SAGE Computing Services

Customised Oracle Training Workshops and Consulting

Trials & Tribulations of an Oracle Forms -> Apex Conversion

A Hypothetical Case Study

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Systems Consultant

Today's Guide

- Strategies
- Differences
- Considerations
- Process
- Converter Review
- What next?

Strategies

http://strategy2c.wordpress.com/2009/01/10/strategy-for-goldfish-funny-illustration-by-frits/

Oracle Product Strategy

Java Development Tools

Traditional Development Tools

Oracle Forms – Statement of Direction

- Oracle Forms and Reports
  - “Oracle has no plan to de-support these products, furthermore new versions are components of Oracle Fusion Middleware 11g”
- Oracle Designer
  - Focus on stability and bug fixes, released via Oracle Development Suite 10g

Lifetime Support Document

Oracle Fusion Middleware Releases

Release	GA Date	Premier Support Ends	Extended Support Ends	Sustaining Support Ends
9*i*AS R2 9.0.2	Apr 2002	Jul 2005	Not Available	Jul 2008
9*i*AS R2 9.0.3	Oct 2002	Jul 2005	Not Available	Jul 2008
10*g* 9.0.4	Dec 2003	Dec 2006	Dec 2008	Dec 2009
10*g*R2 10.1.2.x *	Jan - Oct 2005	Dec 2010	Dec 2011	Indefinite
10*g*R3 10.1.3.x **	Jan - Oct 2006	Dec 2010	Dec 2011	Indefinite
Oracle Containers for J2EE (OC4J) 10*g*R3 (10.1.3.x) ****	Jan - Oct 2006	Jun 2014	Jun 2017	Indefinite
Oracle Fusion Middleware 11*g*R1 (11.1.1.1.0) *****	Jun 2009	Jun 2014	Jun 2017	Indefinite

* Includes: BPEL, InterConnect, B2B, Business Activity Monitoring, Discoverer, Reports, Forms, Portal, Internet Directory, Single Sign-On, Certificate Authority, Containers for J2EE, Web Cache

** Includes: SOA Suite, Enterprise Content Management, Data Integrator, WebCenter Suite, and Identity and Access Management Suite

*** Includes: Internet Directory, Single Sign-On, Virtual Directory, Identity Federation

**** Includes: Containers for J2EE, HTTP Server, Application Server Control, Process Manager and Notification Server, Dynamic Monitoring Service

***** Includes: Application Grid, SOA Suite, WebCenter Suite, Identity Management Foundation, Discoverer, Reports, Forms, Portal

Oracle’s Recommendations for Customers

- Based on E-Business Suite
  - Move from client-server to web
  - Upgrade to latest versions
  - Interoperate with Java/J2EE
  - Develop new modules with JDeveloper

To Quote Oracle…

- *Oracle JDeveloper 11g with ADF is the tool of choice for Forms, Reports and Designer customers because it carries over a similar development model. However, given the architecture difference between Java EE and Forms or Reports,* ***Oracle has no plans to offer a complete migration solution that would attempt to migrate applications built with these tools to Java EE****.*
- *Instead, Oracle's strategy is to provide a Java EE development environment exposing similar concepts as Forms and Reports, giving to Forms and Reports developers the opportunity to become productive in a new, but familiar environment.*

Application Express – Statement of Direction (Feb09)

- Native Web application development framework
- Conceived February 2004 with Oracle Database 10g
- “APEX 4.0 will focus on declarative support for Web 2.0 features as well as extensibility of APEX framework”
  - APEX Websheets – end user define data rules
  - APEX Listener – J2EE alternative to mod plsql
  - Improved tab forms – validation, collection integration
  - AnyChart 4 – flash based maps, Gantt charts
  - Dynamic Actions – page rendering on client events
  - Declarative support for cascading select lists
  - Extensible item framework – custom item types
  - Updateable Interactive Reports – inline editing
  - New Authentication schemes

Differences

Differences

Basic Differences

Feature	Forms	Application Express
4GL Declarative	Renders applications with metadata in .fmx	Renders applications using metadata stored in database
4GL Languages	Client Side PL/SQL	Server Side PL/SQL
User Interface	Java	HTML
Web Services	Yes	Yes

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SA

Key Differences

Feature	Forms	Application Express
Page Layout	Windows / Canvases	Pages / Regions
Client-side Field Control	Forms Triggers	Javascript / AJAX
Locking	Pessimistic / Optimistic / Custom	Optimistic
Database Connection	Synchronous	Asynchronous
Concurrent User Support	Connectivity by user session	Connection only maintained for processing requests
Architecture	3 Tier	2/3 Tier
Reporting	Oracle Reports / BI Beans	Flash Charts / BI Publisher

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Project Considerations

Project Expectations

Right Reason	• Suitable application development environment (why, what, who, where)
Conversion	• Change of behaviour • Best out of Apex? • Retraining required?
Architecture	• Stateful -> Stateless • UI – layout / flow
Cost	• Saving v Conversion Cost
Customer	• Case studies • Feedback

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Technical Expectations

Developer

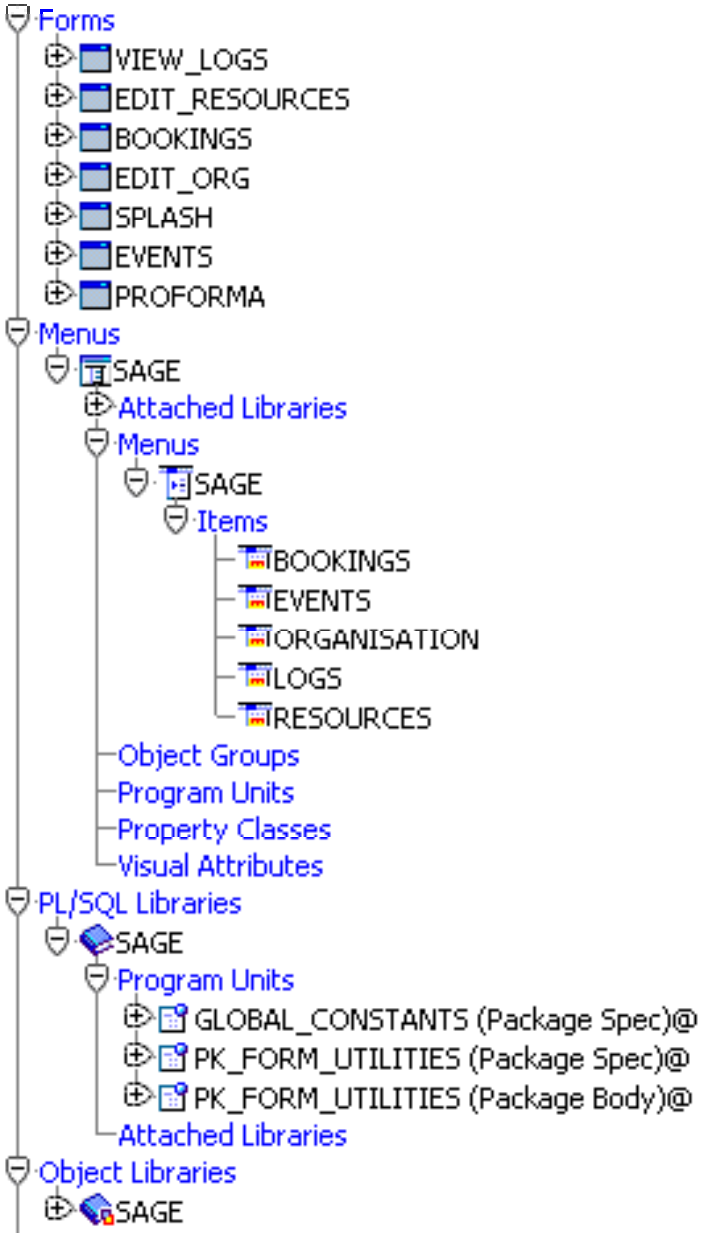
- Forms triggers
- PLLs
- Forms built-ins
- Code split into UI / data layers?
- Blocks based on stored procedures
- Control blocks
- Ongoing changes
- Turnkey vs Phase

Architecture

- Menus (security)
- Object libraries
- Validation
- Hotkeys
- Reports (printing = $$)
- Turnkey vs Phase
- Storyboards

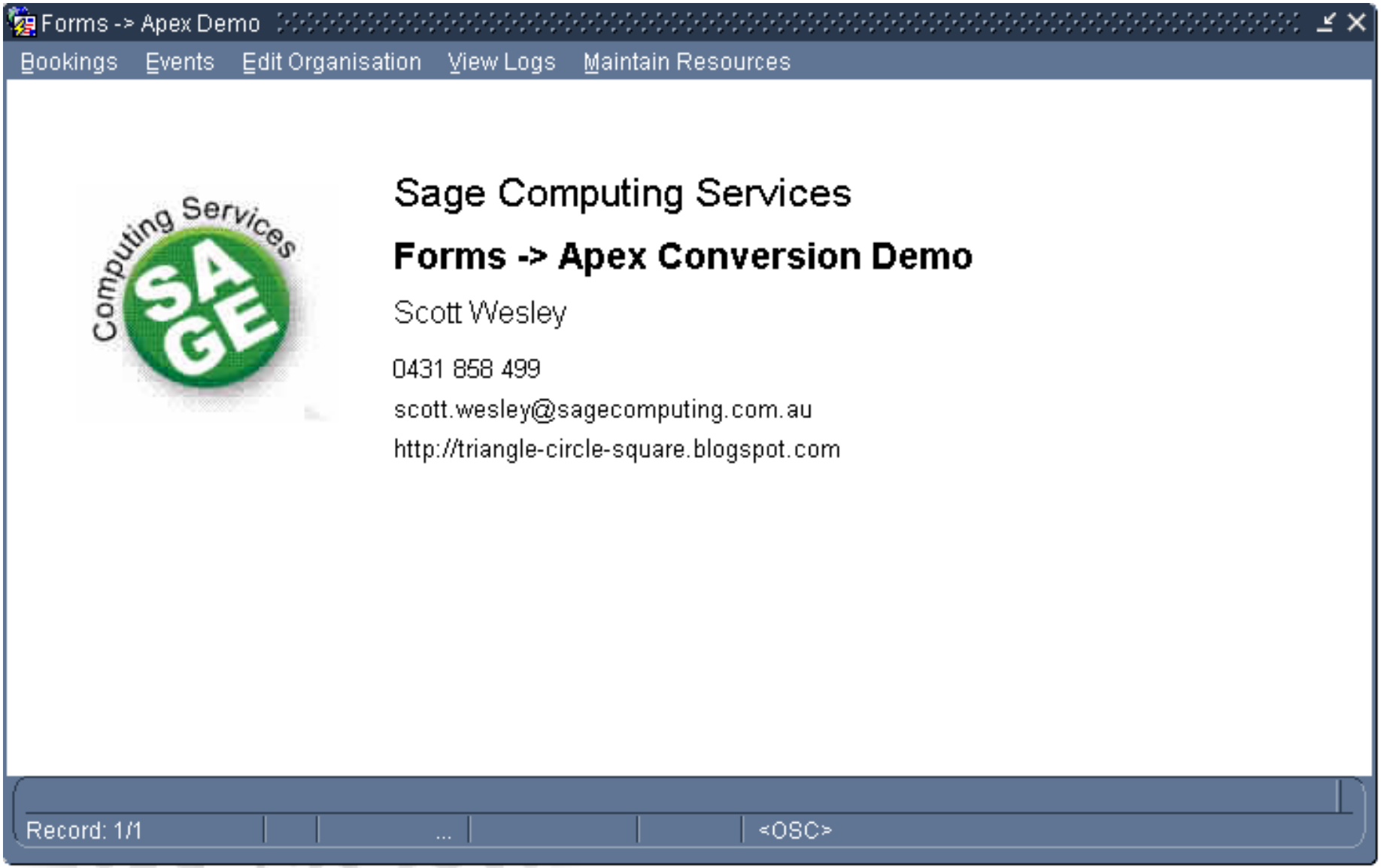
A Hypothetical Case Study

A Hypothetical Case Study

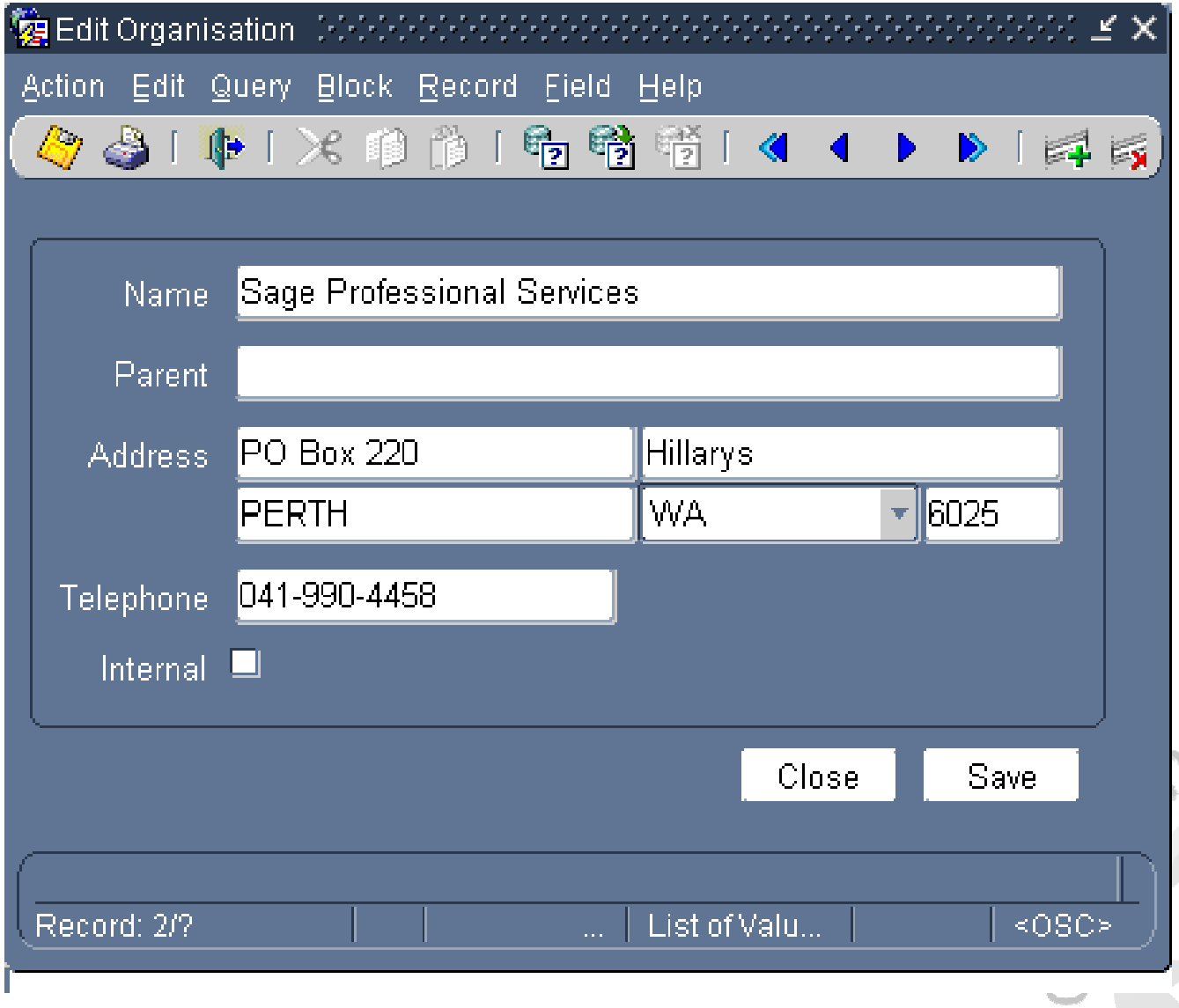


- PLL
- Menu
- Reports
- Forms
  - LOVs
  - Program Units
  - Validation triggers
  - Event triggers
  - Alerts
  - Images
  - Parameters
  - Visual Attributes
  - Hierarchical Tree
  - Procedure based block

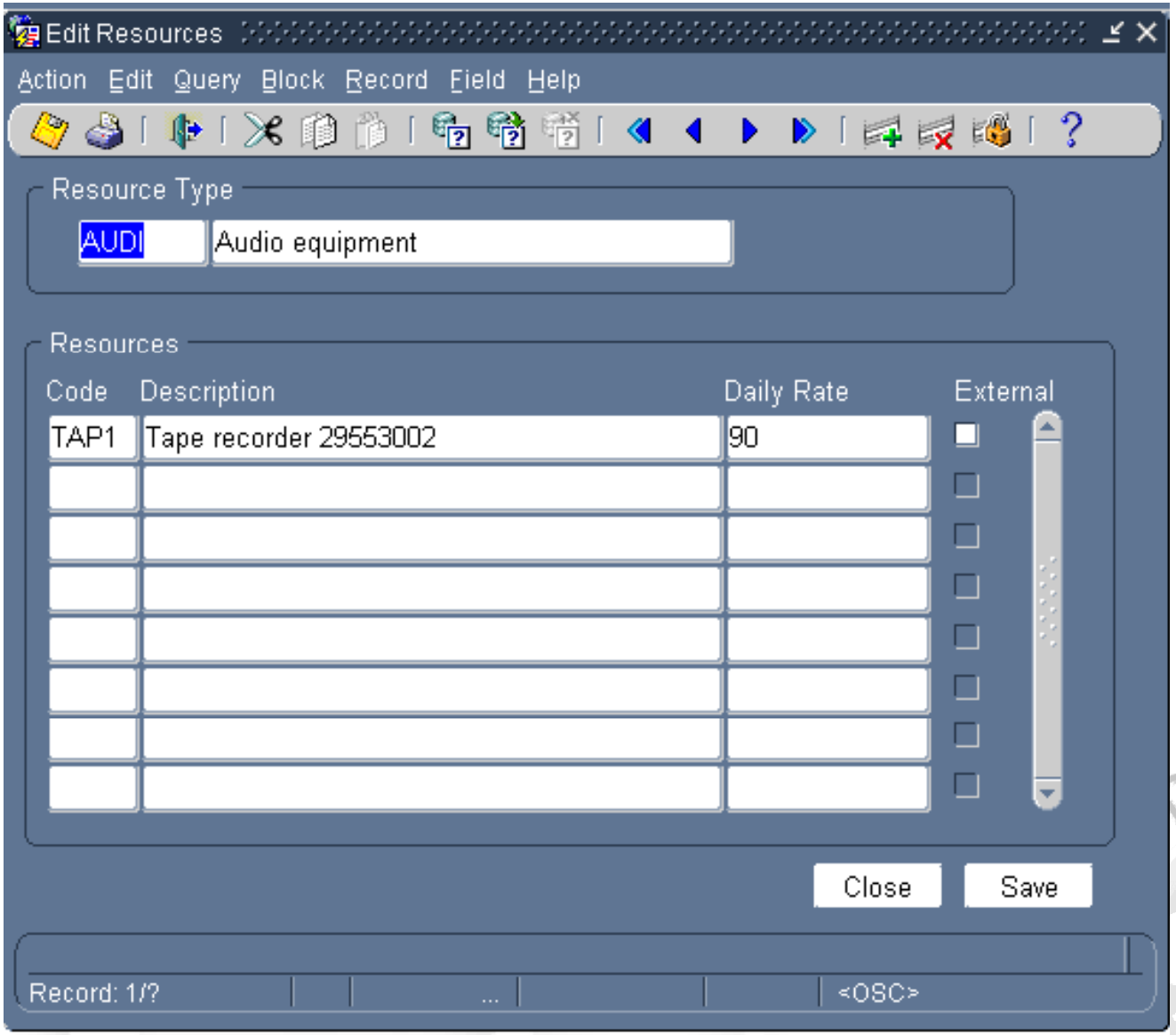
1) Splash Screen



2) Basic Form, Various item types, LOV, Post-Query



3) Master Detail



4) Tabular Form, Basic validation, Pre-Insert, Overflow

Bookings

Action Edit Query Block Record Field Help

Bookings

Event No	Description	Code	Resource	Quantity	Cost	Status	Chargeable
100	Analysis of Patient Managemei	LNCH	Buffet Lunch	20	420	Complete	☐
100	Analysis of Patient Managemei	BRLG	Large board Room	1	0	Complete	☐
100	Analysis of Patient Managemei					ete	☐
102	Land management System Rev					ed	☑
102	Land management System Rev					ed	☐

Comments

Made By USER2

Resources

Find %

Description	Code
Buffet Lunch	LNCH
Chairs	CHRS
Conference Centre	CONF
Data show	DATS
Desktop PC	PC1
File	FILE

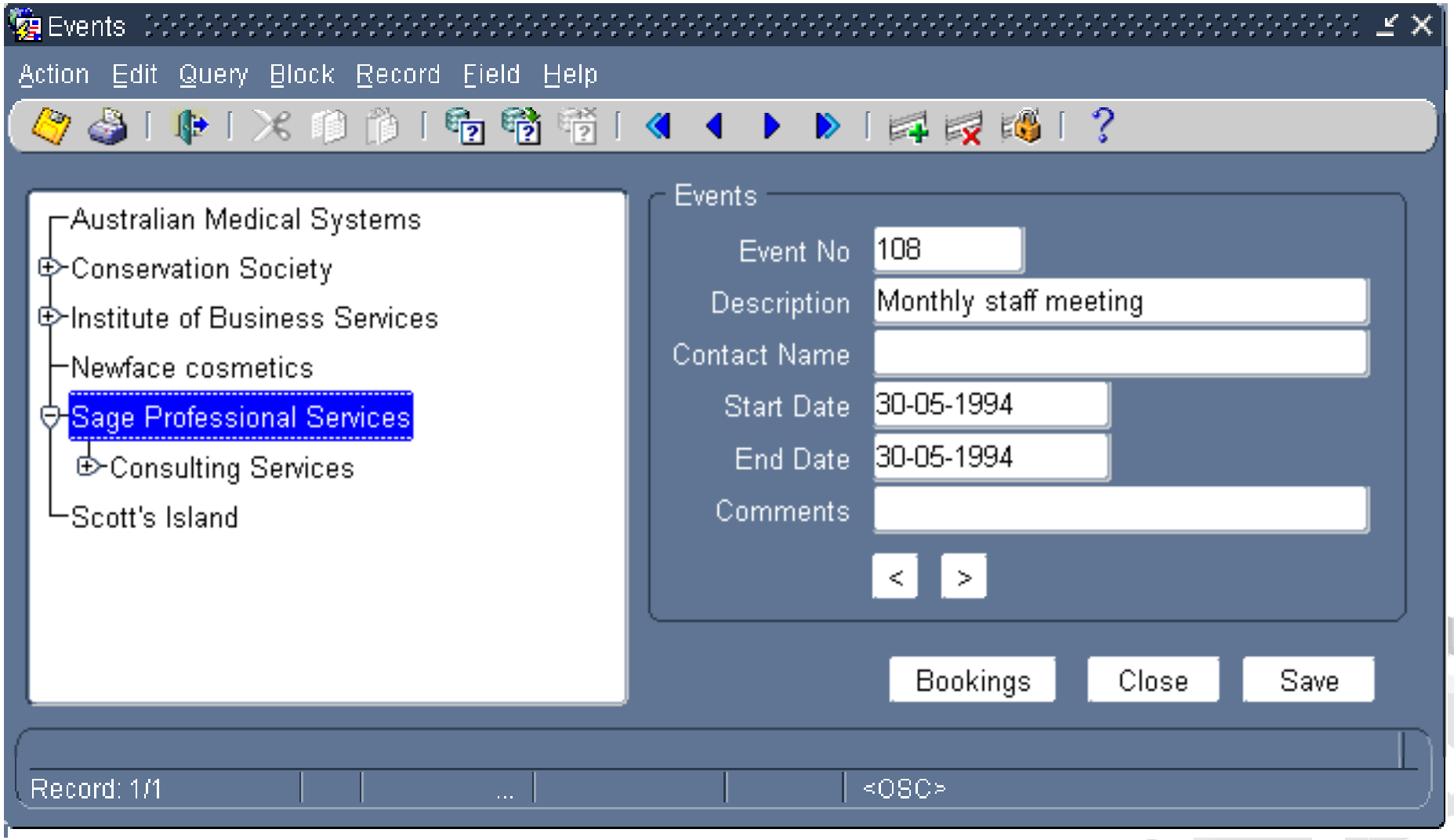
Find OK Cancel

Close Save

Choices in list: 15

Record: 2/? ... List of Valu... <OSC>

5) Hierarchy, Single Record Entry



6) View only, Procedural Entry Example

View Logs

Action Edit Query Block Record Field Help

Message Logs

Date	Value
14-MAR-2009 10:08:21 Row number is 3	3
14-MAR-2009 00:00:00 Row number is 3	3
13-MAR-2009 10:08:21 Row number is 2	2
13-MAR-2009 00:00:00 Row number is 2	2
12-MAR-2009 10:08:21 Row number is 1	1
12-MAR-2009 00:00:00 Row number is 1	1
11-MAR-2009 11:01:04 ** BEGIN	
11-MAR-2009 11:01:04 ** EXCEPTION	
11-MAR-2009 10:52:40 Appropriate message:ORA-20001:	-20001
11-MAR-2009 10:46:41 Power example 8+9**4	-6502
11-MAR-2009 10:42:39 Appropriate message:User-Defined Exception	1
11-MAR-2009 10:07:10 Factorial 8	40320
11-MAR-2009 09:58:54 Power example 2+4**3	216
11-MAR-2009 09:58:44 Power example 2+4**3	216
11-MAR-2009 09:13:59 Rows to be inserted into resource types	7
11-MAR-2009 09:13:08 No data found	
11-MAR-2009 09:12:27 Too many rows	
10-OCT-1999 00:00:00 test	123
10-OCT-1969 00:00:00 test	123

Close

Record: 4/19 ... <OSC>

Conversion Process

Conversion Process Theory

- Chapter 4 – Converting an Oracle Forms Application
- How to convert your application
  - **Step 1: Convert Oracle Forms to XML**
  - Step 2: Create a Workspace and add APEX Users
  - Step 3: Upload database objects into the schema associated with your workspace
  - Step 4: Create a conversion project
  - **Step 5: Review and edit forms metadata**
  - Step 6: Generate the Oracle APEX Application
- Deleting a migration project

How to Convert Oracle Forms Applic...

ORACLE Application Express

Logout Help

Home | Application Builder | SQL Workshop | Utilities

Home > Application Migrations > How to Convert Oracle Forms Applications

1. Convert Oracle Forms to XML.
Run the Forms to XML Conversion tool, Forms2XML, to convert the Forms FormModules in your application. This creates XML output files.

2. Create an Oracle Application Express Workspace.
Run Oracle Application Express and create a workspace. Associate the workspace with the Oracle Forms application schema.

3. Create a migration project.
Log in to the workspace created in Step 2 and navigate to Application Migrations from the Migrations Tasks region. Create a migration project and load the application metadata from Step 1.

4. Analyze the Oracle Forms application.
From the Application Migration Workshop, verify and adjust the Forms application metadata. Refine the scope of migration.

5. Generate the Oracle Application Express Application.
Create an application based on the selected Forms objects.

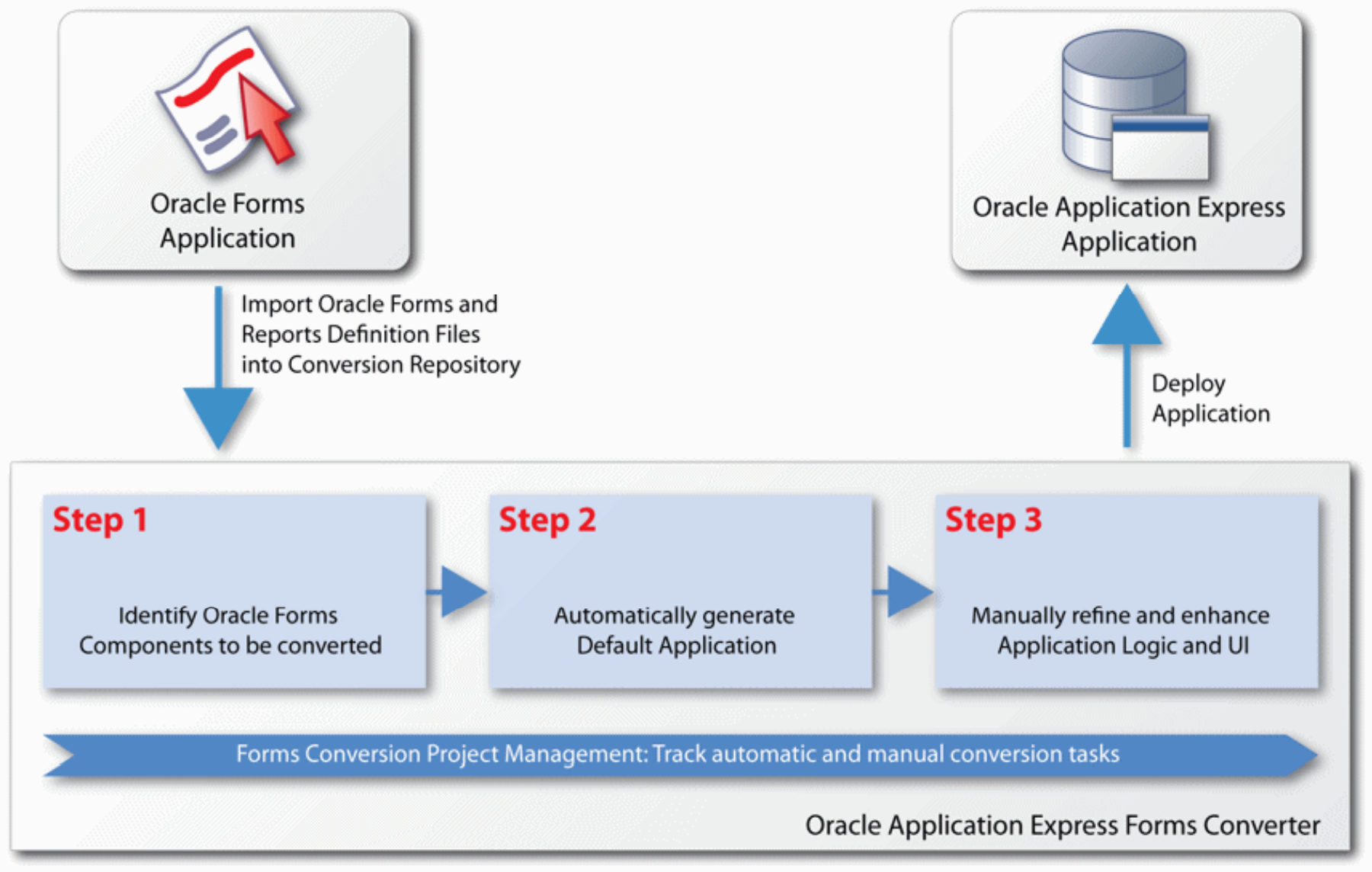
6. Customize your Application Express application.
Open your application in the Application Builder part of Application Express, and customize your migrated application. You can change application attributes or add new pages to the application.

Language: en-gb

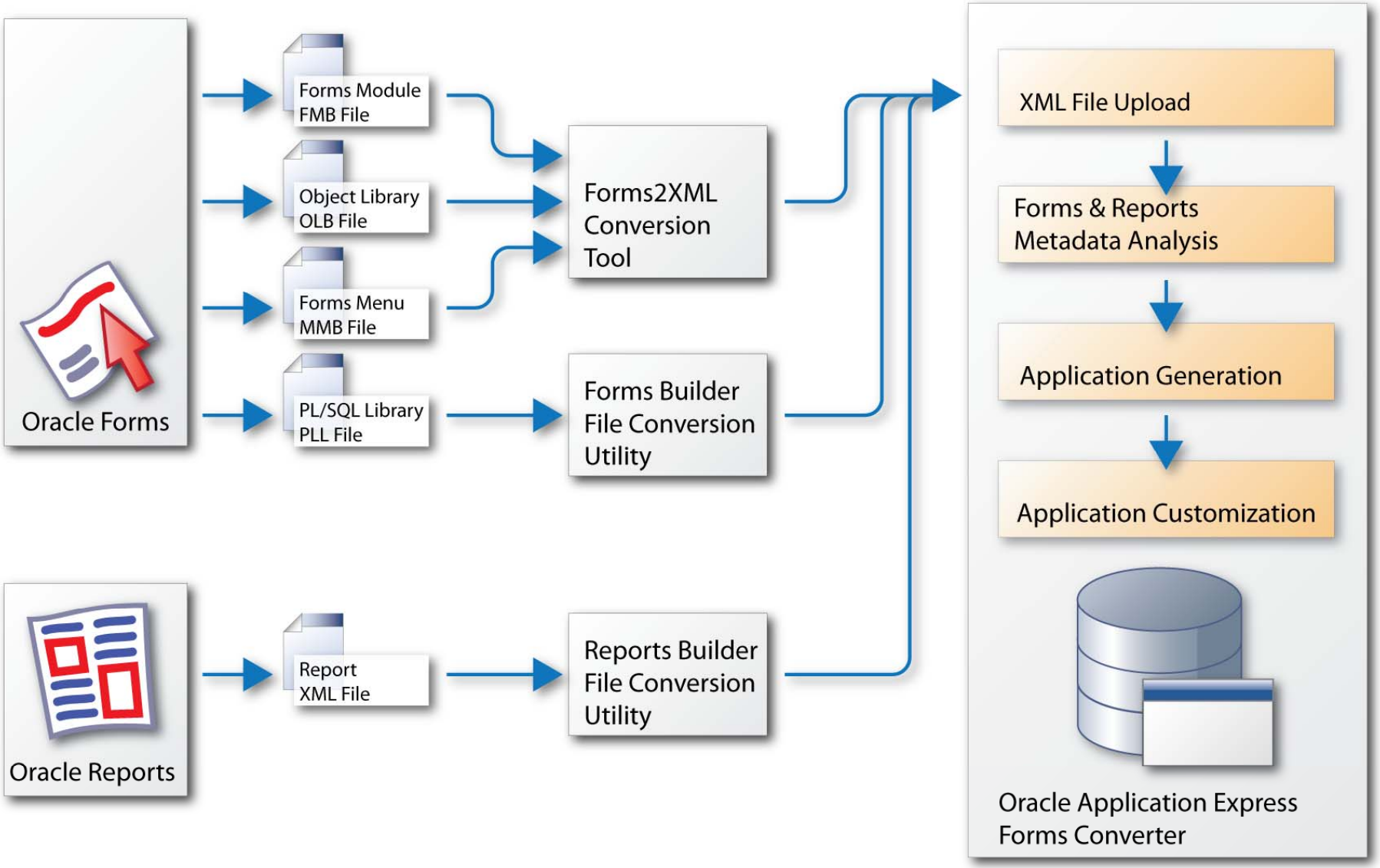
Application Express

Done

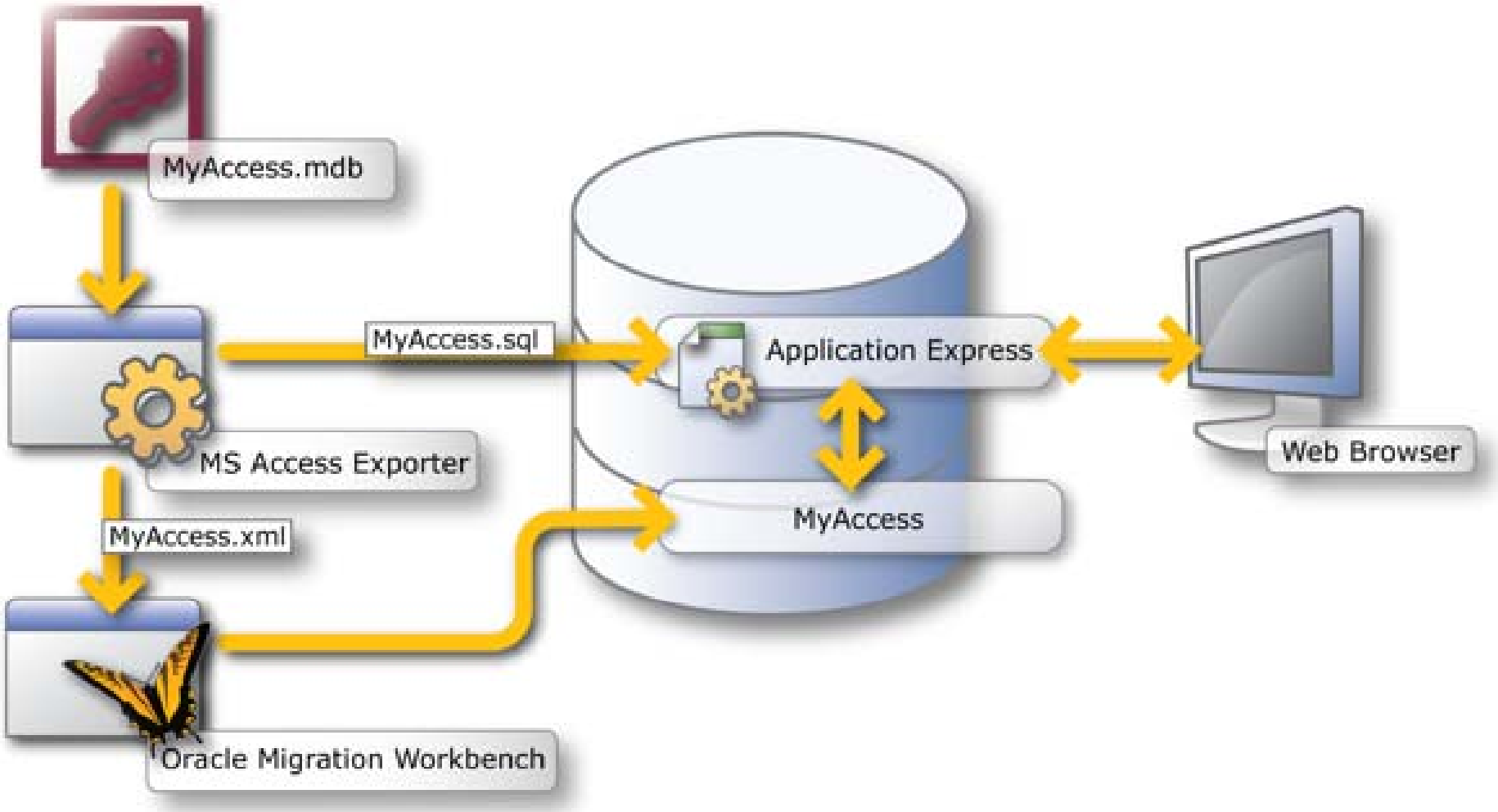
Apex Migration Guide



Apex Migration Guide



Microsoft Access not forgotten

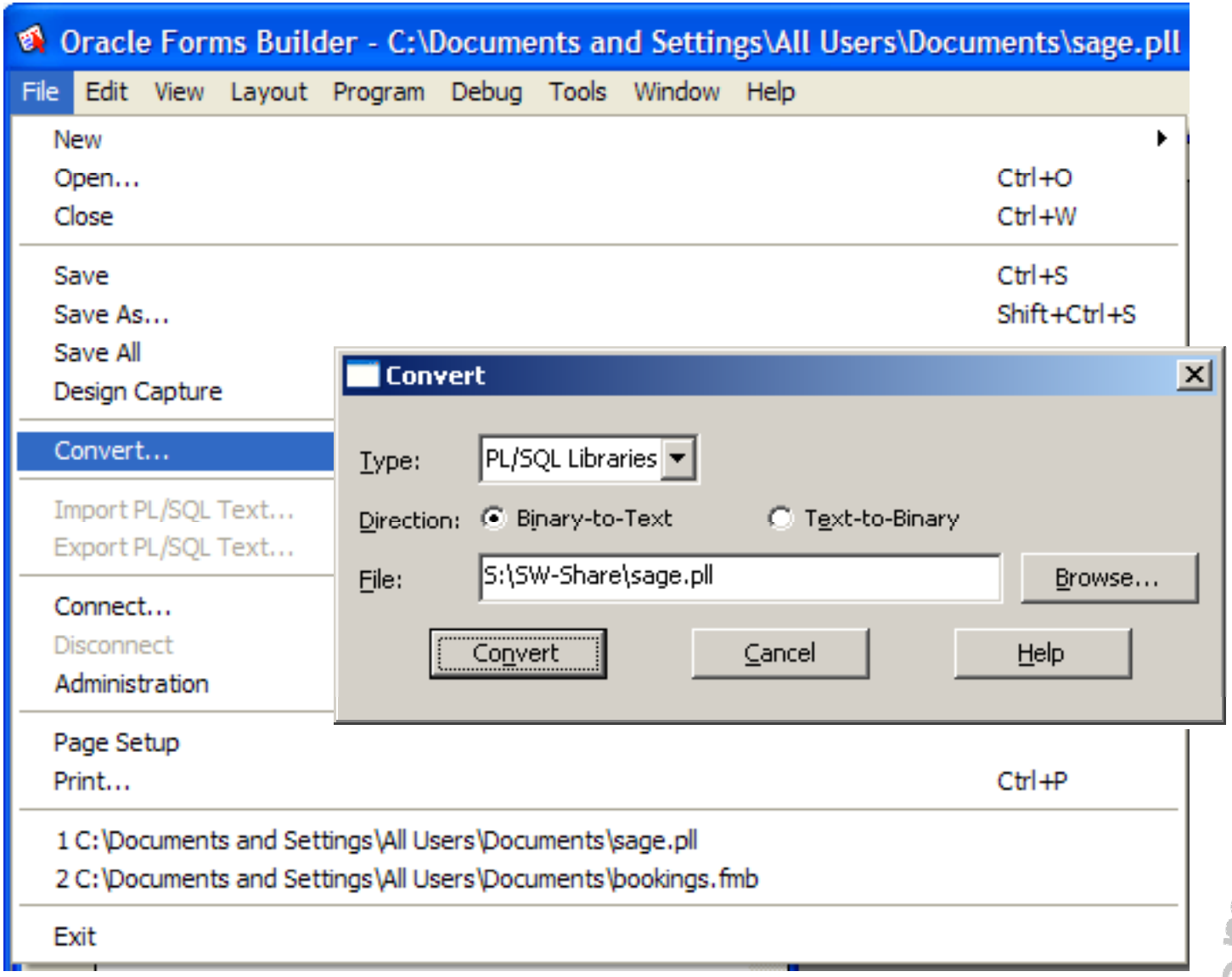


Step 1 - Convert Modules to XML

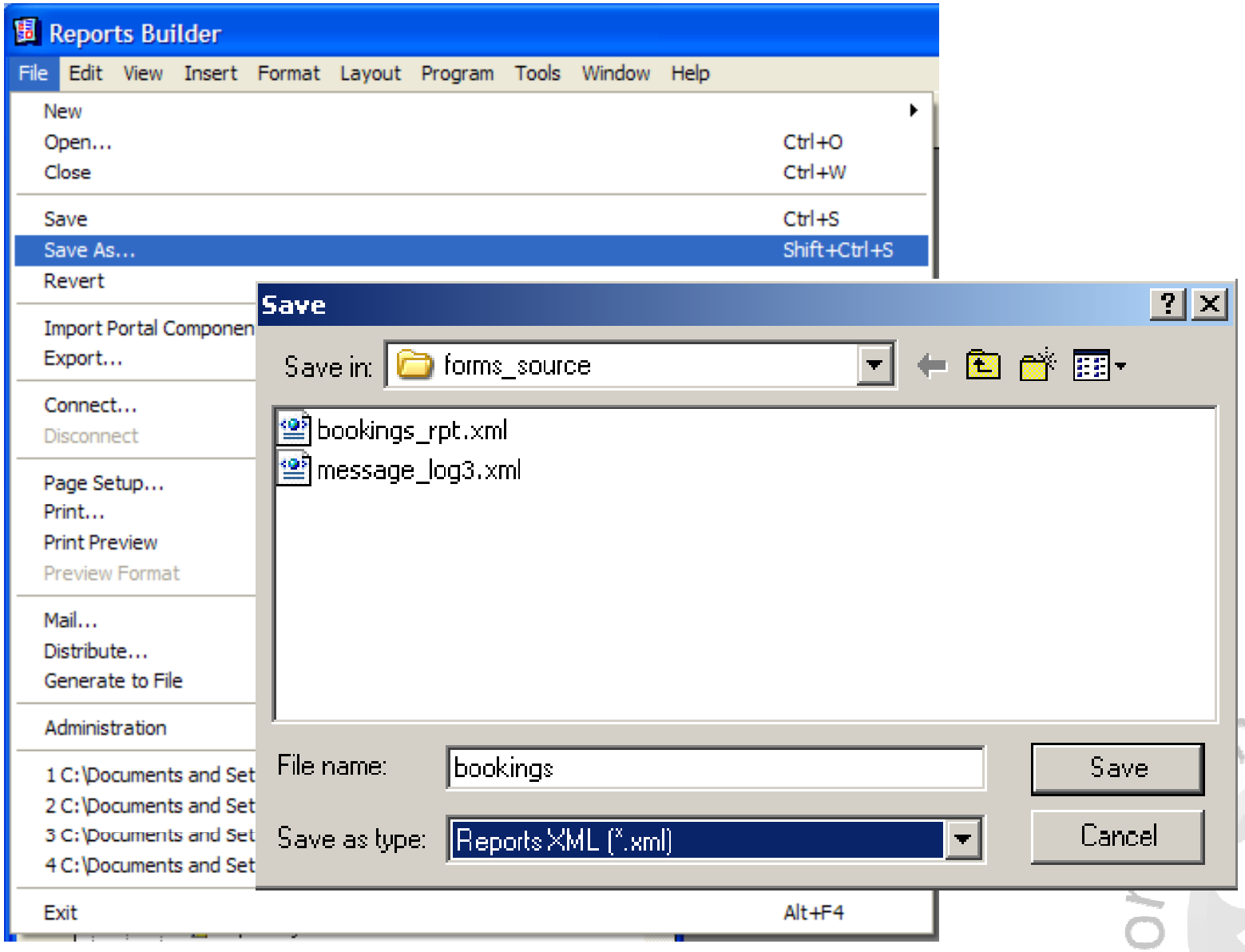
Step 1: Convert .fmb, .olb, .mmb files to XML

```
C:\WINDOWS\system32\command.com
S:\SW-SHARE>frmf2xml
Oracle Forms 10.1.2 Forms to XML Tool
Copyright(c) 2001, 2005, Oracle.  All rights reserved.

Correct usage:
   frmf2xml [options] file1 [file2...]
The tool will accept .fmb, .olb and .mmb files.
Options: (default value in brackets)
DUMP=ALL/OVERRIDDEN dumps ALL properties or just those OVERRIDDEN (OVERRIDDEN)
OVERWRITE=YES/NO overwrite files that already exist (NO)
USE_PROPERTY_IDS=YES/NO writes out the numeric ID of the property value rather than

NOTE : After using the option DUMP=ALL you will NOT be able to reconvert the resulti


S:\SW-SHARE>frmf2xml overwrite=yes bookings.fmb
Oracle Forms 10.1.2 Forms to XML Tool
Copyright(c) 2001, 2005, Oracle.  All rights reserved.

Processing module bookings.fmb
WARNING: Item STATUS - all ListItemElements must have an Index, Name and Value.
XML Module saved as bookings_fmb.xml
```

Convert .pll to .pld



Convert .rdf, .jsp to XML



Resulting XML


```
  <?xml version="1.0" encoding="UTF-8" ?>
- <Module version="101020002" xmlns="http://xmlns.oracle.com/Forms">
  - <FormModule Name="EVENTS" ConsoleWindow="WINDOW1" DirtyInfo="true"
      MenuModule="DEFAULT&SMARTBAR" Title="Events">
      <Coordinate CharacterCellWidth="9" CoordinateSystem="Real" CharacterCellHeight="19" RealUnit="Pixel"
        DefaultFontScaling="false" />
      <Alert Name="SELECT_ALT" DirtyInfo="true" AlertMessage="Please select an event first" Button2Label=""
        AlertStyle="Stop" Title="Select Booking" />
      <AttachedLibrary Name="SAGE3" LibrarySource="File" LibraryLocation="sage3" />
    - <Block Name="ORGANISATIONS" DirtyInfo="true" ScrollbarWidth="18" ScrollbarLength="180"
        DatabaseBlock="false">
      - <Item Name="ORG_TREE" FontSize="1000" DirtyInfo="true" Height="240" XPosition="8"
          FontName="Tahoma" ForegroundColor="black" TreeDataQuery="select -1 initial_state, level depth,
          o.name label, null icon, o.org_id data&#10;from organisations o&#10;start with
          o.parent_org_id is null&#10;connect by prior o.org_id = o.parent_org_id&#10;order siblings
          by name&#10;" Width="280" YPosition="16" FontSpacing="Normal" BackColor="white"
          FontWeight="Demilight" FontStyle="Plain" ItemType="Hierarchical Tree"
          CanvasName="EVENTS_CNV">
          <Trigger Name="WHEN-TREE-NODE-SELECTED" TriggerText="form_globals.selected_org :=
            FTREE.GET_TREE_NODE_PROPERTY(form_globals.htree, :SYSTEM.trigger_node,
            FTREE.NODE_VALUE);&#10;&#10;SET_BLOCK_PROPERTY
            ('events',DEFAULT_WHERE,'org_id =
            '||form_globals.selected_org);&#10;&#10;GO_BLOCK('events');&#10;EXECUTE_QUERY;"
            DirtyInfo="true" />
        </Item>
      </Block>
    - <Block Name="EVENTS" DirtyInfo="true" QueryDataSourceName="EVENTS" ScrollbarWidth="18"
        ScrollbarLength="180">
        <Item Name="ORG_ID" DirtyInfo="true" Height="18" MaximumLength="5" Width="54" ItemType="Text
          Item" Required="true" DataType="Number" Prompt="Org Id" ColumnName="ORG_ID" />
        <Item Name="EVENT_NO" DirtyInfo="true" Height="24" XPosition="400" ParentModule="SAGE"
```

Step 3 - Create Migration Project

Application *Migration*?

Administration

- Administration
  - Manage Services
  - Manage Application Express Users
  - Monitor Activity
- Change Password
- About Application Express

Migrations

- Application Migrations

Workspace Schemas

- SAGE
- SUMMIT

Links

- Oracle Technology Network
- Discussion Forum
- User's Guide

Create Project >

Application Conversion

Tasks

- Download Exporter for Microsoft Access
- How to Migrate Microsoft Access Applications
- How to Convert Oracle Forms Applications
- Sample Files

Define Project

Create Migration Project

ORACLE Application Express

Logout Help

Home | Application Builder | SQL Workshop | Utilities

Home > Application Migrations > Create Migration Project

Project Details

Confirm

Create Migration Project

Cancel Next >

* Project Name: Summit Application

* Type: Forms

Description:

```
David Peake example at
http://www.oracle.com/technology/oramag/oracle
/09-may/o39browser.html?_template=/ocom/print
```

* Schema: SUMMIT

Locate the Forms Module XML file generated by the Forms2XML conversion tool. Click here for information on how to generate a Forms Module XML file.

* Forms Module XML File: S:\SW-Share\forms_conversion\customers_fmb.xml Browse...

Tasks

- Download Exporter for Microsoft Access
- How to Migrate Microsoft Access Applications
- How to Convert Oracle Forms Applications
- Sample Files

Language: en-gb

Workspace: FORMS_CONVERSION User: ADMIN

Application Express

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Done

Start | Create Migration Proj... | Oracle SQL Developer | Oracle SQL*Plus | 9:08 PM

First error…

Create Migration Project

ORACLE Application Express

ORA-06502: PL/SQL: numeric or value error: character string buffer too small

```
ERR-1021 Unable to run "function body returning boolean" validation.
```

Return to application.

Application Express

Workspace: FORMS_CONVERSION User: ADMIN Language: en-gb

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Done

Start | Create Migration Proj... | Oracle SQL Developer | Oracle SQL*Plus | 9:14 PM

Second error…

Create Migration Project

ORACLE Application Express

ORA-31011: XML parsing failed
ORA-19202: Error occurred in XML processing
LPX-00210: expected '<' instead of '.'
Error at line 1

Return to application.

Application Express

Workspace: FORMS_CONVERSION User: ADMIN Language: en-gb

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Done

Start | Create Migration Proj... | Oracle SQL Developer : s... | Oracle SQL*Plus | Application Express View... | 9:48 PM

Upload more files

Create Migration Project

ORACLE Application Express

Logout Help

Home | Application Builder | SQL Workshop | Utilities

Home > Application Migrations > Create Migration Project

Project Details

Upload File

Confirm

Create Migration Project

Cancel | Upload >

Project Name: **Summit Application**

File Count: **1**

* File Type: Forms Module (_fmb.XML)

* File: S:\SW-Share\forms_conversion\customers_fmb.xml Browse... Download

Forms Module XML Files

Supported Upload Files

Forms Module (_fmb.XML)
Upload an Oracle Forms Module .XML file. Use the Forms2XML conversion tool with Oracle Forms to convert Forms Module .FMBs to .XML format.

Oracle Report (.XML)
Upload an Oracle Report in XML format. Use the File Conversion option in Reports Builder to convert binary (.RDF), ASCII(.REX), and .JSP reports to XML format.

PL/SQL Library (.PLD)
Upload a PL/SQL library associated with your Oracle Forms application. The library must be in text format. Use the File > Convert option in Forms Builder to convert PL/SQL library .PLLs to .PLD text files.

Forms Menu (_mmb.XML)
Upload an Oracle Form Menu in XML format. Use the Forms2XML conversion tool with Oracle Forms to convert Forms Menu .MMBs to .XML format.

Object Library (_olb.XML)

Done

Start | Create Migration Proj... | Oracle SQL Developer | Oracle SQL*Plus | 9:17 PM

Create Migration Project

ORACLE Application Express

Logout Help

Home | Application Builder | SQL Workshop | Utilities

Home > Application Migrations > Create Migration Project

Project Details

Upload File

Confirm

Create Migration Project

Cancel | Upload Another File > | Finish

You have requested to run the following script. Please confirm your request.

Forms XML File Name	**customers_fmb.xml**	Size in Bytes	**48,903**
Forms XML File Name	**orders_fmb.xml**	Size in Bytes	**63,391**
PL/SQL Library File Name	**wizard.pld**	Size in Bytes	**5,486**
Forms Menu XML File Name	**customers_mmb.xml**	Size in Bytes	**19,265**
Object Library XML File Name	**stndrd20_olb.xml**	Size in Bytes	**102,012**

Language: en-gb

Application Express

Workspace: FORMS_CONVERSION User: ADMIN

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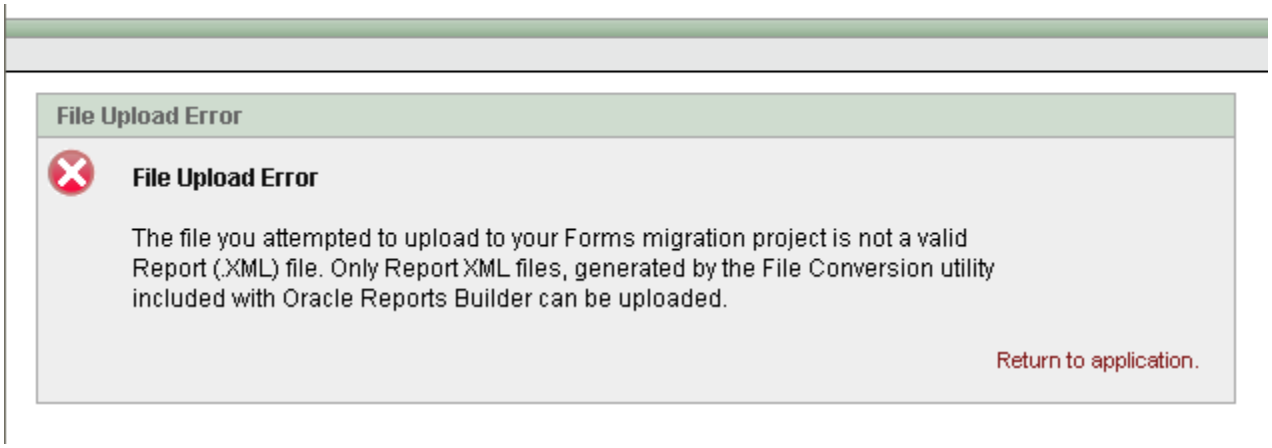
Done

Start | Create Migration Proj... | Oracle SQL Developer : s... | Oracle SQL*Plus | Application Express View... | 9:30 PM

Third error…


File Upload Error
File Upload Error
The file you attempted to upload to your Forms migration project is not a valid Report (.XML) file. Only Report XML files, generated by the File Conversion utility included with Oracle Reports Builder can be uploaded.
Return to application.

Migration Summary (Summit)

Migration Project: Summit Application

ORACLE Application Express

Logout Help

Home | Application Builder | SQL Workshop | Utilities

Home > Application Migrations > Project: Summit Application

Project created.

Rows 15 Go

Upload File > Create Application >

Edit	Type	File Name	Blocks	DB Blocks	Items	Triggers	Record Groups	Lists of Values	Alerts	Program Units	Component Count	Completed Components	Percent Complete
	FMB	customers_fmb.xml	5	4	30	23	1	1	2	7	84	64	76.19
	MMB	customers_mmb.xml	0	0	0	0	0	0	0	0	1	0	0.00
	FMB	orders_fmb.xml	4	3	34	45	1	1	3	5	106	55	51.89
	OLB	stndrd20_olb.xml	0	0	0	0	0	0	0	0	1	0	0.00
	PLL	wizard.pld	0	0	0	0	0	0	0	0	1	0	0.00

1 - 5

Forms Conversion

You define a Forms conversion project by uploading one or more XML files. After uploading the files you can browse Form attributes, generate an application for selected objects, and track manual conversion progress for triggers.

Tasks

- Delete Project
- Edit Project Details and Applicability
- About Forms Conversion
- Set Application Defaults

Recent

- customers_fmb.xml
- orders_fmb.xml
- wizard.pld
- stndrd20_olb.xml
- customers_mmb.xml

Completion Status

Components: **193**

Completed: **119**

Percent Complete: **62.63**

Language: en-gb

Workspace: FORMS_CONVERSION User: ADMIN

Application Express

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Migration Summary (Sage)

Migration Project: Sage

ORACLE Application Express

Logout Help

Home | Application Builder | SQL Workshop | Utilities

Home > Application Migrations > Project: Sage

Rows 15 Go

Upload File > Create Application >

Edit	Type	File Name	Blocks	DB Blocks	Items	Triggers	Record Groups	Lists of Values	Alerts	Program Units	Component Count	Completed Components	Percent Complete
	FMB	bookings_fmb.xml	2	1	13	7	1	1	0	1	28	9	32.14
	FMB	edit_org_fmb.xml	1	1	13	5	1	1	0	0	24	6	25.00
	FMB	edit_resources_fmb.xml	3	2	9	7	0	0	0	3	25	9	36.00
	FMB	events_fmb.xml	3	1	13	11	0	0	1	2	33	14	42.42
	PLL	sage.pld	0	0	0	0	0	0	0	0	1	0	0.00
	MMB	sage_mmb.xml	0	0	0	0	0	0	0	0	1	0	0.00
	OLB	sage_olb.xml	0	0	0	0	0	0	0	0	1	0	0.00
	FMB	splash_fmb.xml	1	0	1	2	0	0	0	0	7	6	85.71
	FMB	view_logs_fmb.xml	3	3	10	8	0	0	0	0	25	8	32.00

1 - 9

Forms Conversion

Tasks

- Delete Project
- Edit Project Details and Applicability
- About Forms Conversion
- Set Application Defaults

Recent

- sage.pld
- sage_mmb.xml
- sage_olb.xml
- view_logs_fmb.xml
- splash_fmb.xml

Completion Status

Components: **145**

Completed: **52**

Percent Complete: **36.62**

Language: en-gb

Workspace: FORMS_CONVERSION User: ADMIN

Application Express

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Step 4 – Analyse the Application

Forms Objects

Forms Objects: customers_fmb.xml

ORACLE Application Express

Logout Help

Home | Application Builder | SQL Workshop | Utilities

Home > Application Migrations > Project: Summit Application > Forms Objects

Rows 15 Go

File Name = 'customers_fmb.xml'

Component	Count	Equivalent Component	Implementation Details	Included	File Name	Applicable
Alerts	2	-	An alert message can be stored as a Text Message in the Shared Components of an Oracle Application Express application. Text Messages can be used to build translatable text strings with substitution variables that can be called from PL/SQL packages, procedures, and functions.	-	customers_fmb.xml	Yes
Blocks	5	Regions	A single block can be mapped to a region in Oracle Application Express. Based upon the block type and data source type (table/view) identified in the Forms XML file, some default mappings are defined. For example, a report block which is based upon an Oracle view, will be mapped to an Interactive report in Oracle Application Express. A form block based upon a table, will be mapped to an Interactive report and form in Oracle Application Express.	2	customers_fmb.xml	Yes
Canvas	5	-	In Oracle Forms, the canvas is the object on which the GUI is drawn, the "background" of the form. In Oracle Application Express, the engine constructs the appearance of each page in a application using Templates. Templates define how pages, page controls, and page components display.	-	customers_fmb.xml	No
Coordinates	1	-	Depending on the Coordinate System used in the Oracle Forms application, coordinates can be expressed in real units such as inches, centimeters, and pixels. One unit in an Oracle Application Express item position might not be equal to one physical pixel in an Oracle Forms application. Therefore the coordinate values cannot be automatically applied to the generated application.	-	customers_fmb.xml	No
Editor	1	-	In Oracle Forms, Editors provide standard editing features, including search/replace and cut, copy, and paste, for text items. For a selected text item, an Editor can be mapped to a HTML Editor in Oracle Application Express.	-	customers_fmb.xml	Yes
Lists of Values	1	Lists of Values	A List of Values can be mapped to an equivalent List of Values in Oracle Application Express. When LOVs are selected for inclusion in the migration to Oracle Application Express their associated record group will also be included in the migration.	1	customers_fmb.xml	Yes

Done

Start | Forms Objects: custo... | Oracle SQL Developer : s... | Oracle SQL*Plus | Application Express View... | 9:37 PM

Data Block: BOOKINGS

Number of Records Displayed	1
Query All Records	No
Record Orientation	Vertical
Single Record	No
Database	
Database Data Block	Yes
Enforce Primary Key	No
Query Allowed	Yes
Query Data Source Type	Table
Query Data Source Name	bookings b, events e, resources r
Query Data Source Columns	
Query Data Source Arguments	
Alias	
Include REF Item	No
WHERE Clause	b.event_no = e.event_no and b.resource_code =
ORDER BY Clause	b.event_no, b.booking_no desc
Optimizer Hint	
Insert Allowed	Yes
Update Allowed	Yes
Locking Mode	Automatic
Delete Allowed	Yes
Key Mode	Updateable

International

Metadata differences

Home > Application Migrations > Project: Sage > Forms Objects > Blocks > Block Details

Cancel | Apply Changes

Show All | Block Details | Annotations | Application Express Page Query | Block Items | Block Triggers

Block Details

Block Name:	**BOOKINGS**	Scrollbar Canvas Name:	
Query Datasource Name:	**bookings b, events e, resources r**	Scrollbar Tabpage Name:	
Query Datasource Type:	**Table**	Show Scrollbar:	**No**
Database Block:		Scrollbar X Position:	
Update Allowed:	**Yes**	Scrollbar Y Position:	
Insert Allowed:	**Yes**	Scrollbar Length:	**180**
Delete Allowed:	**Yes**	Scrollbar Width:	**19**
Enforced Primary Key:		Single Record:	
Records Display Count:	**1**	Back Color:	
Record Visual Attribute Groupname:			
Comment:			

Forgotten Metadata

```
select assignee, querydatasourcename, whereclause, orderbyclause
from apex_030200.wwv_mig_frm_blocks
where name = 'BOOKINGS';
```

esults | Script Output | Explain | Autotrace | DBMS Output | OWA Output

ts:

	ASSIGNEE	QUERYDATASOURCENAME	WHERECLAUSE	ORDERBYCLAUSE
1	PENNY	bookings b, events e, resources r	b.event_no = e.event_no and b.resource_code = r.code	b.event_no, b.booking_no desc

Custom Query

Block Details | Reports | Oracle Application Server Forms Services

```
    "B"."STATUS",
    "B"."CHARGEABLE",
    "B"."MADE_BY",
    "B"."COMMENTS"
 FROM "BOOKINGS" "B"
 , "EVENTS" "E"
 , "RESOURCES" "R"
WHERE "B"."EVENT_NO"= "E"."EVENT_NO" AND "B"."RESOURCE_CODE" = "R"."CODE"
```

Enhanced Query

Original Query

```
select
    "BOOKINGS"."BOOKING_NO",
    "BOOKINGS"."e.EVENT_NO",
    "BOOKINGS"."e.description",
    "BOOKINGS"."b.RESOURCE_CODE",
    "BOOKINGS"."r.description",
    "BOOKINGS"."QUANTITY",
    "BOOKINGS"."COST",
    "BOOKINGS"."STATUS",
    "BOOKINGS"."CHARGEABLE",
    "BOOKINGS"."MADE_BY",
    "BOOKINGS"."b.COMMENTS"
 from "bookings b, events e, resources r" "BOOKINGS"
```

Getting your query right

Block Details | Shared Components | Oracle Application Server Forms Services

```
    "ORGANISATIONS"."ORG_ID",
    "ORGANISATIONS"."PARENT_ORG_ID",
    "ORGANISATIONS"."NAME",
    p.name parent_name
 from "ORGANISATIONS" "ORGANISATIONS"
,organisations p
where p.org_id = "ORGANISATIONS".parent_org_id
```

Enhanced Query

Original Query

```
select
    "ORGANISATIONS"."ADDRESS1",
    "ORGANISATIONS"."ADDRESS2",
    "ORGANISATIONS"."ADDRESS3",
    "ORGANISATIONS"."STATE",
    "ORGANISATIONS"."POSTCODE",
    "ORGANISATIONS"."TELEPHONE",
    "ORGANISATIONS"."INTERNAL",
    "ORGANISATIONS"."SAVE_BTN",
    "ORGANISATIONS"."CLOSE_BTN",
    "ORGANISATIONS"."ORG_ID",
    "ORGANISATIONS"."PARENT_ORG_ID",
    "ORGANISATIONS"."NAME"
 from "ORGANISATIONS" "ORGANISATIONS"
```

Exclude Items

Home > Application Migrations > Project: Sage

Rows 15 Go

Upload File > Create Application > Run

Working Report Assignee

Edit	Type	File Name	Blocks	DB Blocks	Items	Triggers	Record Groups	Lists of Values	Alerts	Program Units
	RPT	bookings_rpt.xml	0	0	0	0	0	0	0	0
	FMB	bookings_test3_fmb.xml	2	1	13	8	1	1	0	1
	FMB	edit_org_fmb.xml	1	1	13	5	1	1	0	0
	FMB	edit_resources_fmb.xml	3	2	9	7	0	0	0	3
	FMB	events_fmb.xml	3	1	13	11	0	0	1	2
	RPT	message_log3.xml	0	0	0	0	0	0	0	0
	PLL	sage.pld	0	0	0	0	0	0	0	0
	MMB	sage_mmb.xml	0	0	0	0	0	0	0	0
	OLB	sage_olb.xml	0	0	0	0	0	0	0	0
	MMB	sage_role_mmb.xml	0	0	0	0	0	0	0	0
	FMB	splash_fmb.xml	1	0	1	2	0	0	0	0

http://localhost:7777/pls/apex/f?p=4400:74:3849825898290789::NO:RIR:IR_FILE_NAME,P53_FILE_ID:edit_org_fmb.xml,1358232205726657

Items | Shared Components | Oracle Application Server Forms Services

Home > Application Migrations > Project: Sage > Items

Rows 50 Go

Apply Changes | Bulk Change

File Name = 'edit_org_fmb.xml'

Include	Item Name	Label	Item Prompt	Triggers	LOV Name	Block	Item Type	Data T
☑	TELEPHONE		Telephone	0		ORGANISATIONS		
☑	PARENT_ORG_ID		Parent Org Id	0		ORGANISATIONS	Text Item	Number
☑	STATE			0		ORGANISATIONS		
☑	ADDRESS3			0		ORGANISATIONS		
☑	ADDRESS2			0		ORGANISATIONS		
☑	ADDRESS1		Address	0		ORGANISATIONS		
☑	[illegible]					RGANISATIONS		
☑	[illegible]					RGANISATIONS		
☐	SAVE_BTN			1		ORGANISATIONS		
☐	CLOSE_BTN			1		ORGANISATIONS		

```
alter table organisations add
  (close_btn raw(1), save_btn raw(1));
```

Done

(Explore meta-data)

```
SAGE@sw10g> break on presentation skip 10
```

SAGE Computing Services

(Unrepentant Marketing)

Register for the Next

Application Express V3.2 course:

23rd ,24th and 26th November

Advanced course:

8th – 9th December

Talk to Sage about moving your Forms applications to Apex

Step 5 – Generate the Apex Application

Generate Application - Theory

Blocks

Regions

Computing Serv

Triggers

Computation / Validation / Process

Program Units

Computation | Validation | Process

Server side packages

Object Library

Computing Serv

LOV

(Record Group)

LOV

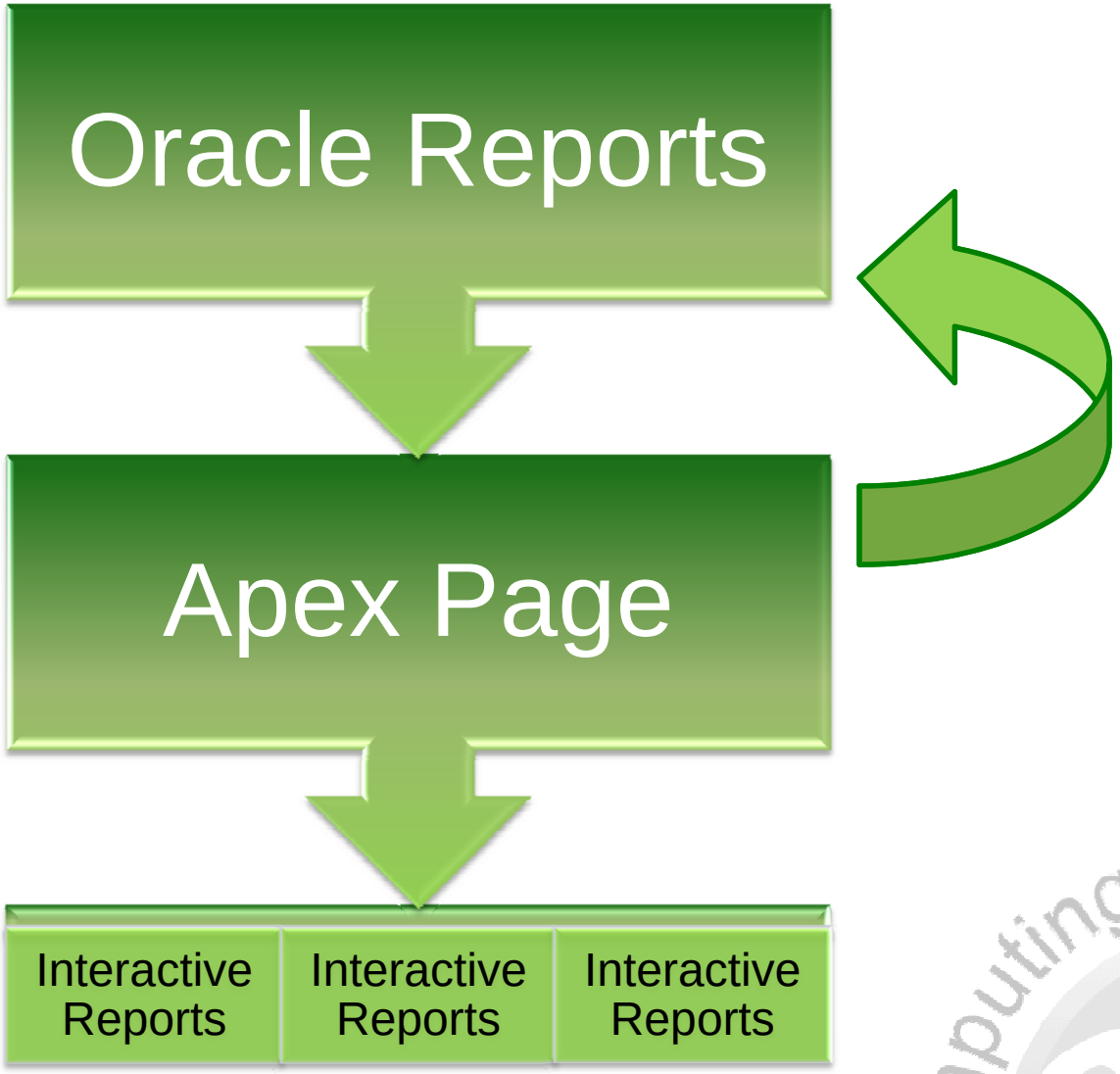
(Select List | Popup)

Computing Serv

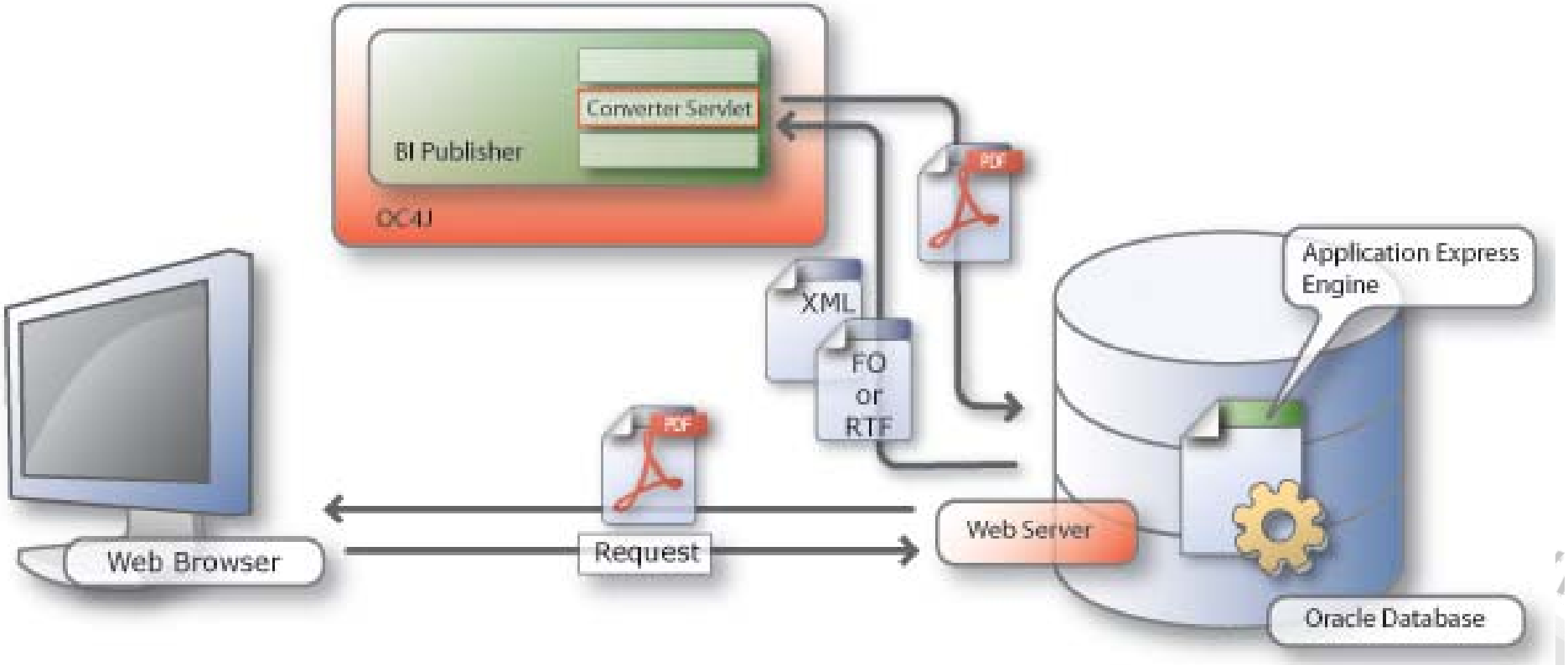
Alerts

Shared Components

– Text Message


Oracle Reports
Apex Page
Interactive Reports
Interactive Reports
Interactive Reports

Apex (potential) Printing Infrastructure



Generate Application - Process

“Compilation errors”

Home > Application Migrations > Project: Sage > Generate Application

1 error has occurred

- **Database schema SAGE does not contain the associated database objects for the project, Sage. Ensure the database schema associated with the project contains the database objects associated with the uploaded Forms Module .XML file(s).**

Name
Pages
User Interface
Confirm

Generate Application Cancel Next >

Enter an application name. Then, select an application creation method and a schema.

* Name: Sage 9

* Application: **148**

Create Application:
- ○ Based on Migration Project
- ◉ Based on existing application design model

Invalid Objects

Object Name	Column Name
MESSAGE_LOG	CURRENT_IND

1 - 1

“Compilation errors”

Home > Application Migrations > Project: Sage > Generate Application

1 error has occurred

- **Database schema SAGE does not contain the associated database objects for the project, Sage. Ensu the database schema associated with the project contains the database objects associated with the uploaded Forms Module .XML file(s).**

Name
Pages
User Interface
Confirm

Generate Application Cancel Next >

Enter an application name. Then, select an application creation method and a schema.

* Name Sage 1

* Application: **134**

Create Application: Based on Migration Project
Based on existing application design model

Schema: **SAGE**

Invalid Objects

Object Name	Column Name
bookings b, events e, resources r	-

1 - 1

“Compilation errors”

Generate Application | Oracle Application Server Forms Services

uploaded Forms Module .XML file(s).

Name
Pages
User Interface
Confirm

Generate Application Cancel Next >

Enter an application name. Then, select an application creation method and a schema.

* Name: Sage 10

* Application: **116**

Create Application: ○ Based on Migration Project
◉ Based on existing application design model

Invalid Objects

Object Name	Column Name
bookings	b.COMMENTS

1 - 1

Invalid Block Queries

Object Name	File Name	Block
select "BOOKINGS"."BOOKING_NO", "BOOKINGS"."event_no", "BOOKINGS"."QUANTITY", "BOOKINGS"."COST", "BOOKINGS"."STATUS", "BOOKINGS"."CHARGEABLE", "BOOKINGS"."MADE_BY", "BOOKINGS"."b.COMMENTS" from "BOOKINGS" "BOOKINGS"	bookings_tab4_fmb.xml	BOOKINGS

1 - 1

Application Design Model

Home > Application Migrations > Project: Sage > Generate Application

Name
Pages
User Interface
Confirm

Generate Application Cancel < Previous Next > Create

Page	Page Name	Page Type	Page Source	Source	Delete Page
1	Home	Blank		-	X
2	ORGANISATIONS	Report	SQL Query	select "ORGANISATIO	X
3	ORGANISATIONS	Form	Table	ORGANISATIONS	X
4	RESOURCE_TYPES	Report	Table	RESOURCE_TYPES	X
5	RESOURCE_TYPES	Master Detail	Table	RESOURCES	X
6	RESOURCES	Tabular Form	Table	RESOURCES	X
7	EVENTS	Report	SQL Query	select "EVENTS"."OR	X
8	EVENTS	Form	Table	EVENTS	X
9	MESSAGE_LOG	Report	SQL Query	select "MESSAGE_LOG	X
10	CTRL	Blank		-	X

Add Page Add Page

Select Page Type:

Blank Report Form

Add Page

Select the type of page you wish to create:

- **Blank** creates a page with no built-in functionality.
- **Report** creates a page that contains the formatted result of a SQL query. You can choose to build a report based on a table you select, or based on a custom SQL SELECT statement or a PL/SQL function returning a SQL SELECT statement that you provide.
- **Form** creates a form to update a single row in a database table.
- **Tabular Form** creates a form to perform update, insert, and delete operations on multiple rows in a database table.
- **Report and Form** builds a two page report and form combination. On the first page, users select a row to update. On the second page, users can update the selected table or view.
- **Master Detail** builds a two page report and form

New Page Definition - Mozilla Firefox

http://localhost:7777/pls/apex/f?p=4400:47:3849825898290789::NO::P43_ICON:issue_tracker_bx_128x128.png

Cancel | Apply Changes

Page Definition

Page: **2**

Page Name: ORGANISATIONS

Sequence:

Page Type: **Report page**

Page Source: **SQL Query**

Source Query:

```
select
    "ORGANISATIONS"."ADDRESS1",
    "ORGANISATIONS"."ADDRESS2",
    "ORGANISATIONS"."ADDRESS3",
    "ORGANISATIONS"."STATE",
    "ORGANISATIONS"."POSTCODE",
    "ORGANISATIONS"."TELEPHONE",
    "ORGANISATIONS"."INTERNAL",
--    "ORGANISATIONS"."SAVE_BTN",
--    "ORGANISATIONS"."CLOSE_BTN",
    "ORGANISATIONS"."ORG_ID",
    "ORGANISATIONS"."PARENT_ORG_ID",
    "ORGANISATIONS"."NAME",
    p.name parent_name
 from "ORGANISATIONS" "ORGANISATIONS"
,organisations p
where p.org_id = "ORGANISATIONS".parent_org_id
```

Parent Page: Home (1)

Implementation: Interactive

Page Icon: issue_tracker_bx_128x128.png

Done

New Page Definition - Mozilla Firefox

http://localhost:7777/pls/apex/f?p=4400:47:3849825898290789::NO::P43_ICON:interactive_report_bx_128x128.png

Page Icon interactive_report_bx_128x128.png

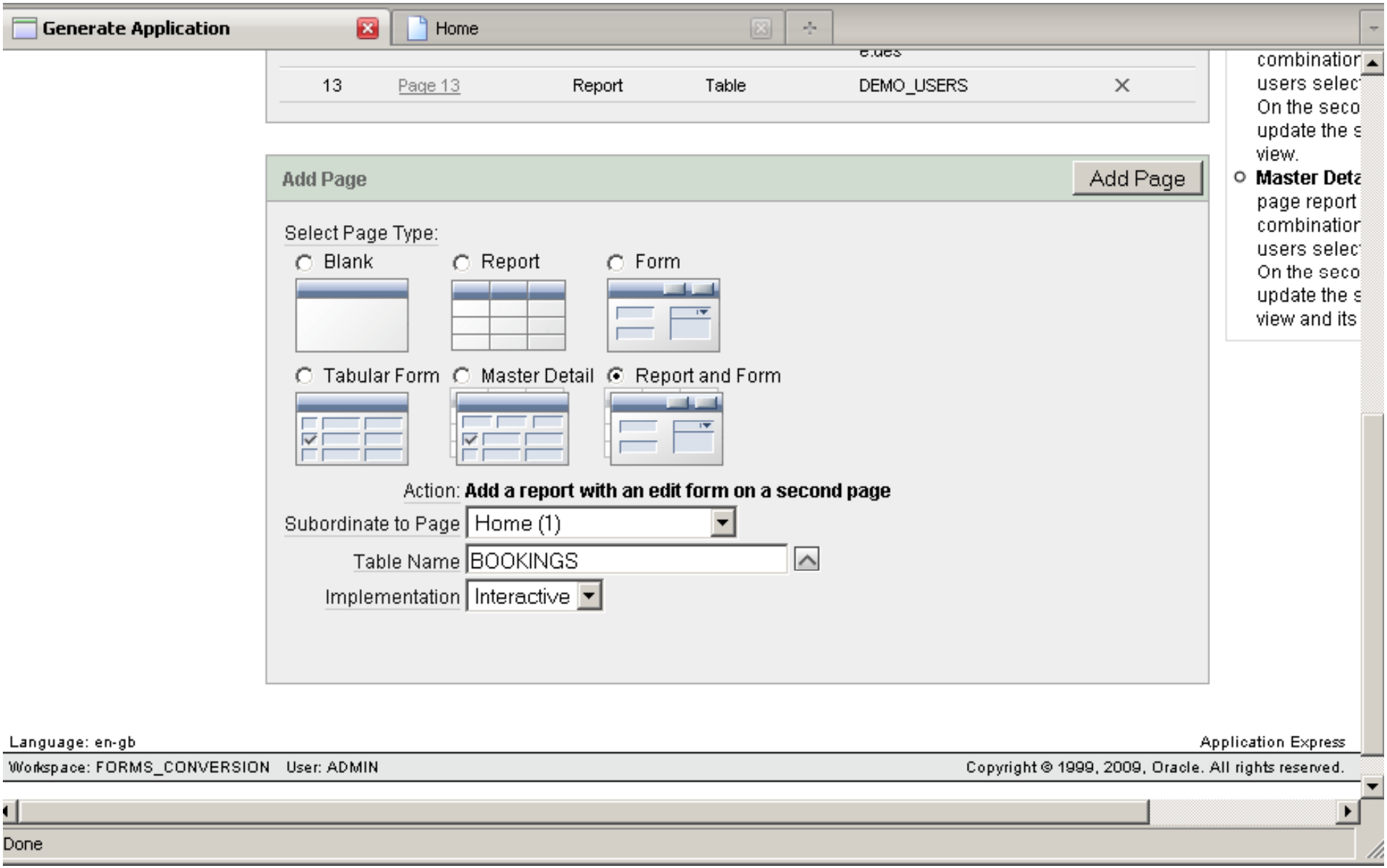
Report Columns

Name	Heading / Label	Datatype	Format Mask
ADDRESS1	Address1	VARCHAR2	
ADDRESS2	Address2	VARCHAR2	
ADDRESS3	Address3	VARCHAR2	
STATE	State	VARCHAR2	
POSTCODE	Postcode	VARCHAR2	
TELEPHONE	Telephone	VARCHAR2	
INTERNAL	Internal	VARCHAR2	
ORG_ID	Org Id	NUMBER	
PARENT_ORG_ID	Parent Org Id	NUMBER	
NAME	Name	VARCHAR2	
PARENT_NAME	Parent Name	VARCHAR2	

row(s) 1 - 11 of 11

Done

Add Extra Pages



Define Theme

Create Application | Home

ORACLE Application Express

Logout Help

Home | Application Builder | SQL Workshop | Utilities

Home > Application Migrations > Project: Sage > Create Application

Name
Pages
User Interface
Confirm

Generate Application

Cancel | < Previous | Next >

Select a theme:

Theme 1 | Theme 2 | Theme 3
Theme 4 | Theme 5 | Theme 6
Theme 7 | Theme 8 | Theme 9
Theme 10 | Theme 11 | Theme 12

Done

Confirm Creation

Generate Application | Home

ORACLE Application Express

Logout Help

Home | Application Builder | SQL Workshop | Utilities

Home > Application Migrations > Project: Sage > Generate Application

Name
Pages
User Interface
Confirm

Generate Application

Cancel | < Previous | Create

You have requested to create an application with the following attributes. Please confirm your selections.

Application	**144**
Name	**Sage 6**
Parsing Schema	**SAGE**
Default Language	**en-gb**
Tabs	**One Level of Tabs**
Default Authentication Scheme	**Application Express Authentication**
Theme Type	**Standard**
UI Theme	**1**

Language: en-gb

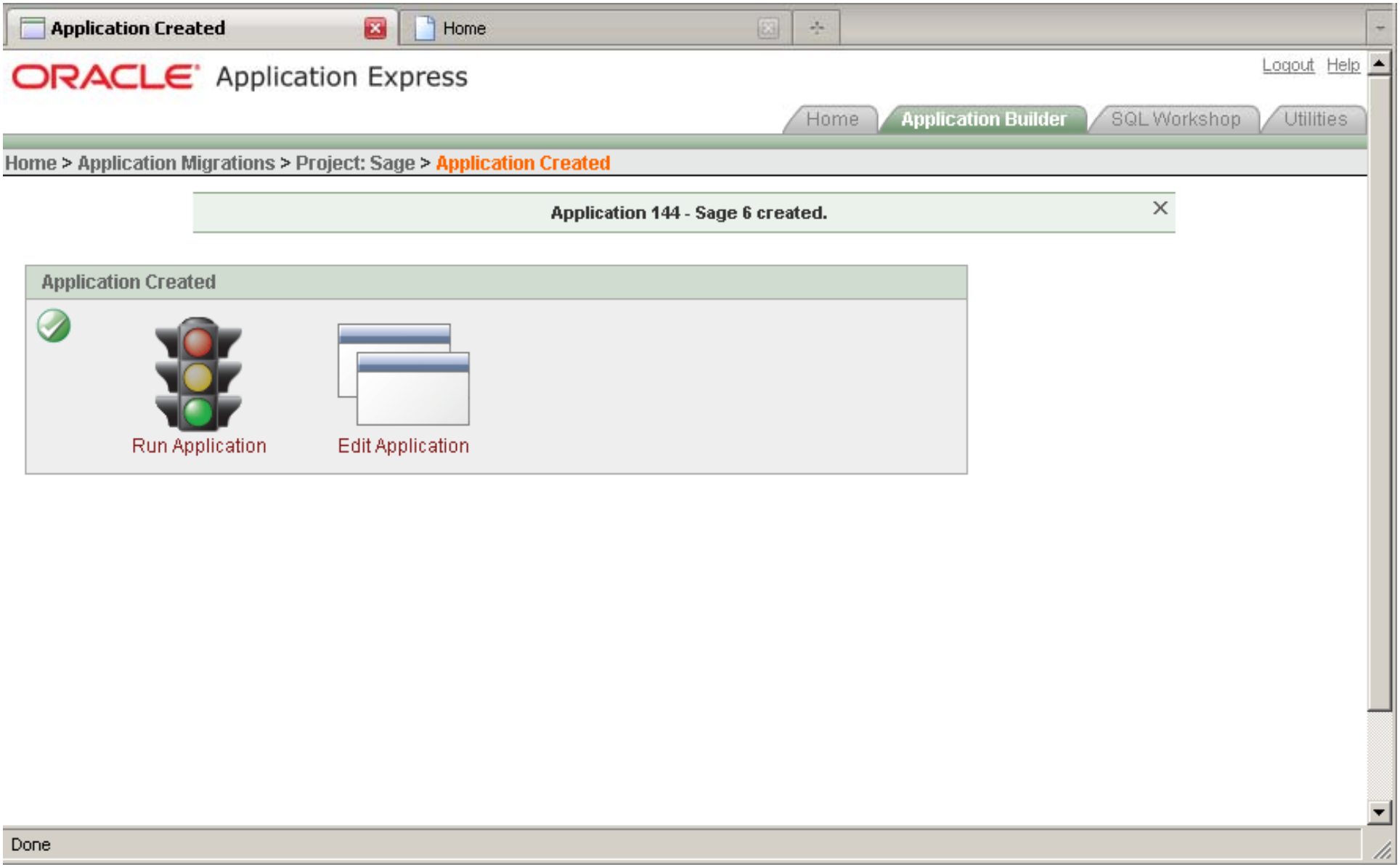
Application Express

Workspace: FORMS_CONVERSION User: ADMIN

Copyright © 1999, 2009, Oracle. All rights reserved.

Done

Success!


Application Created
Home
ORACLE Application Express
Logout Help
Home
Application Builder
SQL Workshop
Utilities
Home > Application Migrations > Project: Sage > Application Created
Application 144 - Sage 6 created.
Application Created
Run Application
Edit Application
Done

So what does my new Application look like?

Application Builder | Home

Logout

Home

Home

ORGANISATIONS

RESOURCE_TYPES

RESOURCES

EVENTS

MESSAGE_LOG

CTRL

ADMIN

Home | Application 138 | Edit Page 1 | Create | Session | Activity | Debug | Show Edit Links

Done

Home > ORGANISATIONS

Rows 15 Go

Create

	Address1	Address2	Address3	State	Postcode	Telephone	Internal	Org Id	Parent Org Id	Name	Parent Name
	PO Box 220	Hillarys	Perth	WA	6025	0419904458	I	1010	1000	Training Division	Sage Professional Services
	-	-	-	-	-	-	I	1030	1010	Self Study Program	Training Division
	-	-	-	-	-	-	I	1040	1010	Classroom Training	Training Division
	14 Green St	N Sydney	-	NSW	2003	02 234 5677	E	3214	3210	Forests Division	Conservation Society
	16 Green St	N Sydney	-	NSW	2003	02 234 5557	E	3216	3210	Rivers Division	Conservation Society
	156 High Rd	Sydney	-	NSW	2056	02 890 MARK	E	3843	3842	Marketing Services	Institute of Business Services
	159 High Rd	Sydney	-	NSW	2056	02 890 FINS	E	3844	3842	Financial Services	Institute of Business Services

1 - 7

ADMIN

Home | Application 138 | Edit Page 2 | Create | Session | Activity | Debug | Show Edit Links

Application Builder | ORGANISATIONS

Logout

Home

Home > ORGANISATIONS > ORGANISATIONS

ORGANISATIONS

Cancel | Delete | Apply Changes

Address	PO Box 220
Address2	Hillarys
Address3	Perth
State	WA
Postcode	6025
Telephone	0419904458
Internal	I
Parent Org Id	1000
*Name	Training Division
*Parent	

ADMIN

Home | Application 138 | Edit Page 3 | Create | Session | Activity | Debug | Show Edit Links

Done

Iterative Process?

Home > Application Migrations > Project: Sage > Generate Application

Name
Pages
User Interface
Confirm

Generate Application

Cancel | < Previous | Next > | Create

Page	Page Name	Page Type	Page Source	Source	Delete Page
1	Home	Blank		-	X
13	Page 13	Report	Table	DEMO_USERS	X
14	Bookings	Report	Table	BOOKINGS	X
15	Bookings	Form	Table	BOOKINGS	X
2	ORGANISATIONS	Report	SQL Query	select "ORGANISATIO	X
3	Organisations	Form	Table	ORGANISATIONS	X
4	RESOURCE_TYPES	Report	Table	RESOURCE_TYPES	X
5	RESOURCE_TYPES	Master Detail	Table	RESOURCES	X
6	RESOURCES	Tabular Form	Table	RESOURCES	X
7	EVENTS	Report	SQL Query	select "EVENTS"."OR	X
8	Events	Form	Table	EVENTS	X
9	MESSAGE_LOG	Report	SQL Query	select "MESSAGE_LOG	X
10	Reports	Blank		-	X
11	message_log3	Report	SQL Query	select message_text, mes	X
12	bookings_rpt	Report	SQL Query	select e.event_no, e.des	X

Done

UI Defaults

Home > Application Builder > User Interface Defaults > Table Defaults

Table/View Name: **ORGANISATIONS (table)**

Form Region Title: Organisations

Report Region Title: Organisations

Column Name	Label	Include in Reports	Report Sequence	Searchable	Group By	Aggregate By	Include in Forms	Form Sequence	Required
ORG_ID	Org ID	✓	1	-	-	-	✓	1	✓
PARENT_ORG_ID	Parent Org Id	-	2	-	-	-	✓	2	-
NAME	Name	✓	3	✓	-	-	✓	3	✓
ADDRESS1	Address1	✓	4	✓	-	-	✓	4	-
ADDRESS2	Address2	✓	5	✓	-	-	✓	5	-
ADDRESS3	Suburb	✓	6	✓	-	-	✓	6	-
STATE	State	✓	7	✓	-	-	✓	7	-
POSTCODE	Postcode	✓	8	✓	-	-	✓	8	-
TELEPHONE	Telephone	✓	9	✓	-	-	✓	9	-
INTERNAL	Internal	✓	10	✓	-	-	✓	10	-
CLOSE_BTN	Close Btn	-	11	-	-	-	✓	11	-
SAVE_BTN	Save Btn	-	12	-	-	-	✓	12	-

Step 6 – Customise your Apex Application

Annotations

Form Details | Reports | Oracle Application Server Forms Services

Home > Application Migrations > Project: Sage > Form Details

Cancel | Delete | Apply Changes

Show All | Form Details | Annotations

Form Details

File Name: **bookings_test3_fmb.xml** Download

Annotations

Applicable: Yes

Priority: 3

Complete: Yes

Assignee: Penny

Notes:

```
May be the most tedious to convert, has lov, multi row info
and some validations.
```

Tags:

```
lov, multirow, validation
```

Review

- Page structures
- UI - themes / images
- Navigation components
- Report implementation

Program Units / Triggers

- Manually transfer code as validation/computation/process
- Annotate

Enhance Apex Application

- Apply conditional processing for regions / items
- Apply security via authorisation schemes / conditions
- Apply LOVs, alerts, specific item type attributes (checkboxes, dates)
- Review all generated buttons
- Add session state protection
- Annotate

Add Apex Components

- Pages, regions, buttons, items as required
- Implement client-side JS & AJAX
- Annotate

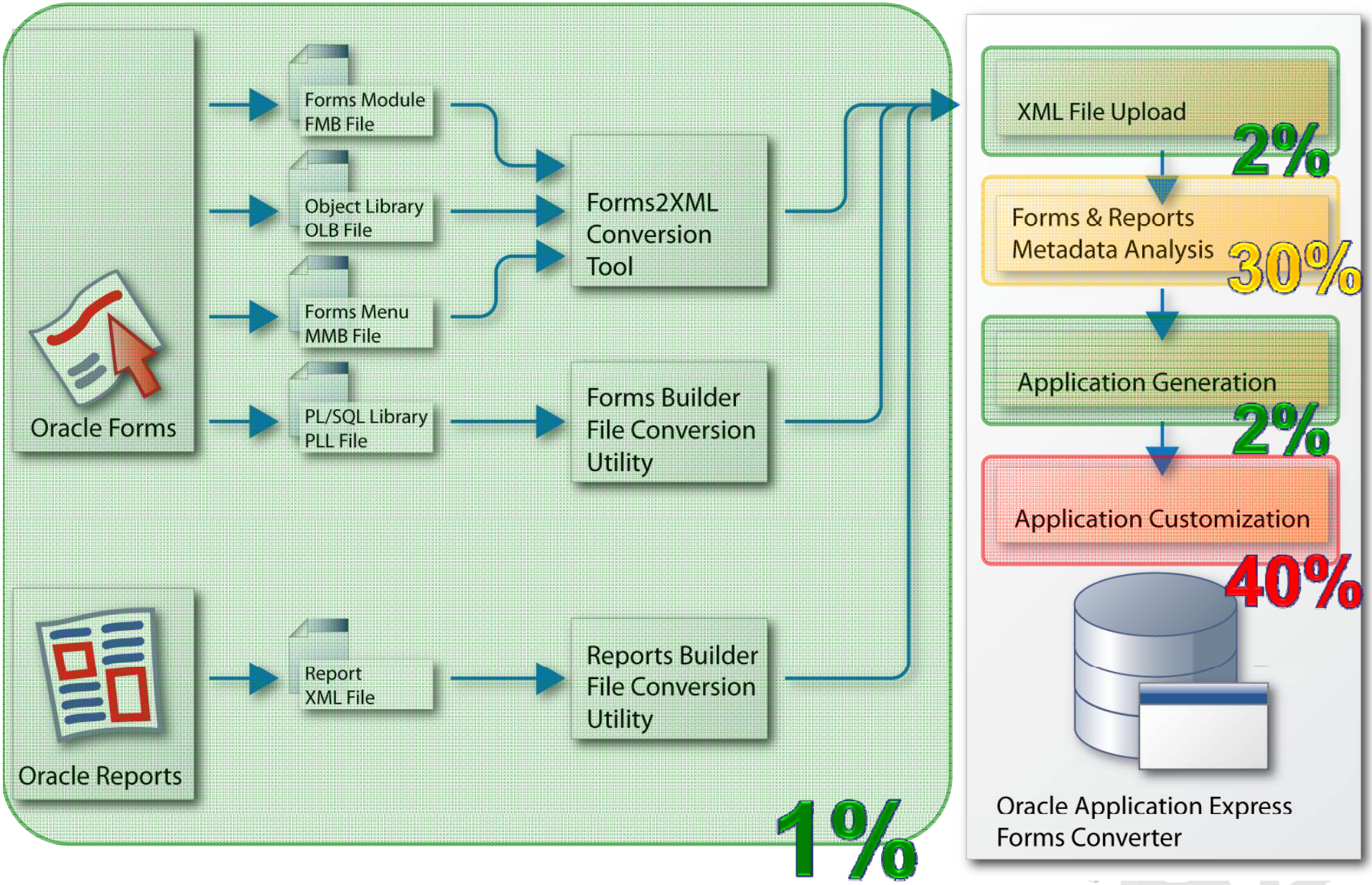
Develop Database Components

- Ensure code reused in packages and not embedded in the Apex Application where possible
- Annotate

Project Management

- System test
- Train users
- Implement application

Where did my time go?


Oracle Forms
Forms Module
FMB File
Object Library
OLB File
Forms Menu
MMB File
PL/SQL Library
PLL File
Forms2XML
Conversion
Tool
Forms Builder
File Conversion
Utility
Oracle Reports
Report
XML File
Reports Builder
File Conversion
Utility
1%
XML File Upload
2%
Forms & Reports
Metadata Analysis
30%
Application Generation
2%
Application Customization
40%
Oracle Application Express
Forms Converter

Transform to XML

Create Application Express Workspace / Migration Project

Upload XML files to workspace

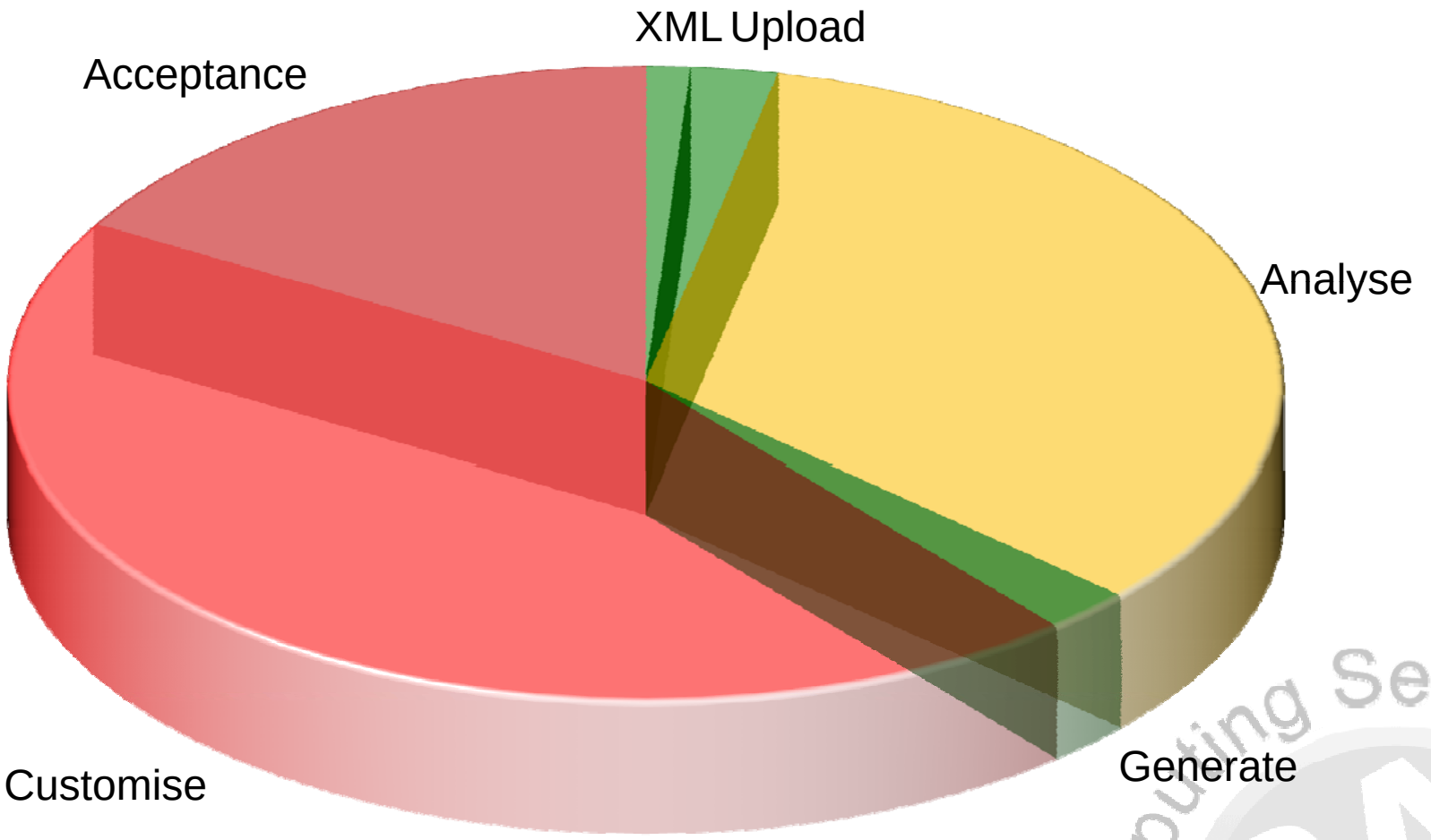
Analyse the application metadata

Generate the Application Express Application

Customise the Application Express Application

User Acceptance & Testing

Consumption of Time



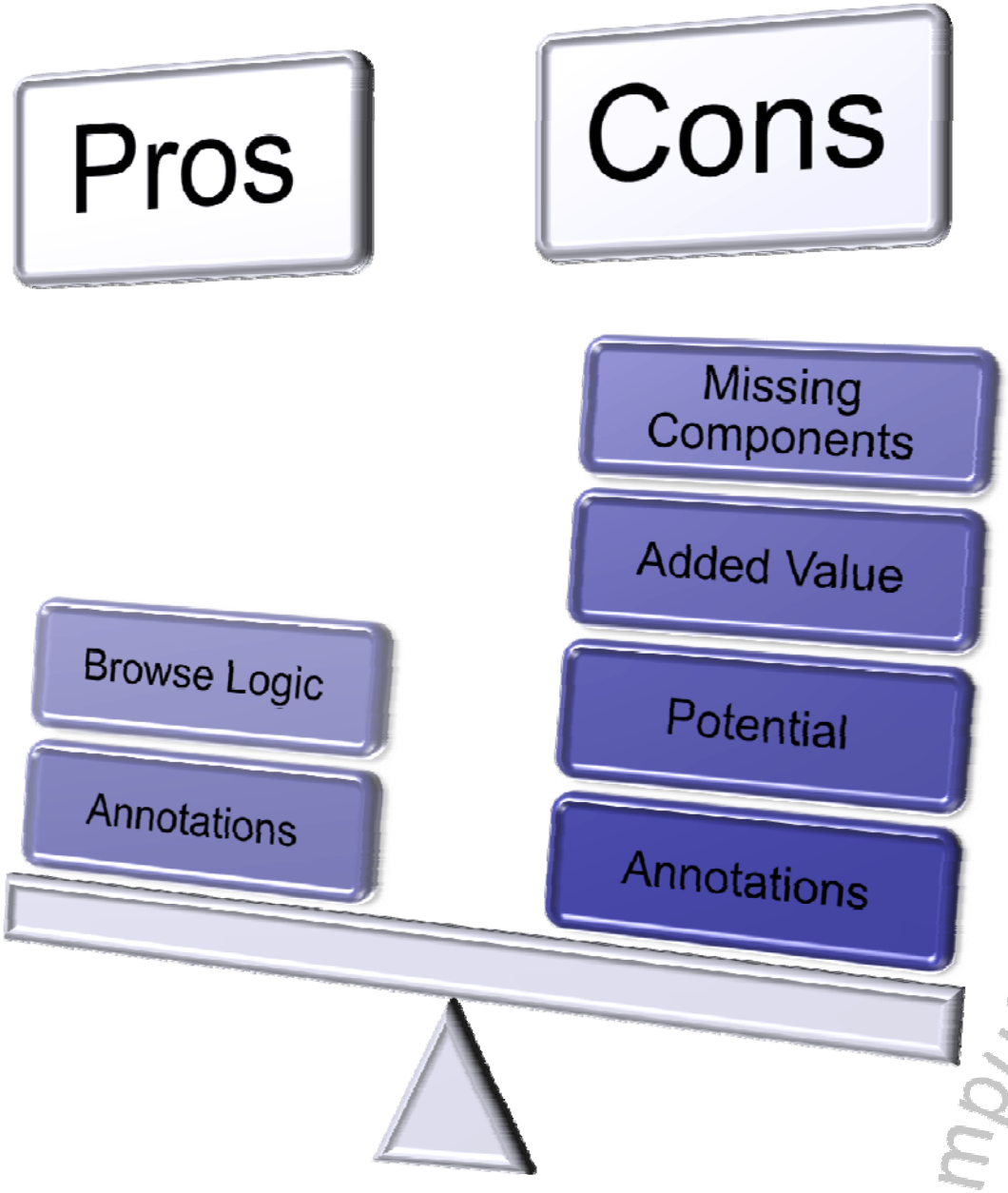
Conversion Tool = ~5%

Review

Bottlenecks / Danger Zones

What’s missing?

- Export / Backup
- Ability to pre-build Apex validations during conversion
  - PL/SQL Placeholders
- Define item type/order
- Conversion of LOVs, Alerts
- Apex Views
  - Annotations
  - Aggregation (combined listings)
- SQL Developer Integration
- Search facility (not IR)
- Bulk change on all object types (not application applicability)
- XML Metadata
  - Report triggers
  - Certain form properties (eg. WHERE clause)
  - Menu roles
  - Parameters
  - Non-Database item recognition
  - ?

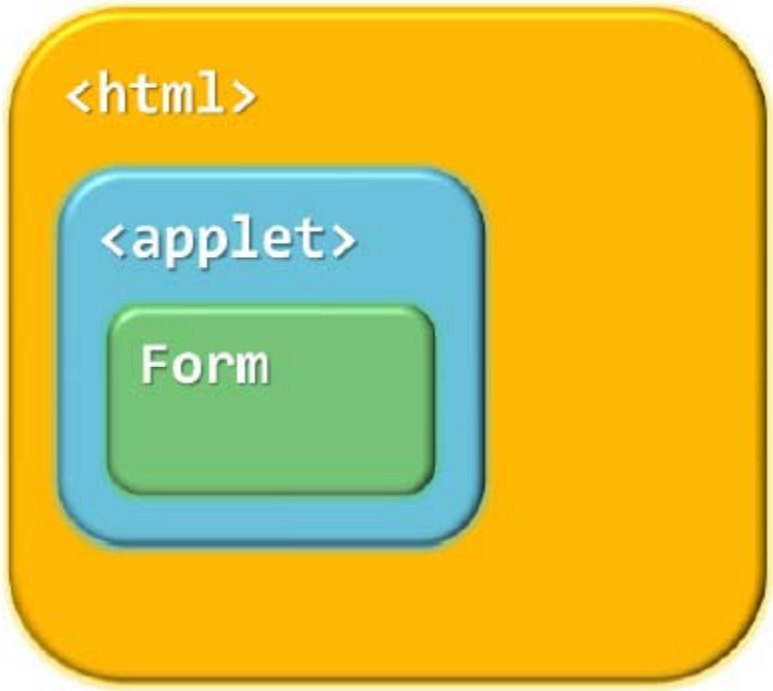

Pros
Cons
Missing Components
Added Value
Browse Logic
Potential
Annotations
Annotations

So what’s next?

Computing Serv
SA

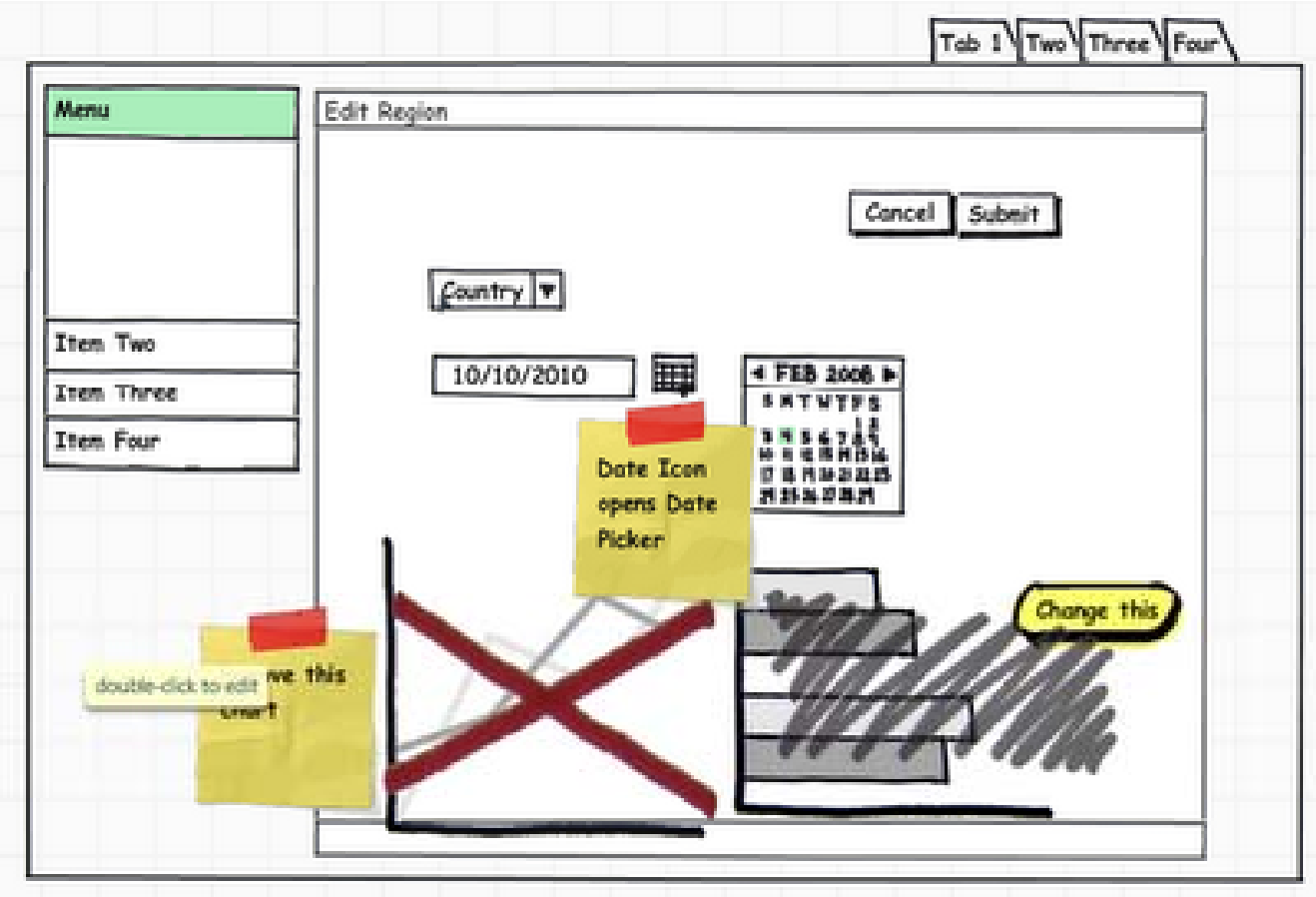
Conversion Alternatives

- Integration
  - Wilfred van der Deijl
  - Visual Integration of Forms & Apex
  - Two way communication
  - Phased approach



Conversion Alternatives

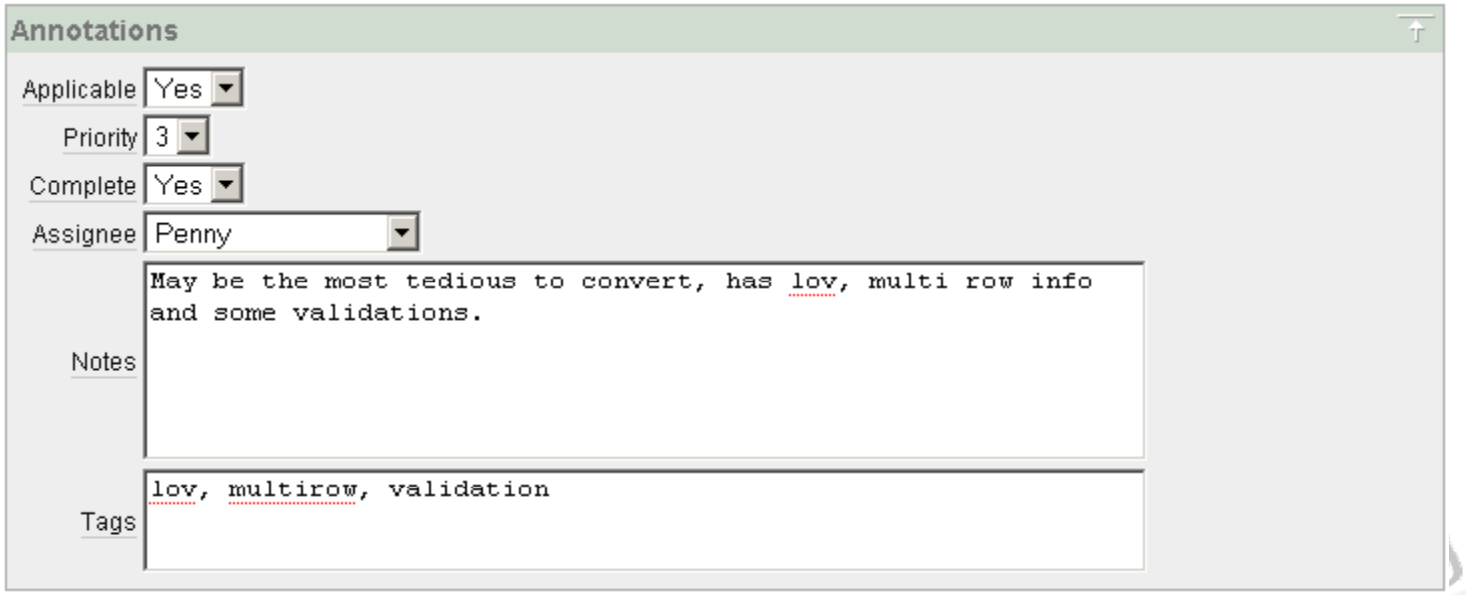
- Manual labour – do it right
  - Storyboards – Balsamiq / MockupScreens / Sketchflow



http://apex-smb.blogspot.com/2009/10/designing-apex-applications-ui-mockups.html

Conversion Alternatives

- Mixture
  - Using the annotation functionality
  - Re-use logic where possible



Underlying Data

```
-- Create view of annotations
create or replace view annotations as
(output of)
select 'select '''||table_name||''' table_name, '
||nvl((select distinct first_value (column_name) over (order by column_id) from
    all_tab_columns s where m.table_name = s.table_name and s.column_name like
    '%NAME%') ,
     (select distinct first_value (column_name) over (order by column_id) from
    all_tab_columns s where m.table_name = s.table_name and (s.column_name like
    '%ROLE%' or s.column_name like '%EXPRESSION%')))
||‘ name, select_for_app, applicable, complete, priority, assignee, notes, tags from
    '||owner||'.'||table_name||' union all ' a
from all_tab_columns m
where column_name like 'APPLICABLE'
and owner = 'APEX_030200'
and table_name not in
    ('WWV_MIG_PROJECT_COMPONENTS','WWV_MIG_FRM_COORDINATES','WWV_MIG_RPT_GRP_FILTER'
    ,'WWV_MIG_RPT_DATASRC_SELECT','WWV_MIG_RPT_DATA'
    ,'WWV_MIG_FRM_MENUS_MODULES','WWV_MIG_FRM_MODULES','WWV_MIG_OLB_MODULES');
```

Annotation Summary

```
-- Summary
select count(*), assignee
,sum(decode(complete,'Y',1)) qty_compl
,sum(decode(complete,'N',1)) qty_incompl
,round(sum(decode(complete,'Y',1))/count(*)*100,1) perc_compl
from annotations
where applicable = 'Y'
group by assignee;
```

esults | Script Output | Explain | Autotrace | DBMS Output | OWA Output

ts:

	COUNT(*)	ASSIGNEE	QTY_COMPL	QTY_INCOMPL	PERC_COMPL
1	837	(null)	71	766	8.5
2	2	EDDIE	(null)	2	(null)
3	1	ADMIN	(null)	1	(null)
4	3	CHRIS	(null)	3	(null)
5	8	BRANKA	(null)	8	(null)
6	5	KATE	(null)	5	(null)
7	5	PENNY	1	4	20
8	4	RAY	(null)	4	(null)

Annotation Priority

```
-- Priority
select table_name, name, priority, assignee, notes
from annotations
where complete = 'N'
and applicable = 'Y'
and assignee is not null
order by priority;
```

esults | Script Output | Explain | Autotrace | DBMS Output | OWA Output

ts:

	TABLE_NAME	NAME	PRIORITY	ASSIGNEE	NOTES
1	WWV_MIG_FORMS	events_fmb.xml	1	RAY	Depending on consumption of time, this may take a while for an ajax tree
2	WWV_MIG_FRM_BLOCKS	EVENTS	1	RAY	(null)
3	WWV_MIG_FRM_BLOCKS	RESOURCES	2	BRANKA	(null)
4	WWV_MIG_OLB	sage_olb.xml	2	PENNY	translate to templates.
5	WWV_MIG_FORMS	bookings_test3_fmb.xml	3	PENNY	May be the most tedious to convert, has lov, multi row info and some validations.
6	WWV_MIG_FRM_BLK_ITEMS	EXTERNAL	3	PENNY	help branka with these checkboxes
7	WWV_MIG_FRM_BLK_TRIGGERS	POST-QUERY	3	CHRIS	this should be replaced by custom query
8	WWV_MIG_FRM_BLOCKS	MESSAGE_LOG	3	BRANKA	(null)
9	WWV_MIG_FRM_MENU_MENUITEM	EVENTS	3	KATE	This form passed a parameter to bookings
10	WWV_MIG_FRM_BLOCKS	ORGANISATIONS	3	CHRIS	(null)
11	WWV_MIG_FRM_RECORDGROUPS	PARENT_RG	3	BRANKA	just lov to get parent org
12	WWV_MIG_FRM_MENU	SAGE	3	KATE	(null)

Today's Summary

Strategies	***Forms v Apex v ADF***
Differences	***Stateful v Stateless***
Considerations	***Right Decision***
Process	***Simple***
Converter Review	***Poor***
What next?	

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