



COLLABORATE 15

TECHNOLOGY AND APPLICATIONS FORUM
FOR THE ORACLE COMMUNITY

R12.2 Development and Deployment of Customizations

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APRIL 12-16, 2015
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REMINDER

Check in on the
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About the Presenter

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- Independent Consultant based in the San Francisco Bay Area
- Worked with Oracle EBS since 1993
- OAUG Workflow SIG Coordinator
- Founding board member of the Northern California OAUG GEO
- Presented many papers at many conferences:
<http://jrpjr.com> (paper archives)
This presentation is posted there so don't try to write everything down as I go through this.
- john.peters@jrpjr.com

■ Primarily Technology Focus

- Extension/Customization Design and Development
- DBA/System Administration





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Agenda

- Introduction
- General OnLine Patching Concepts
- Development Standards
- Development Steps
- Questions



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This is Just a cursory Introduction

- If we were to cover all of the 12.2 Development Details it would take at least a full day.
- Please refer to:
 - Oracle® E-Business Suite Developer's Guide Release 12.2 (Part No. E22961-09)
 - Deploying Customizations in Oracle E-Business Suite Release 12.2 (MOS Doc ID 1577661.1)
 - Using the Online Patching Readiness Report in Oracle E-Business Suite Release 12.2 (MOS Doc ID 1531121.1)
 - Oracle E-Business Suite Release 12.2: Online Patching FAQ (MOS Doc ID 1583902.1)
- It is all logical and well thought outAnd yes it does work.....
- You can start to appreciate why 12.2 took so long to come out



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General OnLine Patching Concepts

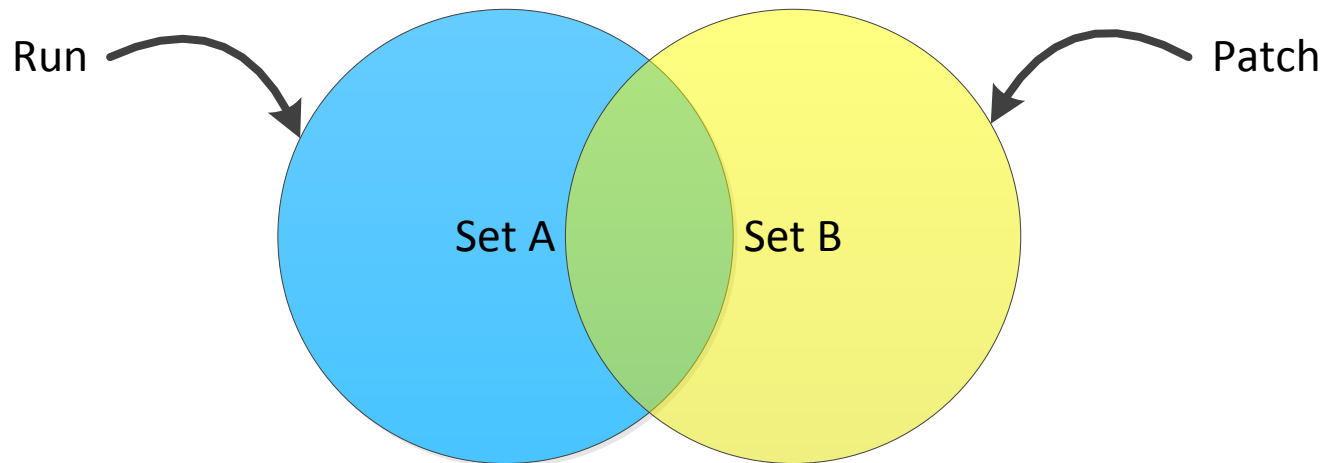


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Edition Based Redefinition

- EBR allows us to modify database objects as a “Set”, while in use, thus minimizing downtime.
- Users will see “Set A” while you are changing “Set B”.
- You can switch the “Set” reference in the database session which will allow an almost instantaneous cutover.



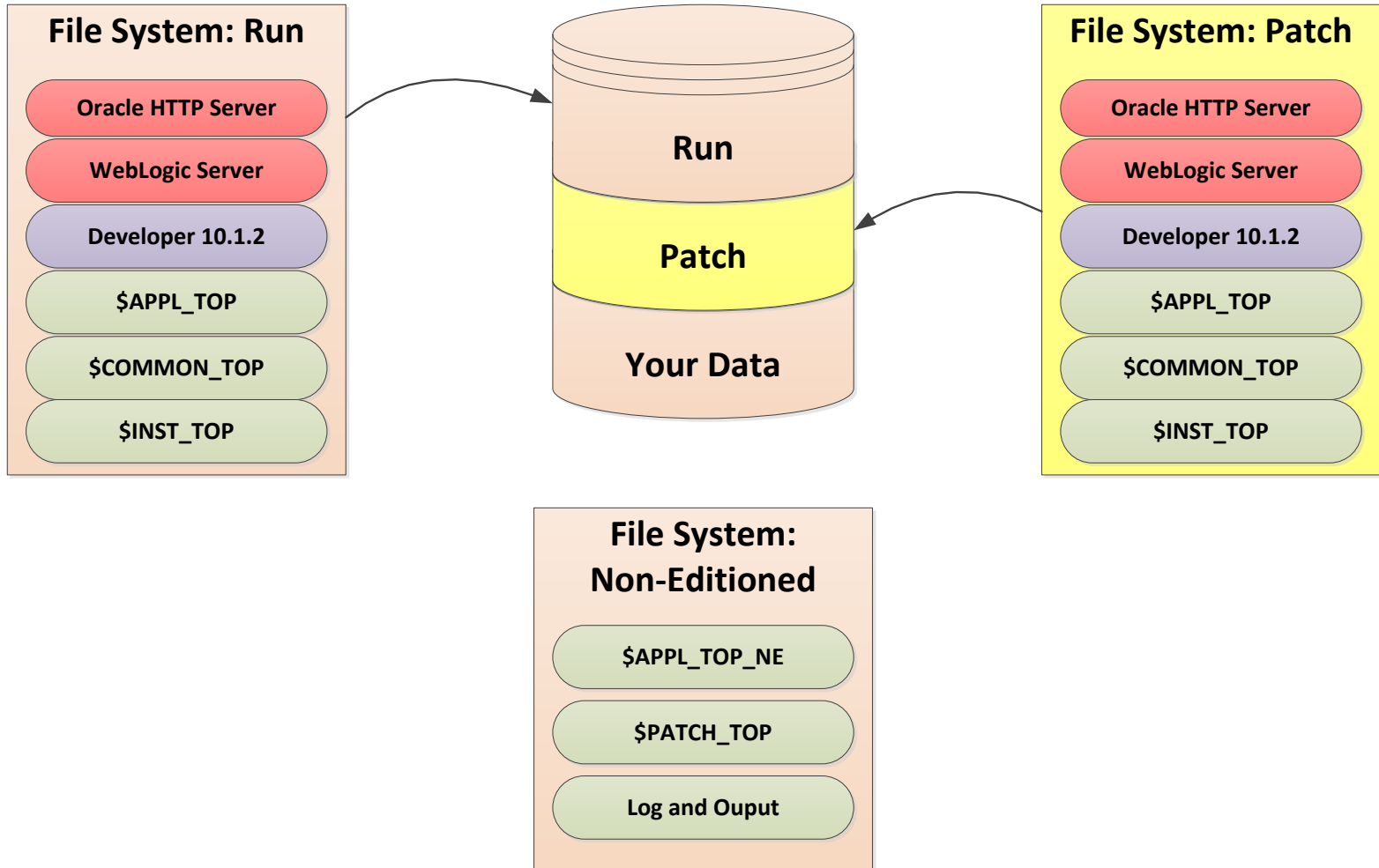
Editions Include

For each edition RUN and PATCH you will have the following:

- Database
 - Your data that is in the tables (only one copy)
- Database Objects
 - Tables, indexes, views, PL/SQL, etc
 - Some objects are Editioned
- Seed Data, Meta Data
 - Lookups, config's, etc
 - Some data is Editioned
- Filesystem Objects
 - The various APPS filesystems
 - Complete copy of the filesystems



Editions



Edition Based Redefinition


- Edition
 - Basically this is an attribute assigned to the DB session
 - You have two: Run and Patch
 - Only affect: Views, Synonyms, PL/SQL

- Editioning View
 - This provides a logical representation of the data
 - Physical table storage may be different

- Cross Edition Triggers
 - Forward Cross Edition Trigger to update the Patch data
 - Reverse Cross Edition Trigger to update the Run data



Editions in the DB

- Editionable DB Objects are:
 - Synonyms
 - Views
 - All PL/SQL Object Types
Function, Library, Package Spec/Body, Procedure, Trigger, Type and Type Body
- Everything else in the DB is non-Editionable 
- Rules
 - A Non-Editioned Object cannot depend on an Editioned Object
 - An Editioned Object (View) cannot be involved in a Foreign Key Constraint
 - An Abstract Data Type cannot be both editioned and evolved



Editions and DB Data

- You have one copy of your data in the DB
- You have Editioning Views that provide you the correct “rendition” of the data
- Table Data is maintained through triggers
- Seed Data is handled by striping it with an Edition column
- More on this later



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Editions in the Filesystem

Exact Copy of the Filesystems before you start patching

- RUN will contain the code you are currently using
- PATCH will contain the code you are changing

- Oracle has a variety of utilities to sync up the filesystems



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Set EBS Edition

- Editions are sync'ed between the OS filesystem and database
- How to set your Edition:

- OS:

```
source /oracle/ebs122/EBSapps.env run
```

or

```
source /oracle/ebs122/EBSapps.env patch
```

```
echo $RUN_BASE          - the run filesystem
```

```
echo $PATCH_BASE      - the patch filesystem
```

- DB:

```
ad_zd.SET_EDITION('RUN')
```

or

```
ad_zd.SET_EDITION('PATCH')
```



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Determine EBS Editions

- Editions are sync'ed between the OS filesystem and database
- Two Edition Definitions:
 - Runtime
 - Patch

- How to tell your Edition:

- OS:

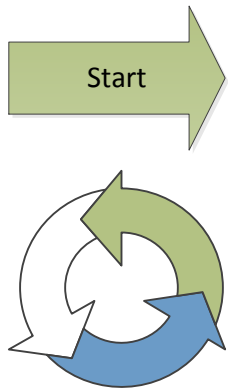
```
echo $FILE_EDITION
```

- DB:

```
select ad_zd.GET_EDITION_TYPE,  
       ad_zd.GET_EDITION  
from dual;
```



Patching Life Cycle



Prepare <ul style="list-style-type: none">• Copies the filesystem• Creates DB Edition	UP	Abort Is Possible
Apply <ul style="list-style-type: none">• Use adop to apply your changes		
Finalize <ul style="list-style-type: none">• Compile invalids, determine DDL to run during Cutover		
Cutover <ul style="list-style-type: none">• Migrate Run to Patch	DOWN	
Cleanup <ul style="list-style-type: none">• Remove old editions	UP	



Check EBS Edition Status

- How to check the status of patching

- In the OS:

```
adop -status
```

- From the DB:

```
sqlplus apps @ADZDSHOWED.sql
```



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Development Standards



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EBS Global Standards Compliance Checker

Reviews schemas that are registered with the EBS to ensure they will support EBR and On Line Patching

- `$AD_TOP/sql/ADZDPSUM.sql`
 - Lists schemas containing objects that reference EBS objects that are not editioned.
 - You must manually correct these.
- `$AD_TOP/sql/ADZDPMAN.sql`
 - Lists objects that violate EBR standards.
 - You must manually correct these.
- `$AD_TOP/sql/ADZDPAUT.sql`
 - Lists objects that violate Online Patching Enablement standards.
 - Adjusted automatically by the Online Patching Enablement patch, no action required.
- `$AD_TOP/sql/ADZDDBCC.sql`
 - Lists objects that violate Online Patching Development standards.
 - You must manually correct these.



DB Object Names

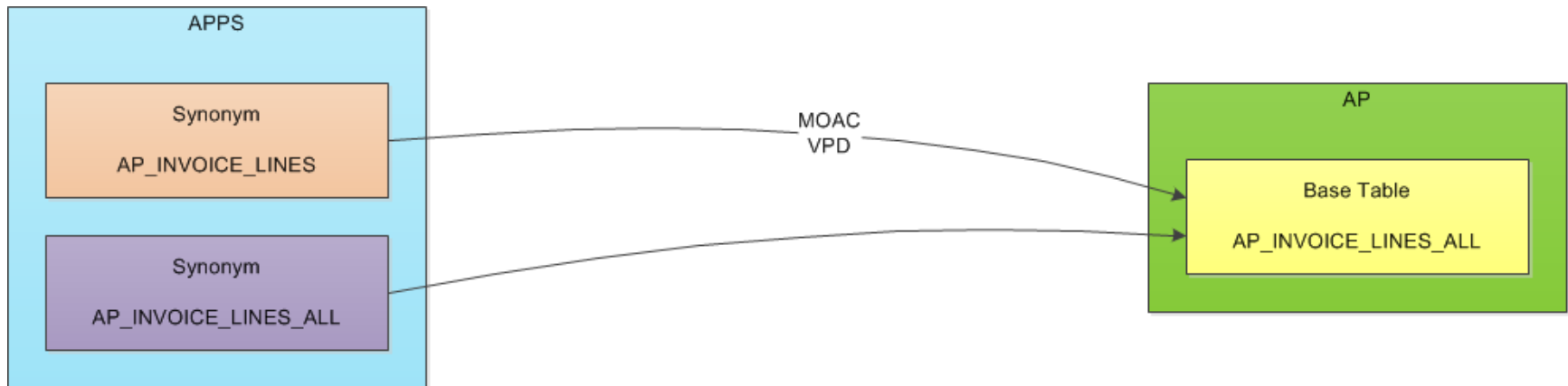
- Table Names must be unique at 29 bytes or less
 - The Editioning Views will have suffix of # added to them automatically
 - This is done with a substr(table_name,1,29)
- Column Names must be 28 bytes or less
 - A Revised Column Name has the form:
 - <logical_column_name>#<version_tag>
 - Version_tag is a string of the form: [0-9A-Z]
- Forward Cross-Edition Triggers
 - <table_name>_F<change_number>
- Suffix + are the EBR DB Triggers on Seed Data
- A Materialized View Definition must be stored in an ordinary view called MV_NAME||'#'



DB Objects pre 12.2

I am using a simple example of AP_INVOICE_LINES_ALL (post 11i)

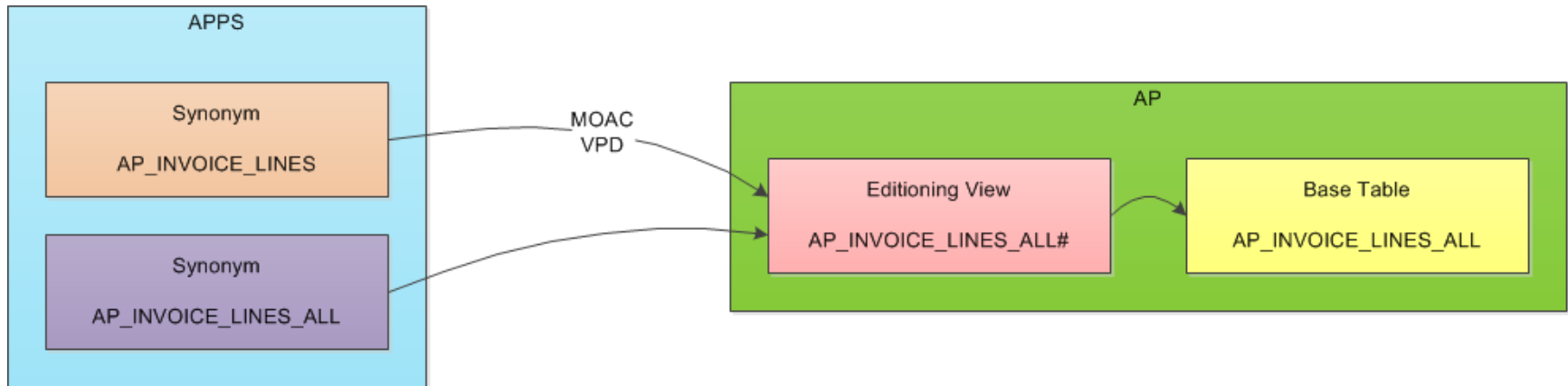
- Base table owned by AP
- Synonym for MAOC object owned by APPS
- Synonym for _ALL object owned by APPS



DB Objects post 12.2

What changed in 12.2?

- Editing View added (# suffix)
- APPS synonyms now point to the Editing View



Where is the Editioning Done?

- Editioning is performed using a View.
- A Virtual Private Database (VPD) Policy must be on the Editioning View or Table Synonym, not the base table.
- This provides the filtered representation of the Editioning View to ensure you get a consistent representation of the data.



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AP.AP_INVOICE_LINES_ALL

- **AP.AP_INVOICE_LINES_ALL** has the columns:
 - MERCHANT_NAME varchar2(80)
 - MERCHANT_NAME#1 varchar2(240)

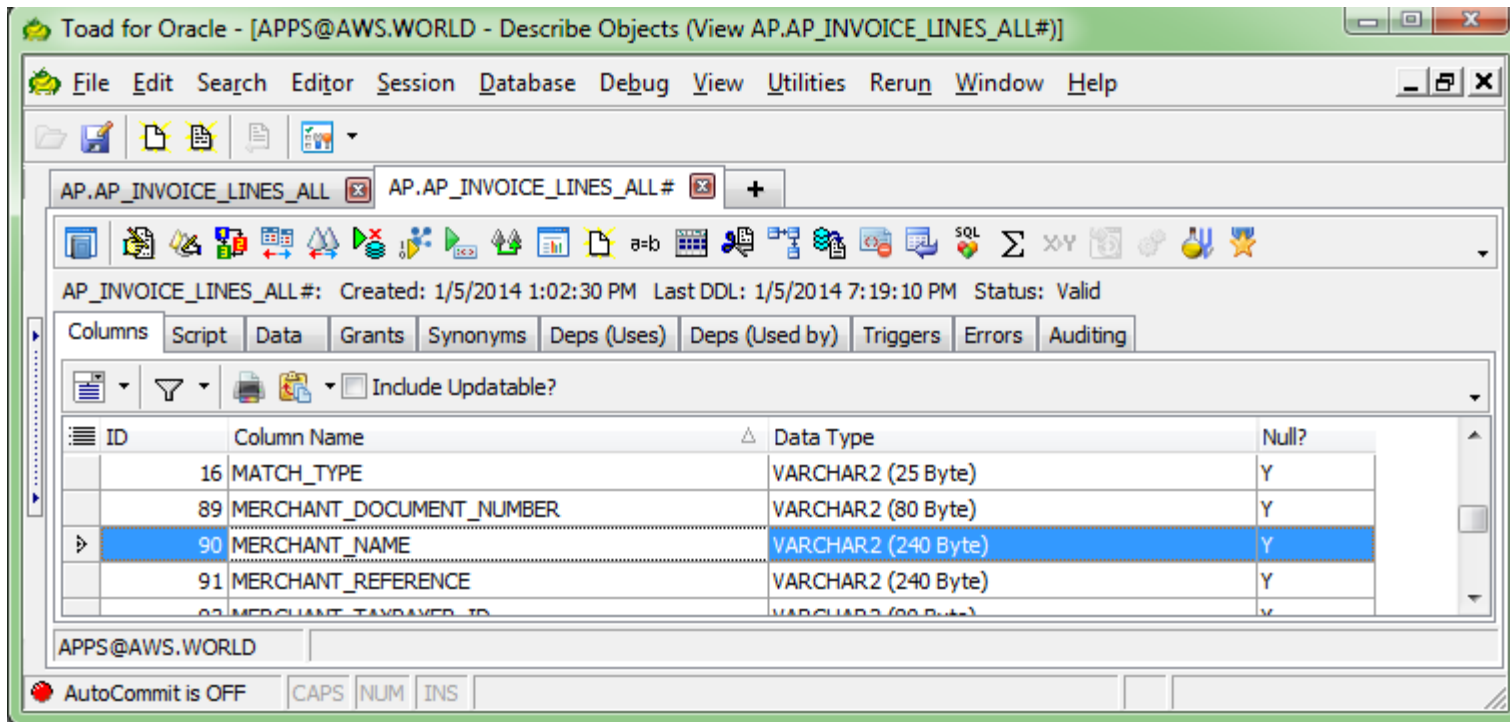
The screenshot shows the Toad for Oracle interface displaying the structure of the table AP.AP_INVOICE_LINES_ALL. The table was created on 12/30/2010 and last DDL was on 1/6/2014. The primary key is set to <None>. The columns are listed in the following table:

ID	Column Name	PK	Index Pos	Null?	Data Type	Default	Histogram	Num [
89	MERCHANT_DOCUMENT_NUMBER			Y	VARCHAR2 (80 Byte)		None	
90	MERCHANT_NAME			Y	VARCHAR2 (80 Byte)		None	
203	MERCHANT_NAME#1			Y	VARCHAR2 (240 Byte)		None	
91	MERCHANT_REFERENCE			Y	VARCHAR2 (240 Byte)		None	



AP.AP_INVOICE_LINES_ALL

- **APPS**.AP_INVOICE_LINES_ALL has one column:
 - MERCHANT_NAME varchar2(240)
 - Synonym on AP_INVOICE_LINES_ALL#



Why use the Editioning View

- You must use the Editioning View in order to get the correct column representation, that is consistent for your DB Edition
- We can see below the editioning view's create statement for **AP.AP_INVOICE_LINES_ALL#**
- It has mapped it to our new column **MERCHANT_NAME#1**

The screenshot shows the Toad for Oracle interface. The main window displays the create statement for the editioning view **AP.AP_INVOICE_LINES_ALL#**. The statement is as follows:

```
AP_INVOICE_LINES_ALL#: Created: 1/5/2014 1:02:30 PM Last DDL: 1/5/2014 7:19:10 PM Status: Valid
Columns Script Data Grants Synonyms Deps (Uses) Deps (Used by) Triggers Errors Auditing
295 DAILY_AMOUNT DAILY_AMOUNT,
296 WEB_PARAMETER_ID WEB_PARAMETER_ID,
297 ADJUSTMENT_REASON ADJUSTMENT_REASON,
298 MERCHANT_DOCUMENT_NUMBER MERCHANT_DOCUMENT_NUMBER,
299 MERCHANT_NAME#1 MERCHANT_NAME,
300 MERCHANT_REFERENCE MERCHANT_REFERENCE,
301 MERCHANT_TAX_REG_NUMBER MERCHANT_TAX_REG_NUMBER,
302 MERCHANT_TAXPAYER_ID MERCHANT_TAXPAYER_ID,
```

The column **MERCHANT_NAME#1** is highlighted in yellow. The status bar at the bottom indicates "AutoCommit is OFF" and shows "CAPS NUM INS" options.

What Did We Just Learn?

1. You can no longer directly access the base tables in the table owning schema **AP**.ap_invoice_lines_all
2. You must use the objects in the APPS schema to get a consistent representation of the data
3. DB Storage is going up
4. The Cleanup phase of adop is important
5. How do we keep these two columns in sync unit the Cutover phase of adop is completed.....
(more on this in a minute)



Development Steps



Development Steps

General Steps

1. Develop customization in the run edition of your non-PROD environment

- Both DB and OS File System
- Object specific steps we will talk about below
- Recompile invalids (ad_zd.compile)

2. Create the patch (manually create patch actions)

3. Test the patch

Deploying Customizations in Oracle E-Business Suite Release 12.2 (MOS Doc ID 1577661.1)

All of the following pages are focused on your actions in the non-PROD (DEV) instance.



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Dev Steps - Tables

An Edition Synonym will point to the correct version of the Table

The following steps are done in the non-PROD instance:

1. Make your table changes
2. Regenerate the edition view (ad_zd_table.patch)
3. Upgrade table for Edition Storage (ad_zd_seed.upgrade)
4. Create loader LCT for Seed Data
5. Create Forward Crossedition Trigger (FCET)
This keeps data in sync with the new data representation
6. Create Reverse Crossedition Trigger (RCET)
This keeps data in sync with the old data representation
7. Extract updated table definition (xdfgen.pl)
8. Extract Seed Data (FNDLOAD)
9. Recompile invalids (ad_zd.compile)



Dev Steps - Seed Data

Seed Data tables must include a new column ZD_EDITION_NAME that is added automatically by Oracle.

The following steps are done in the non-PROD instance:

1. Create initial table definition

Table must go in APPS_TS_SEED tablespace

2. Upgrade table to support Editioned Storage (ad_zd_seed.upgrade)

This adds the column ZD_EDITION_NAME

3. Manually insert new Seed Data records into table

4. Create a Loader Control File for Seed Data

FNDLOAD *.LCT file

5. Extract Seed Data

```
FNDLOAD apps/<apps_pwd> 0 Y DOWNLOAD my_table.LCT my_table.ldt my_table
```



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How is Seed Data Filtered?

- Seed Data is filtered using the ZD_EDITION_NAME by a Virtual Private Database (VPD) Policy
- This is used to present a consistent view of the data based on the Edition, and is referred to as “Editioned Data Storage Architecture”.
- The conversion of Standard Tables to Seed Data tables is not currently supported during on-line patching, it must be left as a step to be run during the ‘CUTOVER’ phase. You can register custom steps to be run in the ‘Cleanup’ phase using:
`ad_zd.load_ddl('CUTOVER', <your SQL>)`



How to Maintain Table Data



We only have to maintain the table data from Apply to Cutover.

Updating an existing Table Column

- Existing MY_COLUMN has values of (RED, GREEN)
- New MY_COLUMN will have values of (ONE, TWO, THREE)

How is this done

- Create a new MY_COLUMN#1
- Editioning View Maps:
 - RUN – MY_COLUMN => MY_COLUMN
 - PATCH – MY_COLUMN => MY_COLUMN#1

How is MY_COLUMN#1 populated until cutover is completed?



Forward CrossEdition Trigger

Forward CrossEdition Trigger (FCET)

- Updates the “PATCH” edition of the data.
- This is a database trigger the developer has to create
- Maps the old values to new values
 - RED => ONE
 - GREEN => THREE
 - Nothing maps to TWO since this might be a new value with no equivalent meaning

What about Multiple Updates to the same table?



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Forward CrossEdition Trigger

Multiple Updates to the same table

1. F1
2. F2 follows F1
3. F3 follows F2
4. ... and so on ...

```
create or replace trigger XYZ_MY_TABLE_F2
before insert or update on &1..xyz_my_table
for each row forward crossedition
FOLLOWS XYZ_MY_TABLE_F1
disable
```



Reverse CrossEdition Trigger

Reverse CrossEdition Trigger (RCET)

- Update the “RUN” representation of the table
- Used to back populate a Not Null or Unique Index column in a Table.
- As part of your patching you will be loading new Seed Data and you need to back populate the old column.
- The RCET must populate values that will satisfy a Unique Index, in which case you might need a new sequence to just generate values.



FCET and RCET Triggers

- It is the developers responsibility to create the FCET and RCET triggers.
- EBS won't know the exact logic to apply in these triggers, so you as the developer must code that logic.
- You can possibly skip these if you will not allow users or processes on the system between the patch Apply and Cutover steps.....



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Or Another Alternative

- The majority of this complexity around data maintenance during the patching cycle is to support On Line Patching.
- If you do not perform true On Line Patching, and you shutdown access to your system as you move from Apply to Cutover then you *“might”* not need to handle the data maintenance tasks using triggers.
- This gets complicated if there are also Oracle changes involved in the same patch cycle so you must really understand your data and the changes.
- You can perform the data maintenance of custom objects during the ‘Cutover’ phase of adop using your own data fix scripts that are registered using:

```
ad_zd.load_ddl('CUTOVER', <your SQL>)
```

This will increase your downtime during the cutover phase
- However, you will still need to follow the EBS standards for customizations in R12.2.



Dev Steps – Global Temp Tables

Use Synonym to point to Global Temp Table

1. Make your table change in a new temp table with a different name
2. Extract updated table definition (xdfs.pl)
3. Create Helper Script
 - The Global Temp Table can not be editioned and it can not be changed while users are using it
 - Instead a synonym is created to point to the new temp table
 - This synonym is the permanent logical name
 - During cutover the helper script will change the synonym to point to a new temp table
4. Recompile invalids (ad_zd.compile)



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Dev Steps – Materialized Views

An effectively-editioned Materialized View includes both a Logical View (managed by the developer) and a Materialized View (generated by Online Patching).

The Logical View is an ordinary database view, and is therefore an editioned object that can be changed in the Patch Edition without affecting the Run Edition.

But the generated Materialized View is a non-editioned object, meaning the definition and content of the materialized view is shared across all editions.

In order to avoid breaking the running application during an online patch, the system must defer materialized view regeneration until the cutover phase, when the application is down.

1. Create a Logical View
2. Generate the Materialized View (ad_zd_mview.upgrade)
3. Extract updated table definition (xdfgen.pl)
4. Recompile invalids (ad_zd.compile)



Dev Steps - Views

Views are just like normal View Development.

Just create an Edition Synonym to point to the correct view.



Dev Steps – PL/SQL

PL/SQL Development is same as today.

PL/SQL code is stored in the data dictionary by Edition.

So based on the Edition you will run a specific version.

Everything within a Edition should be consistent.



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Dev Steps – DB Triggers

- If your development includes a new or changed DB Trigger, it must be on the Editioning View, not the Base Table.
- **Tip:** The simplest way to comply with this standard is to create triggers on the APPS table synonym. The resulting trigger will be created on whatever the synonym points to, which will be the editioning view if one exists.



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Dev Steps – Concurrent Programs

- Same as you do today
- Use FNDLOAD to export your Concurrent Program Definition.
- FNDLOAD handles the Editioning of the data.
- You will use FNDLOAD to import the Concurrent Program Definition as part of your patching.
- Make sure you put any files in the correct filesystem.
- No more manually entering/updating the program definition. The UI is always pointing to the Run edition.



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Prevent Concurrent Programs Running



- You can prevent specific concurrent programs from running after the Prepare phase to the Cutover phase of a patch
- The concurrent program:
“Online Patching In Progress” (ADZDPATCH)
Is submitted and is running.
- You just need to define an incompatibility with this program and the program you don’t want to run.
- Oracle has seeded some incompatibilities in 12.2.4.
- The programs actually error out like the following:
 - MSG-00000: OPT Currently patch application is in progress. <Name Of Failing Program> after patch application.
 - MSG-00000: 101504: non-ORACLE exception
 - REP-1419: MSG-00000: OPTCurrently patch application is in progress. Validate Application Accounting Definition after patch application
- 12.2: Functionality Disabled During An Online Patching Cycle (ADZDPATCH) (Doc ID 1586609.1)



Dev Steps – Forms

- Same as you do today
- Use FNDLOAD to export your Forms Definition.
- FNDLOAD handles the Editioning of the data.
- You will use FNDLOAD to import the Forms Definition as part of your patching.
- Make sure you put any files in the correct filesystem.
- No more manually entering/updating the Forms definition. The UI is always pointing to the Run edition.



Dev Steps – Application Framework

- Export your modified Framework Personalization Using the XMLExporter or XLIFF Extractor utility
- Patch Action to Import your modified Framework Using the XMLImporter or XLIFFImporter utility



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Dev Steps – Custom Web ADI

- No PL/SQL API support any longer, use the UI to create the definition
- Use FNDLOAD to export your Custom Web ADI Definition.
- FNDLOAD handles the Editioning of the data.
- You will use FNDLOAD to import the Custom Web ADI Definition as part of your patching.



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Dev Steps – Workflow

- Use Workflow Definitions Loader or Workflow Builder to export your Custom Workflow Definition.
- You will use Workflow Definitions Loader to import your Custom Workflow Definition as part of your patching.
- Use Workflow XML Loader utility to export your Event and Subscription metadata.
- You will use Workflow XML Loader to import your Event and Subscription metadata as part of your patching.



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Dev Steps – BI Publisher

1. Export your BI Publisher Definition using a combination of FNDLOAD and XDOLoader utility.
 2. Import your BI Publisher Definition using a combination of FNDLOAD and XDOLoader utility as part of your patching.
- No more manually entering/updating the BI Publisher definition. The UI is always pointing to the Run edition.



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Applications Express (APEX)

APEX integration with 12.2 is now completed.

Database Objects

- Your custom XXAPEX schema that APEX uses to read from the EBS tables, through APPS, will be editioned.
- All of your supporting DB objects: Views, PL/SQL, etc are Editioned, they should be okay to migrate.
- You should register your APEX DB user with EBS to ensure that the standards checks will see and evaluate this schema

APEX Application

- APEX stores application configuration in metadata in the DB.
- This APEX metadata is not Edition enabled
- Just import your APEX Application during the CUTOVER Phase. This will make your CUTOVER phase a little longer.



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Many, Many More Object Types

- Please refer to the referenced Oracle Documents.
- I hope to revise this presentation as time goes by and I find other tricks and tips.
- You can abstract the general concepts from the examples above and the Oracle documentation.



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Do's and Don'ts



Do's and Don'ts

■ Don't

- Call DB objects directly: `ap.AP_INVOICE_LINES_ALL`
- Query seed data directly, use the Synonym with the VPD applied.
- Do not drop an existing table until the Cleanup phase of patch execution.
- Do not drop an existing column. Columns that are replaced by new revised columns will be dropped automatically at cleanup. Dropping a logical column is not supported.
- Do not rename an existing table.



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Do's and Don'ts

■ Do's

- Take time to learn the new development methodologies.
- Start using these development standards today!
- Test your migrations first to a non-DEV instance.
- You will use Patches to load and modify your customizations using the various utilities Oracle ATG provides.
- Always use the APPS synonyms for the objects.
- Unique Index on a Seed Data Tables must include ZD_EDITION_NAME.



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What missing?

- Third Party Add-Ons
 - Particularly when considering an upgrade to 12.2. Does the vendor support 12.2?
- Integrations



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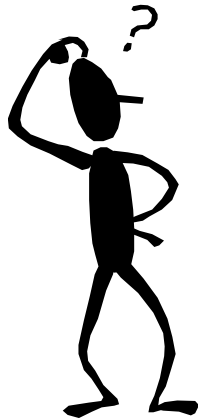
Questions and Answers



Questions....

Thanks for sticking through this, just remember it is logical and try not to get overwhelmed.

This presentation will be posted on the OAUG Web Site.



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