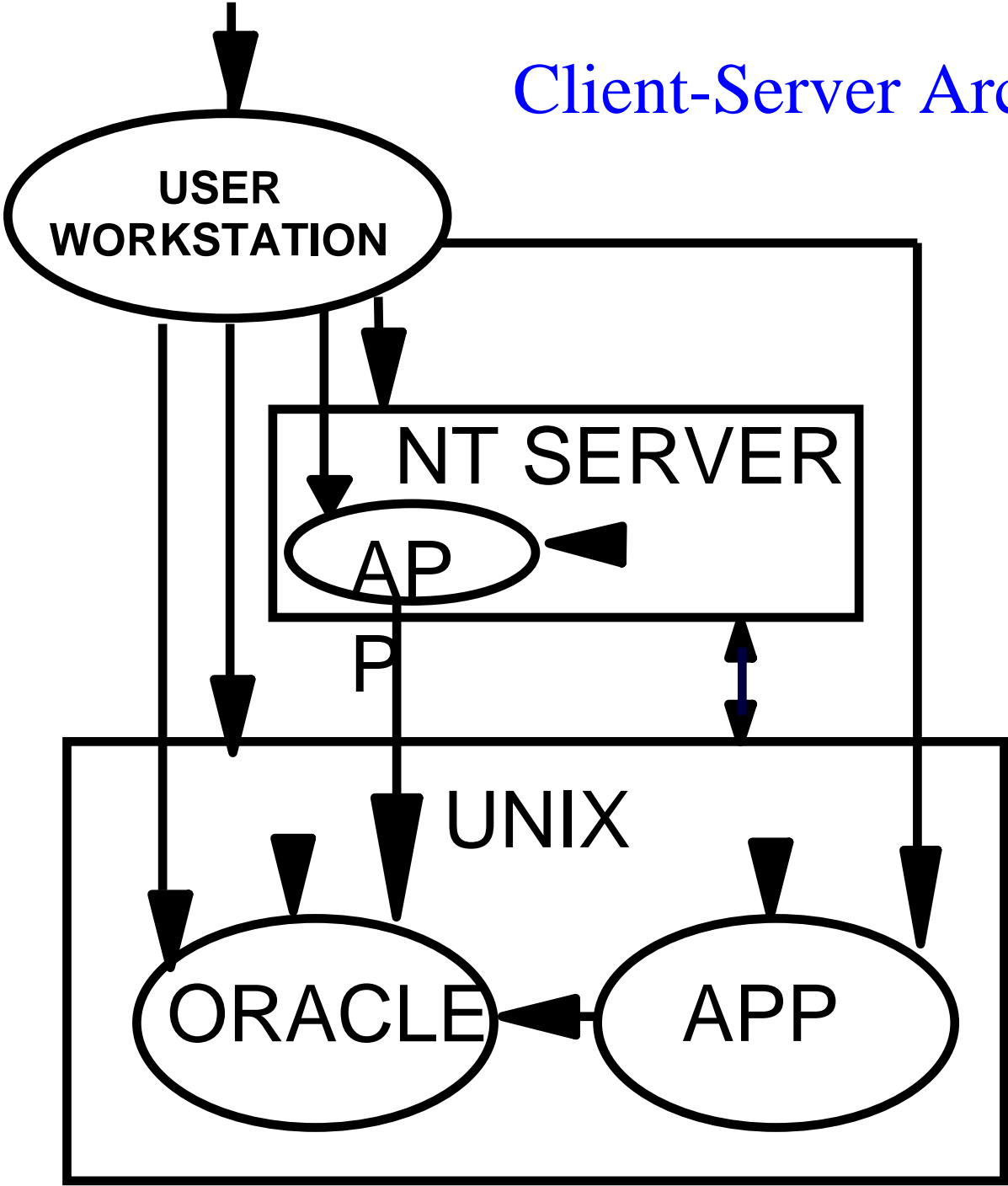


# Oracle Database Control Issues

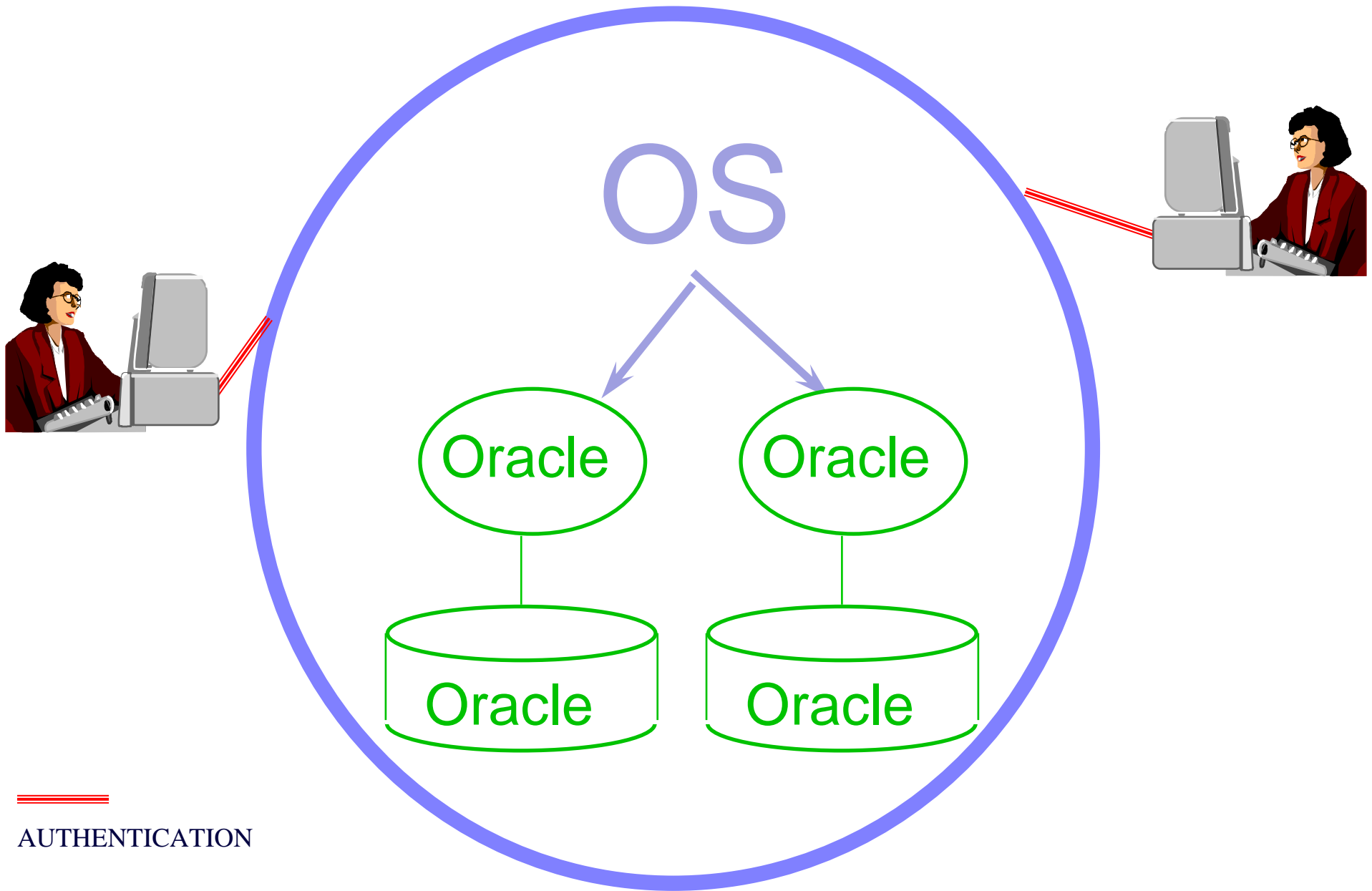
**Jennifer L. Bayuk**

**[jennifer\\_bayuk@attcapital.com](mailto:jennifer_bayuk@attcapital.com)**

# Client-Server Architecture

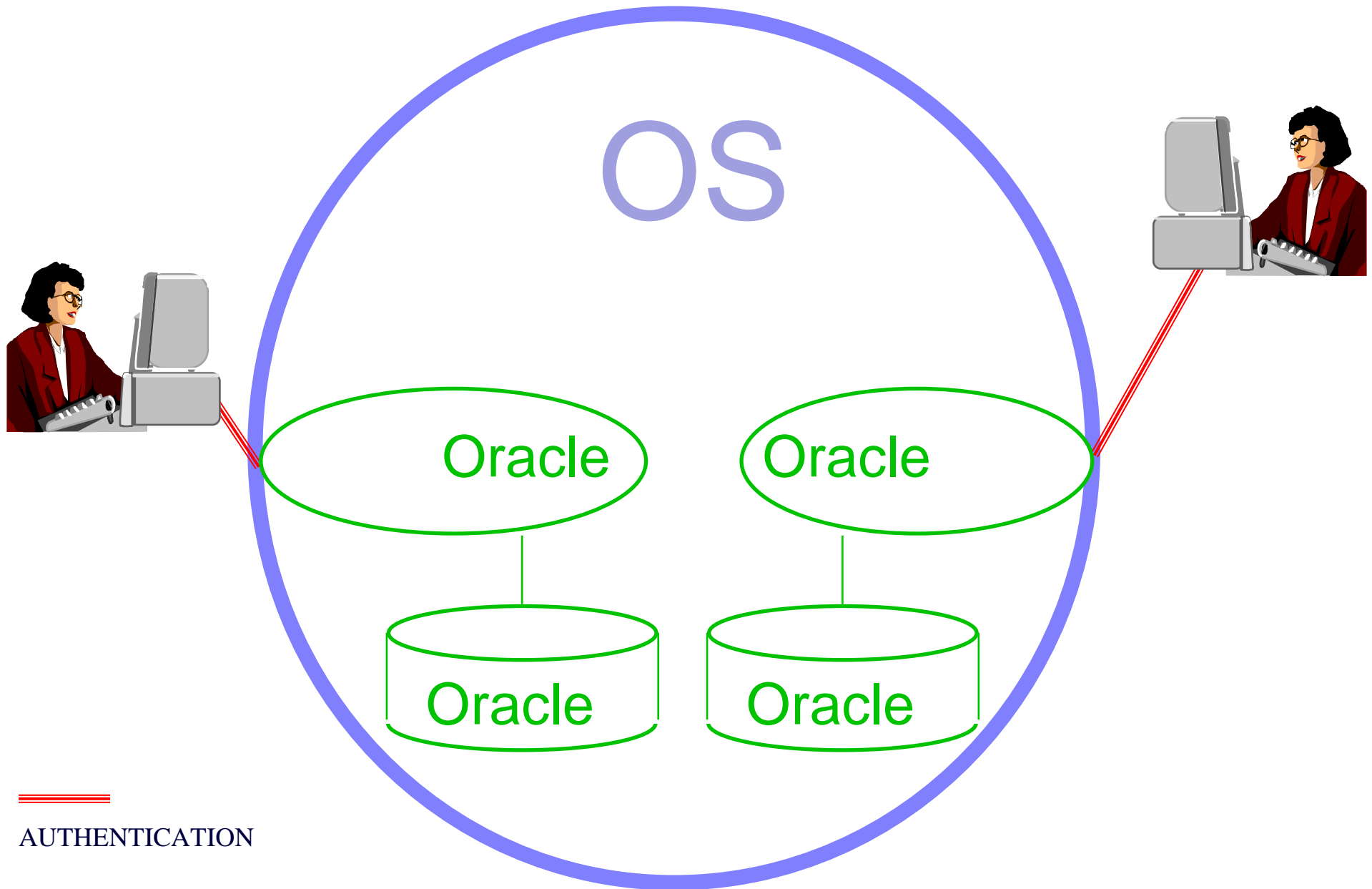


# Architecture Example 1: Host-based Access Control



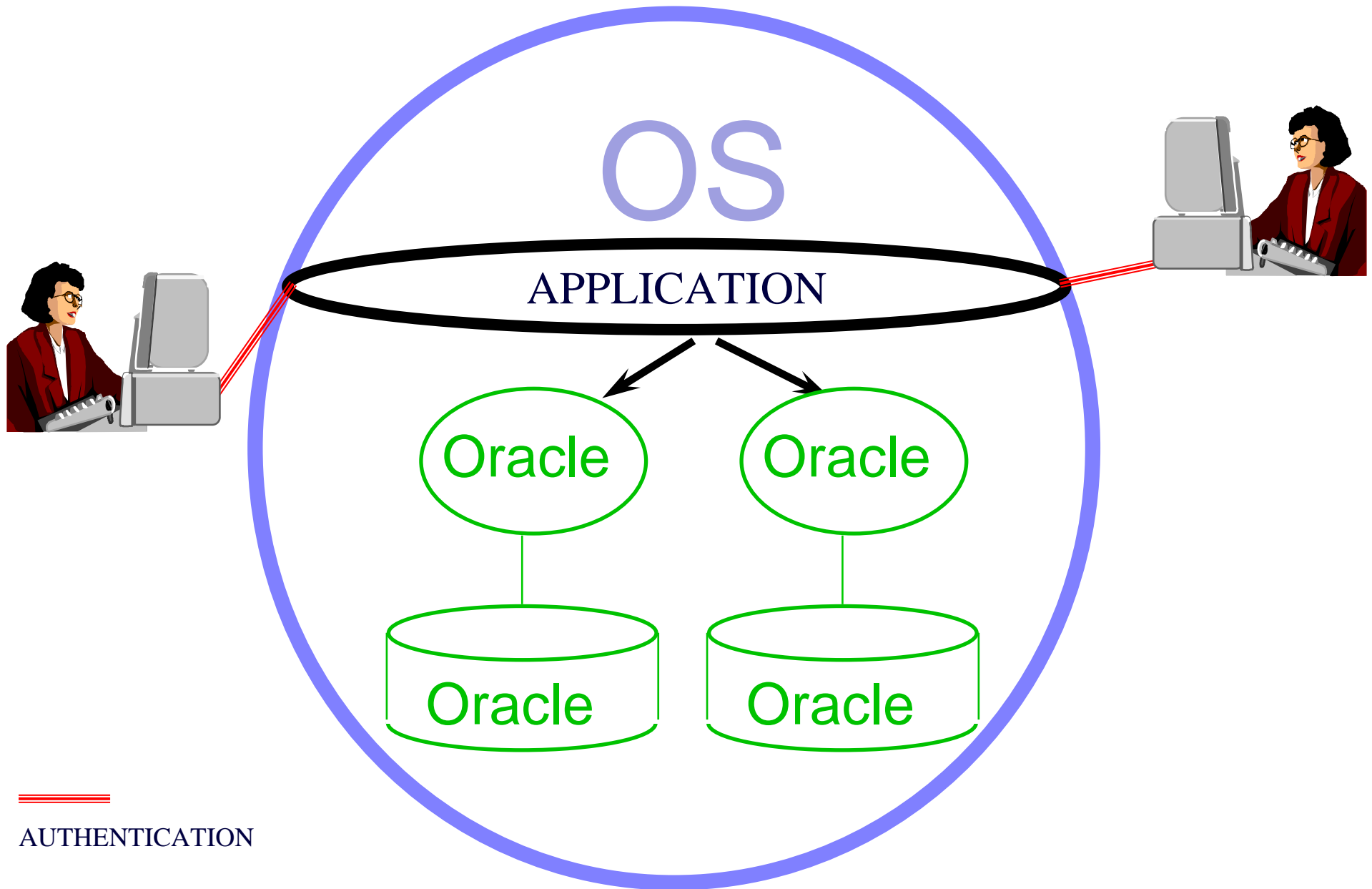
=====  
AUTHENTICATION

# Architecture Example 2: DBMS-based



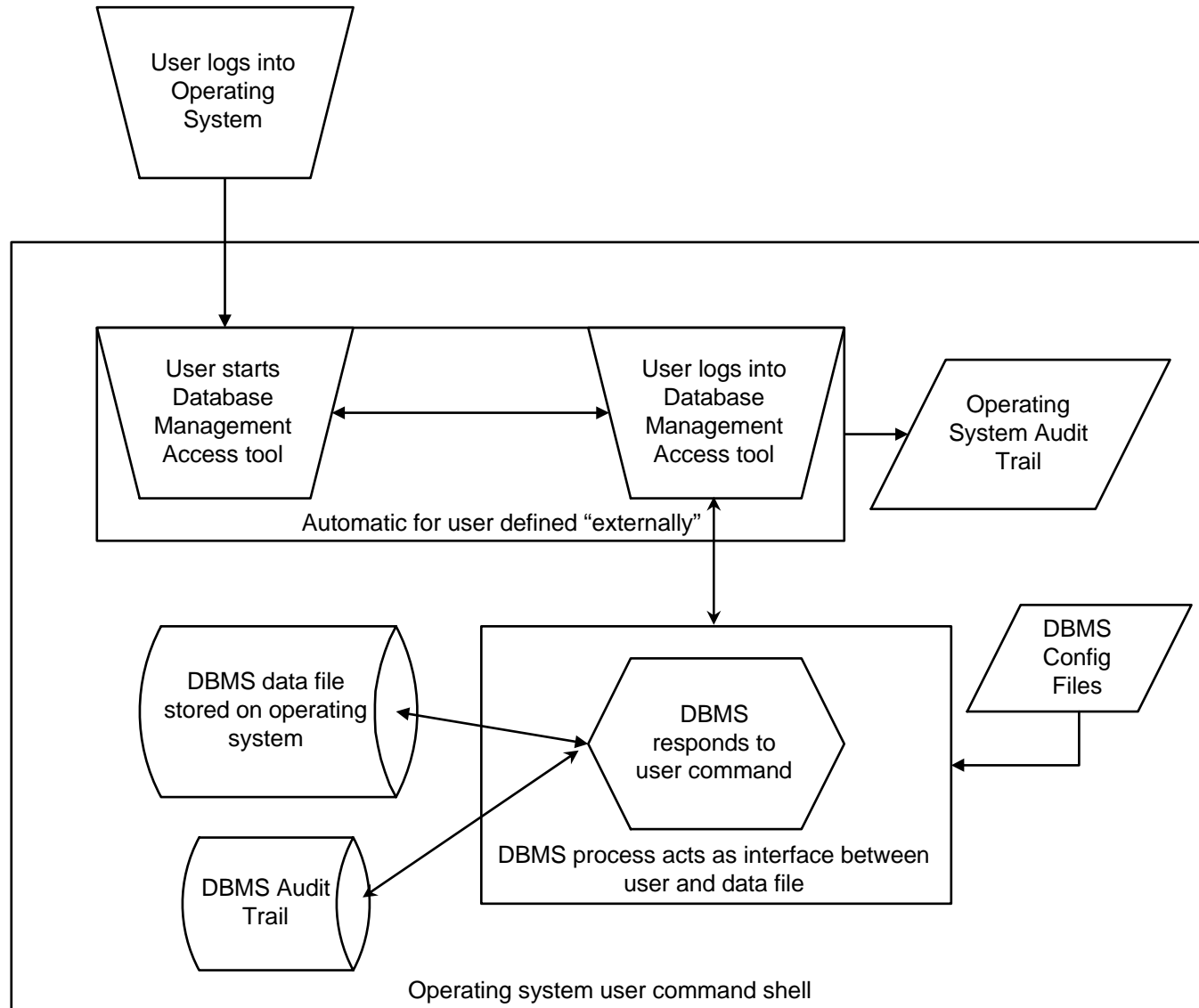
=====  
AUTHENTICATION

# Architecture Example 3: Application-based

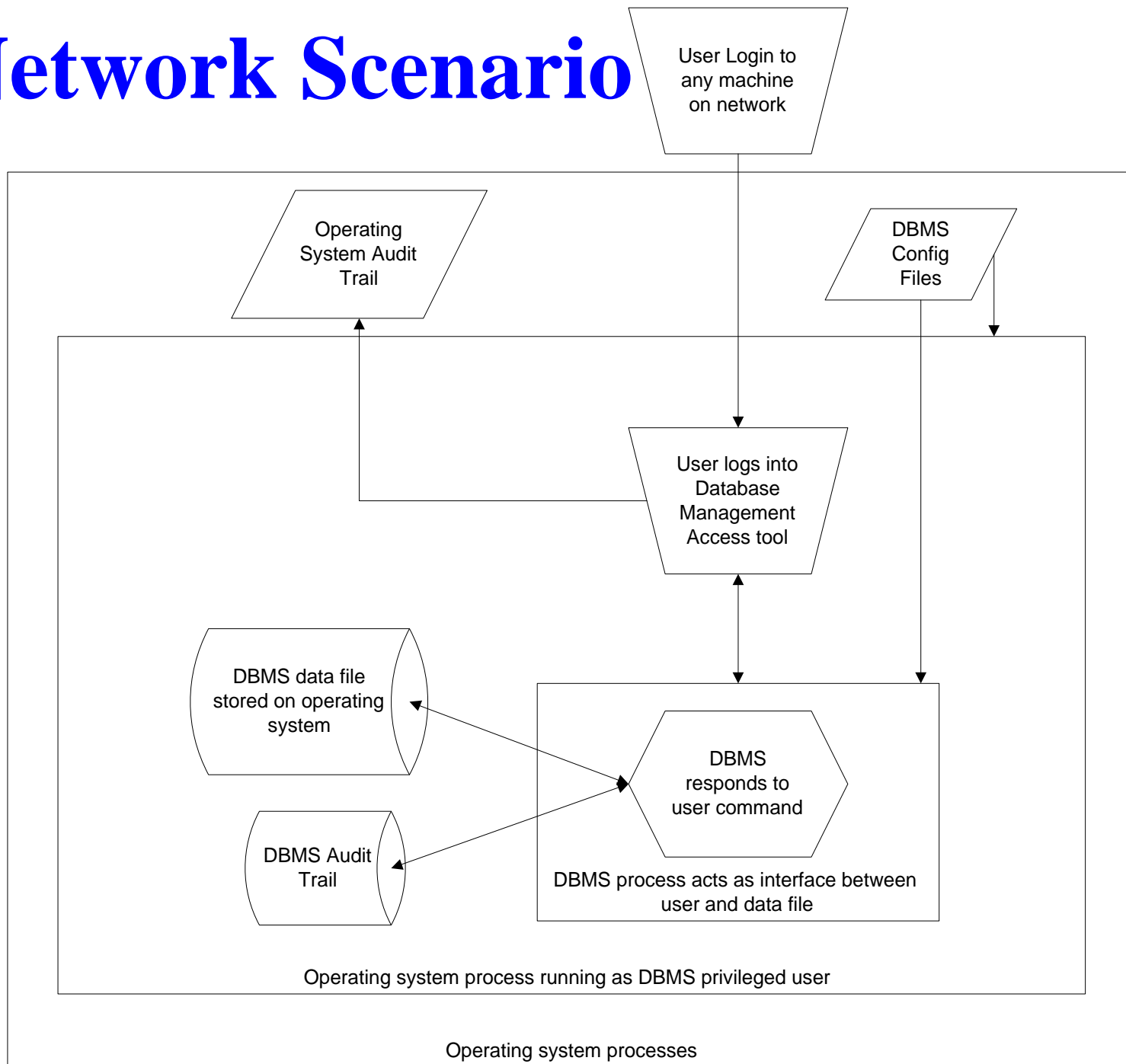


AUTHENTICATION

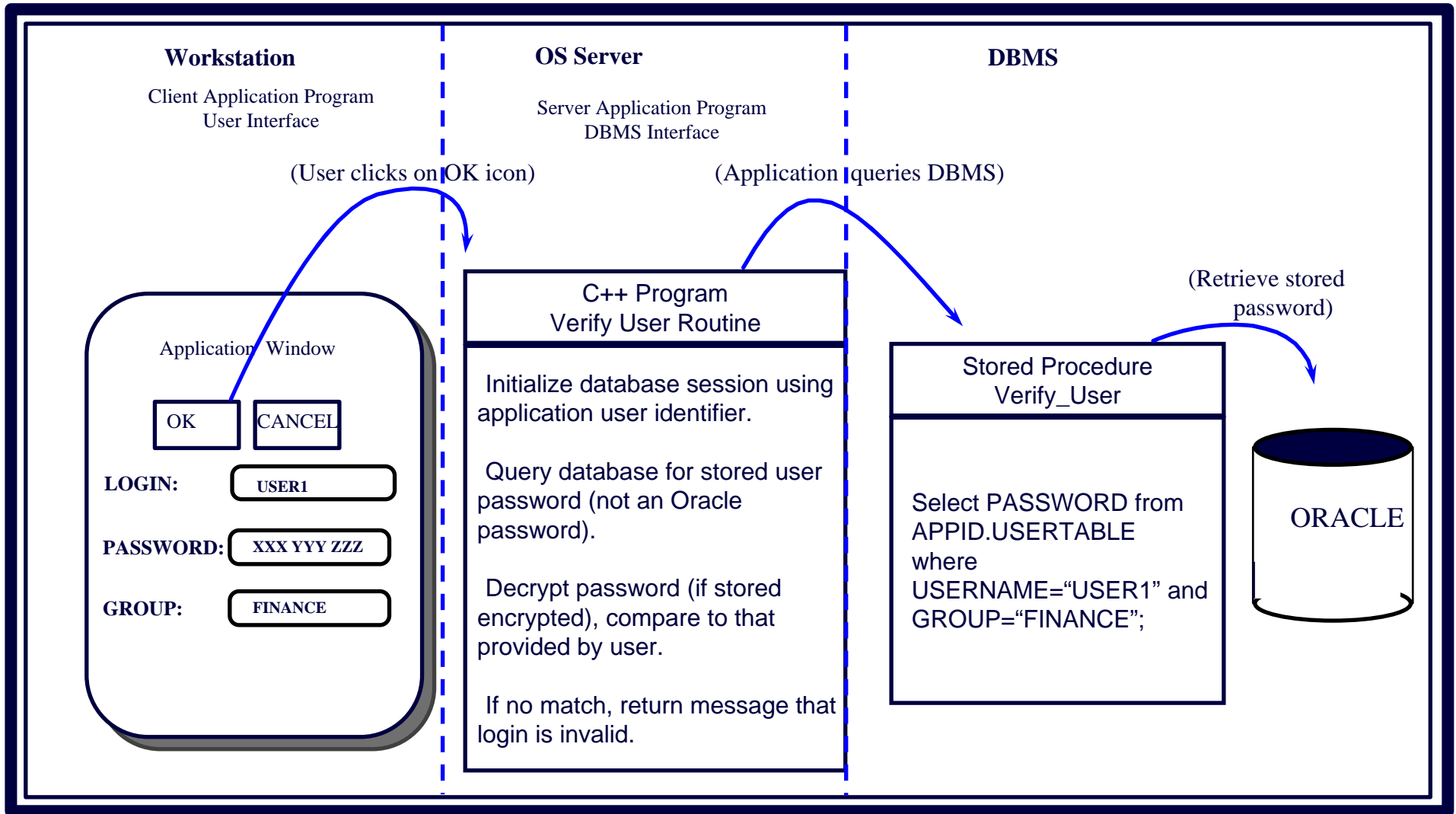
# Operating System Scenario



# Network Scenario



# Application Scenario





# Operating System Security vs Oracle Security

- **Operating System**
  - **Rights to restrict, execute and/or manipulate Oracle program files**
  - **Rights to copy, rename, or delete Oracle data files stored as OS files**
- **Oracle**
  - **Rights to tables within Oracle data files**
  - **Rights to create and execute procedures that manipulate table structure and data**

# Oracle Access Control Issues:

- Applications embed security in code rather than database
- Non-application-controlled database access can result in corruption of transaction data
- DBMS generic application user access may be uncontrolled
- Database management systems transmit all transactions, data, user IDs and passwords in cleartext, vulnerable to Network analysis (sniffer) software
- Standard installation contain generic passwords
  - sys/change\_on\_install
  - system/manger
  - scott/tiger

# Access Control using Roles

- Oracle DBAs may create any number of roles
- Oracle roles (groups) may be assigned any set of permissions
- Users may be assigned to multiple roles.
- Application privilege assignments may not correspond to Oracle role assignments (but they should)

# Access Control using Application Handshakes

Stored procedure key-based authentication

- Prevents users from running stored procedures from a command line

Implementations

- Code conditional into procedure or trigger that forbids execution unless it is passed a secret key from the application
- Code conditional into procedure or trigger that forbids execution if process ID does not = application name.

# Access Control using Product User Profiles

Can be used to limit ad-hoc access by SQL-Plus  
Enforced by SQL-Plus, not by Oracle.

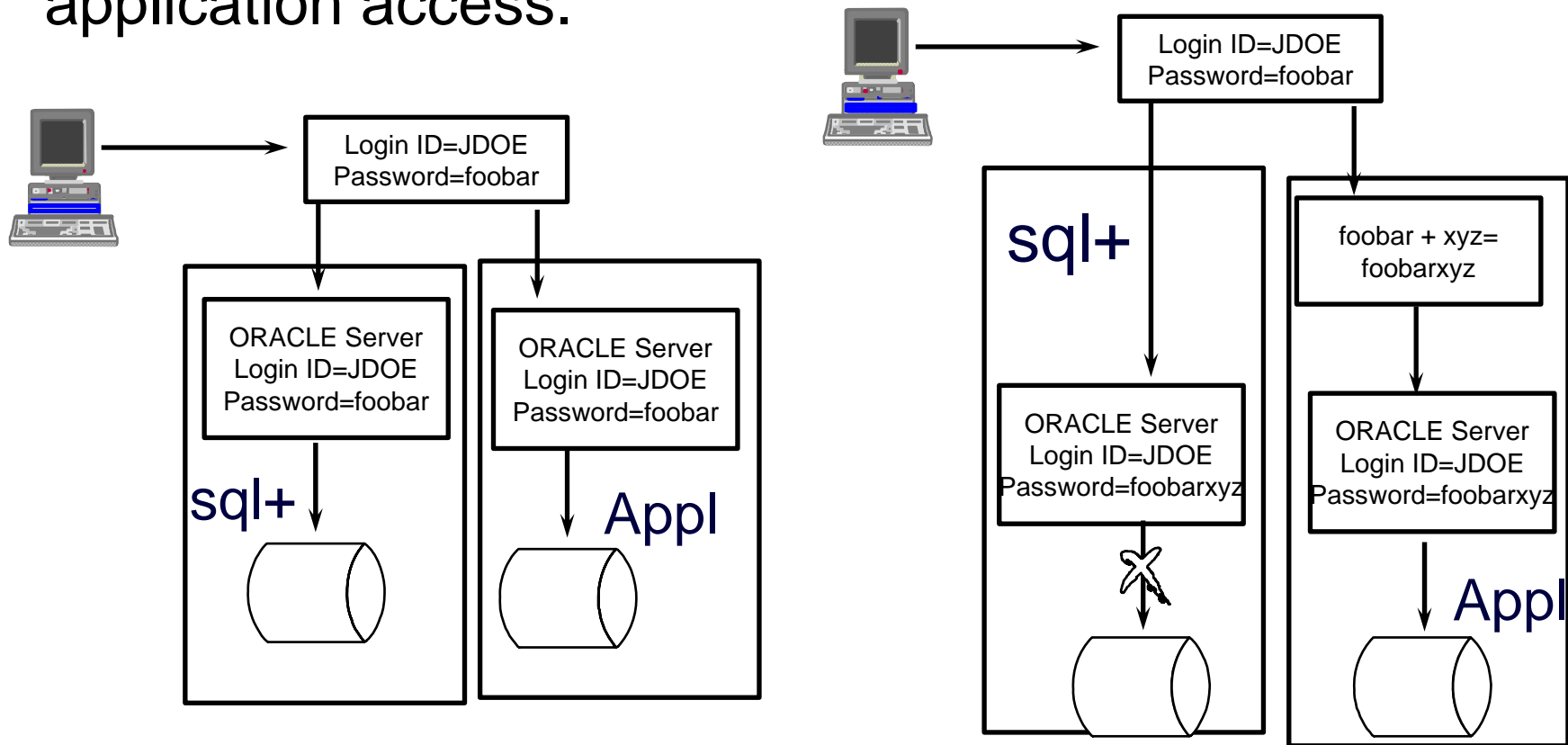
May be used where operating system access is granted to users with no database access.

```
select * from sys.product_user_profile;
```

PRODUCT	USERID	ATTRIBUTE	SCOPE	NUMERIC VALUE	CHAR VALUE	DATE VALUE
SQL*Plus	JDOE	GRANT			DISABLE	
SQL*Plus	JSMITH	AUDIT			D DISABLE	
SQL*Plus	JSMITH	SET ROLE			D DISABLE	
SQL*Plus	%	INSERT			D DISABLE	
SQL*Plus	%	UPDATE			D DISABLE	
SQL*Plus	%	DELETE			D DISABLE	
SQL*Plus	%	SELECT			D DISABLE	
SQL*Plus	ROLES				D CLERK	
SQL*Plus	ROLES				ADMIN	

# Access Control using Password Masking

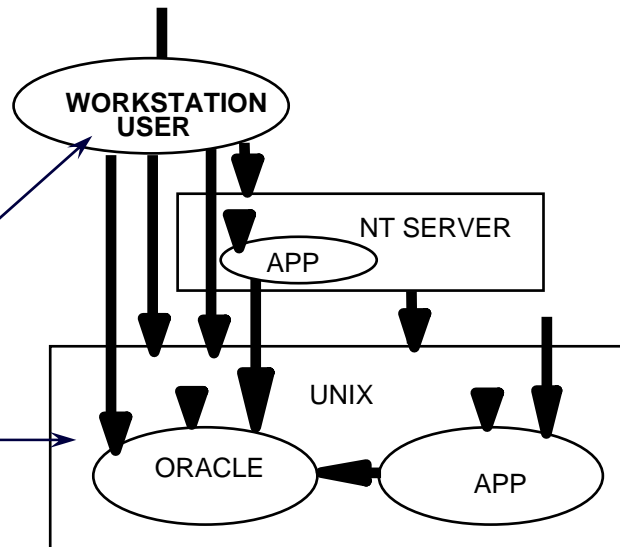
Protects from ad-hoc access to stored procedures and database tables. Will not protect against spoofing of application access.



# Common Sense Access Control Mechanisms

- Always change initial passwords.
- Wherever possible, change the names of all generic accounts or disable them and grant the necessary privileges to an account of a different name.
- Use token or biometric authentication devices if network is unsecure.
- Use hardware or software encryption if disclosure is also an issue.

Note: in order for token, biometrics or encryption controls to work, the encryption and decryption of the authentication string or data must be here:  
and here:  
Not all on one side or in the middle!  
Do not assume this is the case!



# Detection: Oracle Audit Systems

## Problems:

- Default configuration has all auditing disabled
- Comprehensive audit requires considerable CPU and storage

## Solution:

develop targeted monitoring via a combination of:

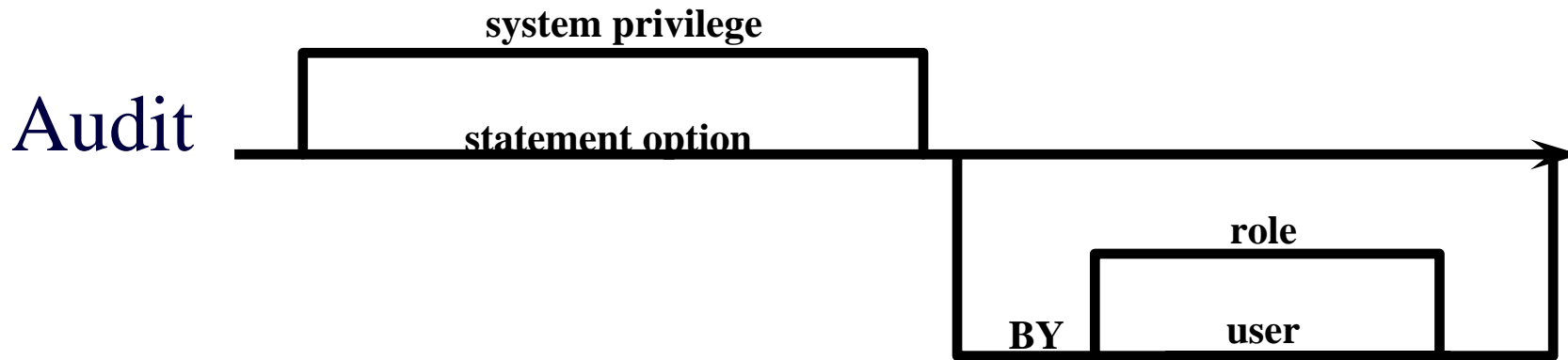
- System-level audits
- Object-level audits
- Statement-level audits



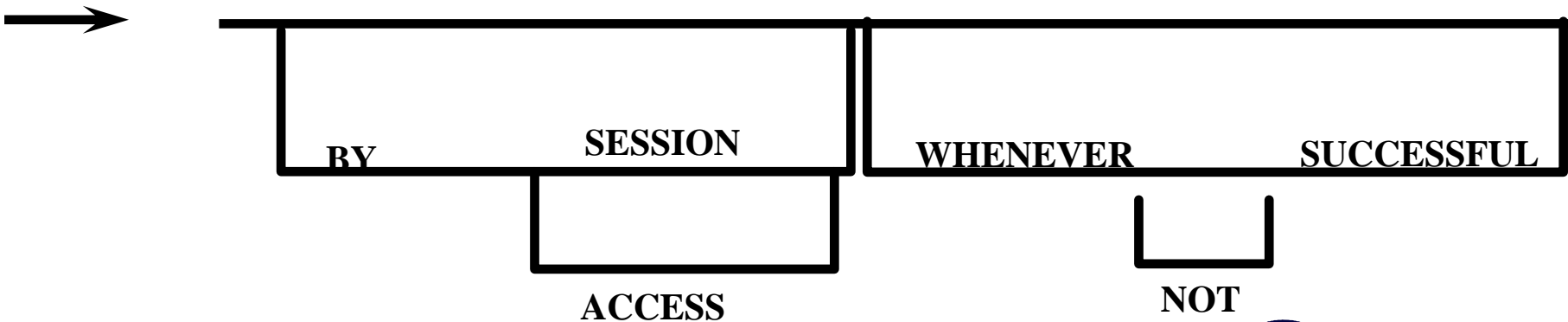
# Types of Oracle Audits

- System
  - Audits of activity other than data access
- Object
  - Audits that are recorded whenever a given object is accessed
- Statement
  - Audits record commands issued (not necessarily that they were issued successfully)
  - Recommended for very critical functions and all database administrator actions.

# Detection Options:



Audit <privilege> on Object



# Oracle Recovery

## Challenges:

- Database operation relies on operating system and application configuration
- Operating system backup may not cover most recent database transactions

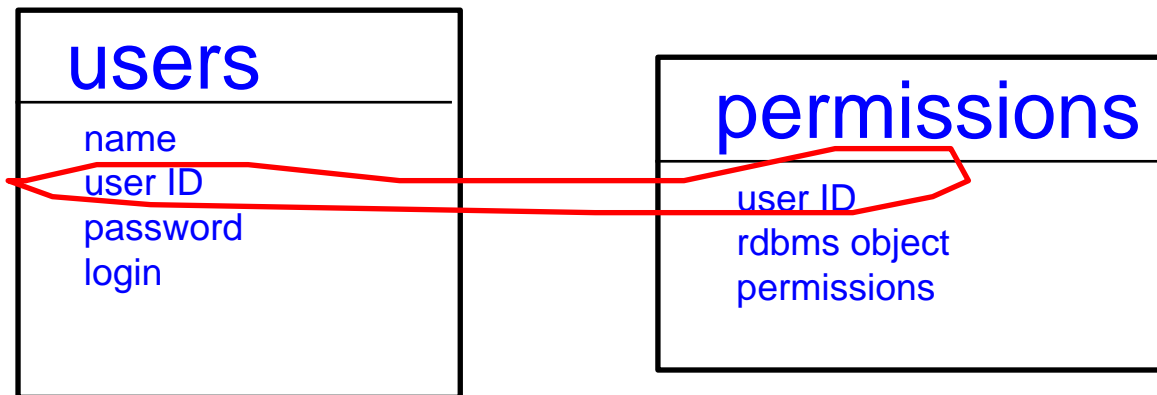
## Backup must include:

- Operating System backup
- Application backup
- Data file backup
- Transaction-based backup

# Transaction-based backup

- Database transactions are written to a separate file in addition to the database itself: a **transaction log**
- If the database is corrupted, and no current backup exists, transaction logs may be applied to a database backup rather than re-entering all data since last backup. Data will be restored to the time of the last available transaction log.
- To ensure recoverability:
  - Ensure the transaction log is updated well within the minimum recovery time interval required.
  - Periodically back up the transaction log
  - Ensure that the transaction log is backed up before it is truncated.

# INFORMATION ON CONTROLS WITHIN ORACLE



IS STORED JUST LIKE THE  
RELATIONAL DATA

Oracle table of users: sys.dba\_users

sys.dba\_users

username  
user\_ID  
password  
default\_tablespace  
temporary\_tablespace  
created  
profile

**Question:**

***How to use an  
RDBMS to list this  
data?***

**ANSWER: SQL**

# SQL (Structured Query Language)

## Select Statement

**select X from Y**

**X**=column name of data item

**Y**=table name

**select username from sys.dba\_users**

# SQL (Structured Query Language)

## More about the Select Statement

**select Y.X from Y,Z where Y.X=Z.X**

Y=table name

Z=table name

X=column name of data item where the  
value of the data is the same in both tables Y and Z

Y.X = the column X in the table Y

Z.X = the column X in the table Z



Oracle SQL query tool is “sqlplus”.

e.g.: *sqlplus <username>*

To look at users:

```
select username,profile,password,user_id,created from sys.dba_users order by username;
```

To look at profiles:

```
select distinct profile from sys.dba_profiles order by profile;
```

```
select * from sys.dba_profiles order by profile;
```

To look at roles:

```
select distinct grantee,role,admin_option,default_role,password_required from sys.dba_roles,  
sys.dba_role_privs where sys.dba_roles.role=sys.dba_role_privs.granted_role order by grantee;
```

To look at system privileges granted to users:

```
select * from sys.dba_sys_privs order by grantee;
```

To look at table privileges:

```
select table_name,privilege,grantee,grantable from sys.dba_tab_privs;
```

To look at column privileges:

```
select table_name,column_name,privilege,grantee,grantable from sys.dba_col_privs;
```

To look at audit options:

```
select user_name,audit_option,success,failure from sys.dba_stmt_audit_opts;
```

To look at system privilege audit options:

```
select * from sys.dba_priv_audit_opts;
```

To look at object privilege audit options:

```
select * from sys.dba_obj_audit_opts  
where (ALT != '-/-') or (AUD != '-/-') or (COM != '-/-') or (DEL != '-/-') or (GRA != '-/-')  
or (IND != '-/-') or (INS != '-/-') or (LOC != '-/-') or (REN != '-/-') or (SEL != '-/-')  
or (UPD != '-/-') or (REF != '-/-') or (EXE != '-/-') order by owner,object_type;
```

To read Oracle audit options:

< Whenever successful >/< Whenever not successful >

S = By session, A = By access

To look at statement audit options:

```
select * from sys.dba_stmt_audit_opts;
```



