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|  | ***AND WHOSOEVER PUTS HIS TRUST IN ALLAH,***  ***THEN HE WILL SUFFICE HIM.*** |  |  |



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|  | **Date: 25 May 2018**  **Version: 1.0** |  |  |

**Conventions, Guidance**

**And**

**Lessons Learned**

Preface

بسم الله الرحمن الرحيم

**In the name of Allah, Most Gracious, Most Merciful**

This document was written with focus on letting readers understand the working architecture, concepts behind the scene and technology basis. We hope you enjoy reading this document and make much use of it.

*Conventions, Guidance and Lessons Learned*

Target Readers

This document mainly targets ARCHITECTURE, IT and/or JEE lovers.

Acknowledgment

Many Thanks for **Allah** for help over the whole life to achieve continuous success and we pray for **Allah**'s support in the following periods of life.

Thanks for every team member and every engineer who share constructing this document, enhancing its content, read it or put it on his reading list.

Thanks for families, friends and supporters.

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# Tools

|  |  |  |  |
| --- | --- | --- | --- |
| Type | Tool | Version | Notes |
| OS | RedHat Enterprise Linux (RHEL) | 7.5 | Development Environment: Windows |
| DBMS | IBM DB2 | 11.1.3.3 |  |
| DB Browser | Toad for DB2 |  |  |
| Application Server | IBM WebSphere Application Server (WAS) | 9.0.0.7 |  |
| JDK | IBM SDK | 8.0.5.11 |  |
| Reports IDE | iReport | 5.0.1 |  |
| Development IDE | Eclipse | Oxygen 3a |  |
| Repository | SVN and Tortoise |  |  |

WAS/DB2/JEE/JSF Tools during 2018/2019

WebLogic/Oracle DB/JEE/JSF Tools during 2014/2018

|  |  |  |  |
| --- | --- | --- | --- |
| Type | Tool | Version | Notes |
| OS | RedHat Enterprise Linux (RHEL) | 7 | Development Environment: Windows |
| DBMS | Oracle DB | 12c |  |
| DB Browser | SQL Developer | 4 |  |
| Application Server | WebLogic | 12.2.1.0.0 |  |
| JDK | Oracle JDK | 8 |  |
| Reports IDE | iReport | 5.0.1 |  |
| Development IDE | Eclipse | Neon SR1 |  |
| Repository | SVN and Tortoise |  |  |

# Libraries

## Primefaces-Hibernate During 2018/2019

|  |  |
| --- | --- |
| Library | Jars |
| JSF 2.2  Primefaces 6.1 | * myfaces-api-2.2.12.jar * myfaces-bundle-2.2.12.jar * myfaces-impl-2.2.12.jar * primefaces-6.1.jar |
| Hibernate 5 | * antlr-2.7.7.jar * classmate-1.3.0.jar * dom4j-1.6.1.jar * hibernate-commons-annotations-5.0.1.Final.jar * hibernate-core-5.2.10.Final.jar * hibernate-jpa-2.1-api-1.0.0.Final.jar * jandex-2.0.3.Final.jar * javassist-3.20.0-GA.jar * jboss-logging-3.3.0.Final.jar * jboss-transaction-api\_1.2\_spec-1.0.1.Final.jar * ojdbc7.jar (for Oracle) * mssql-jdbc-6.2.1.jre8.jar (for MS SQL Server) * db2jcc4.jar (for DB2) * db2jcc\_license\_cu.jar (for DB2) |
| Jasper Reports 5.0.1 | * jasperreports-5.0.1.jar * jdt-compiler-3.1.1.jar * itext-2.1.7.jar * fonts.jar * barcode4j-2.0.jar * xml-apis-ext.jar * batik-all-1.7.jar |
| Common | * commons-beanutils-1.9.2.jar * commons-codec-1.6.jar * commons-collections-3.2.2.jar * commons-digester-1.8.jar * commons-logging-1.1.1.jar * commons-discovery-0.4.jar * commons-el-1.0.jar * commons-fileupload-1.0.jar * commons-lang-2.1.jar * commons-validator-1.3.1.jar |
| Time Operations | * joda-time-1.6.2.jar |
| Scheduler | * c3p0-0.9.1.1.jar * log4j-1.2.16.jar * quartz-2.2.1.jar * quartz-jobs-2.2.1.jar * slf4j-api-1.6.6.jar * slf4j-log4j12-1.6.6.jar |
| Excel | * poi-3.17.jar * poi-ooxml-3.17.jar * ooxml-schemas-1.3.jar * commons-collections4-4.1.jar * xmlbeans-2.6.0.jar |

## Richfaces-Hibernate During 2014/2018

|  |  |
| --- | --- |
| Library | Jars |
| JSF 2.1.12  Richfaces 4.3.2 | * myfaces-api-2.1.12.jar * myfaces-bundle-2.1.12.jar * myfaces-impl-2.1.12.jar * richfaces-components-api-4.3.2.Final.jar * richfaces-components-ui-4.3.2.Final.jar * richfaces-core-api-4.3.2.Final.jar * richfaces-core-impl-4.3.2.Final.jar * annotations-4.0.0.Final.jar * cssparser-0.9.5.jar * guava-14.0-rc1.jar * sac-1.3.jar |
| Hibernate 4.1.10 | * antlr-2.7.7.jar * dom4j-1.6.1.jar * hibernate-commons-annotations-4.0.1.Final.jar * hibernate-core-4.1.10.Final.jar * hibernate-jpa-2.0-api-1.0.1.Final.jar * javassist-3.15.0-GA.jar * jboss-logging-3.1.0.GA.jar * jboss-transaction-api\_1.1\_spec-1.0.0.Final.jar * ojdbc7.jar |
| Jasper Reports 5.0.1 | * jasperreports-5.0.1.jar * jdt-compiler-3.1.1.jar * itext-2.1.7.jar |
| Common | * commons-beanutils-1.8.3.jar * commons-codec-1.6.jar * commons-collections-3.2.1.jar * commons-digester-1.8.jar * commons-logging-1.1.1.jar * commons-discovery-0.4.jar * commons-el-1.0.jar * commons-fileupload-1.0.jar * commons-lang-2.1.jar * commons-validator-1.3.1.jar |
| Handle passing parameters from XHTML to Java with old servlets version | * jboss-el-2.0.0.GA.jar |
| Time Operations | * joda-time-1.6.2.jar |
| Scheduler | * c3p0-0.9.1.1.jar * log4j-1.2.16.jar * quartz-2.2.1.jar * quartz-jobs-2.2.1.jar * slf4j-api-1.6.6.jar * slf4j-log4j12-1.6.6.jar |

# Architecture





## Introduction

We will use N-tier Uni-direction architecture.

N-tier as we will utilize multi-tier in our architecture (Presentation – Backend (Business, Workflow, Data Access and Integration) – Data Repository).

Uni-direction (Anti of Bi-direction architecture) means that upper layers only have dependencies on the lower layers and lower layers have neither dependencies nor knowledge about the upper layers. (In that way we can change upper layers entirely with zero effect on the lower layers).

In case the architecture implementation was a fully segregated:

* The separation between the presentation layer and the backend layer will be based on web-services interfaces and the presentation layer will never interact with the data repository layer.
* The separation between the backend layer and data repository layer will be based on data sources and the backend layer should be database independent.
* The external systems should interact with our architecture throw only the backend layer via web-services or messages.

In case the architecture implementation was segregated by concepts:

* To ensure that Uni-direction feature is achieved, examine the imports. No lower layer should contain any import statement from upper layer classes or technology library.
* Eliminate technology dependencies from which upper layers have on lower layers. For example: Business layer needs to control business transactions that will affect at the end database transactions. If these transactions will be controlled via the application (application managed), they will depend on the technology of the Data Access Layer (i.e. Hibernate Session Factory or Persistence Context or …). The whole idea is to isolate the business layer from these technology dependencies. We can achieve this goal via the Adapter Design Pattern. We will make Adapter that introduces only the main transaction control needs for the business layer (i.e. start - commit - rollback - close). The adapter will convert the interface for needed transaction controls to the real interface of the used technology in the data access layer. So now we can change the technology of the lower layers with zero effects on the upper layer.

Of course, Standard Java Naming Conventions will be used (Interface – Class – Method – variables/attributes – Constants - …).

Usage of Enumerators and Resource Bundles will be empowered trying our best to avoid hard coding and match the Internationalization/Localization standards.

The rest of this document is listings of conventions, guidance, best practices and lessons learned that we will follow.

***Of course, these guidelines could be broken at certain situations and that is the nature of our work BUT we will commit to it as we can***.

## Presentation Layer

* The target is to use the standard components, events … of JSF.  
  Whenever JSF can fit, we will use it otherwise we will use the libraries features and components.
* We will have an abstract Base Managed Bean to handle common functionalities among managed beans (like messaging – Internationalization - …).
* We will have an abstract Base Workflow Managed Bean to handle common workflow functionalities.
* For each group of managed beans, if there are a range of common functionalities we will make a base class for them.
* By default, use View Scope for managed beans unless there is a need for using other types of scopes.  
  View scope beans must be serialized along with all contained attributes.
* Internationalization will be handled via Resource Bundles.
* Resource Bundle keys should be classified:
  + For error messages: error\_
  + For labels: label\_
  + For notification and warning messages: notify\_
  + For questions: q\_
  + For titles: title\_
  + For font awesome: fa\_
* Strive for non-repeated values in resource bundles and make use of the following tips:
  + Adding new key: Always search in the resource bundle with the exact value and wanted meaning.
  + Removing key: Always search for usage before removing. Always strive for removing non-used keys by looking for the keys in any code subject for deletion.
  + Updating key value: Always search for usage before updating. If there is any usage inapplicable then we need another key so we should go to adding new key steps.
  + Empower the usage of parameterized messages.
  + Always update the resource bundle before changing it and commit directly after changing.
* Resource Bundle keys naming convention:
  + After the only \_ key naming should follow Java convention in naming variables.
  + Key names should represent the message value not the business or technical design terms.
* Strive for separate XHTML pages for each screen in the application design and do not merge two or more screens in one XHTML unless there is a very specific situation need this. (For security – extendibility – maintainability).
* Empower the usage of composite components and make use of the following tips for detection:
  + Whenever you found the same design for a portion of page shared between two or more pages.
  + Whenever you found a design for a portion of page shared between two or more pages with a rendering change behavior that could be parameterized.
  + Whenever you discuss with the team about one portion of a design that should be made as a composite component for future vision.
* Use only one managed bean per XHTML page and name the two files by the same name. Also name the managed bean annotation by the same name but in variable naming convention.
* For items selection and inquiry:
  + Use DDLs (drop down lists) for selection from a short list values.
  + Use MSMS (mini search multi selection – a page that offers a simple search and ability to select single or multiple items from the result) pages for selection.
  + Use modes in MSMS pages to fit for more than one search perspective.
  + Lookups items should be loaded from the Database and mapped in the UI using (ID and Description).
  + Always design the search criteria to limit the number of returned items to 50000 – 70000 items only. Use JavaScript validations and server side validations to make sure of that.
  + Always use grid pagination unless there is a clue from the application design that avoiding the pagination is better for that case.
  + Define different page sizes in the base managed bean:
    - Small page size 5.
    - Normal page size 10.
    - Large page size 50.
  + If the business requirements specifies that more than 70000 items to be viewed in the XHTML page, then database pagination methodology should be used.
* Validations:
  + No business validations should exist in the presentation layer.
  + Authentication and Authorization validations should be handles by the presentation layer and the business layer will deal with the presentation layer as a trusted zone.
  + Empower the usage of JavaScript client side validations to reduce the client-server communications.
  + Limit JavaScript validations for mandatory fields and data type validations only.  
    These validations should be repeated in the business layer.
  + Data length validations (Client Side):
    - “inputText”: use the “maxlength” JSF attribute.
    - “inputTextarea”: use the custom JS function “limitMaxLength” in conjunction with “onchange” and “onkeyup” JSF attributes.
    - In case that the input is mapped to be stored in the database, the size should be the exact database field size.  
      In case that Arabic letters stored in database in two units of the specified size (ex: DB2 or Oracle VARCHAR2 (BYTE)), then half the size should be specified.
    - If the input is not mapped to be stored in the database (ex: search parameter) we should set the max-length with MIN (100, length that should be specified in case of direct DB mapping).
    - 100 is a rule of thumb.
  + Data types validations:
    - Any input that should not accept non-numeric characters should be validated before form submission.
      * Use the custom JS function “isDigit” or “isFloat” in conjunction with “onkeypress” JSF attributes for non-numberic validations.
      * To prevent errors from the copy/paste behavior, use the custom JS function “isNumber” before form submission.
    - Any input (alpha-numberic or non-numeric) that accepts a certain group of characters only should be validated before form submission using regular expressions.
* There will be a general purpose JavaScript file “utilities.js” for common functionalities.
* Strive for avoiding writing JavaScript in XHTML files and use JavaScript files instead (Due to more organized code – cashing issues and performance).  
  Organize these files around modules not around pages.
* There should be only one JS function that will open the MSMS page. This function should contain all the parameters to open the screen. This function should have multiple wrappers with different signatures to be used by the caller pages to avoid the problem of editing in all the screens that open the same MSMS. Also MSMS opener JavaScript function should be organized around modules.
* Empower the usage of templates:
  + Main Template for the entire application (Header – Menu Tree – Body – Footer).
  + Plain Template for MSMS pages and pop-up pages.
* Messages:
  + Empower the usage of the messages stack component in the templates.
  + Messages handling should be centralized in the base managed bean.
  + Differentiate messages in the stack by styles (Success – Warning – Error).
* Screen Lock:
  + Empower the usage of screen lock methodology in the templates to lock every page on every Ajax submit to stop handling the UI while a data manipulation is under processing to protect our system from unwanted changes.
  + All Navigation actions must be non-Ajax and show the screen lock.
* Empower the usage of passing parameters from XHTML pages to managed beans action and event methods (especially in grid operations).
* Buttons Locations:
  + Place form Actions at the bottom.
  + Place grid actions at the top.
  + MSMS buttons besides its fields.
  + May be we can use the search icons besides some fields for specific search behavior (like search above a tree of items).
  + Always use reset button with search button.
* Cross browsers compatibility should be considered (At least IE and Chrome).
* Executing and Rendering:
  + Try to avoid executing @form (execute your needed part).  
    Do not re-Render @form (Always re-Render your needed part).
  + If a component Ajax event will re-Render the area in which the component is part of, then hide the reload component in the on complete of the Ajax event (Only when the component need to catch the Ajax event for other purpose).
  + Do not re-Render a panel that has a rendered condition (You should render a parent container for it).
  + Do not re-Render a panel unless it has all of its children JSF components or it has an html table as a direct child.
  + Always use the form id as prefix while re-Render or execute.
  + Take care that not rendered / disabled components will not submit its value, but if there is a panel or column that will be hidden and has components, these components will submit its value unless it have the same render conditions.
* Managed beans should work only with data objects (unless there is no data object) or objects generated from web-services clients.
* Use a red star on mandatory fields.
* Always use styles to differentiate mouse over and mouse selection for grid rows.
* Use the following convention for naming in XHTML:
  + Do not name the element if you will not use that name in execute, re-Render…
  + Always name the main form as the same as the file name but in a variable naming convention and followed by “FormId”.
  + The value of the id attribute is the name of the field/component followed by ‘id’ suffix, example:
    - <h:inputText id="jobNameId" value="#{jobsInquiry.jobName}" />
  + In case the attribute is an ID , a foreign key as an example we captalize the ‘Id’ part of the field and follow it by ‘Id’ suffix, examples:
    - <h:inputText id="jobIDId" value="#{jobsInquiry.jobId}" />
  + In some cases we need to map two components on the same field one is for view and the other to be hidden for submitting, we put ‘H’ before the ‘Id’ suffix in the hidden component:
    - <h:inputText id="jobNameId" value="#{jobsInquiry.jobName}" />
    - <h:inputHidden id="jobNameHId" value="#{jobsInquiry.jobName}" />
* Managed bean structure should be as following:
  + Attributes order, preferable in the same order like the XHTML page.
  + Constructor (contains the initialization code).
  + The method init() (mainly should not be used in request or view scops).
  + The method reset().
  + Action and listeners methods, in the same corresponding UI components order.
  + Utilities methods if needed.
  + All getters and setters in the same order as corresponding fields order (Use Eclipse generator).
* Managed bean should not contain any business logic, but only call wrapper methods in the business layer or web-services clients (Managed bean is the controller part of the MVC design pattern).
* Upload / Attachments component should be centralized for all pages.
* Hijri/Gregorian component should be centralized for all pages.
* Structure resources folder for (css – javascript – images – fonts – composites components).
* Context listener should be used for initializing and configuring the application.
* Web Filter should be used for securing the application (implementing authorization).
* Phase Listener should be used for custom processing logic into the JSF lifecycle (like internationalization/localization) and debugging purposes.
* The file “faces-config.xml” should be used for java server faces configurations:
  + Supported locales.
  + Resource bundles.
  + Phase Listener.
  + Navigation rules.
* The file “web.xml” should be used for the application configurations:
  + Context Listener.
  + Context parameters (Libraries needed configuration – max upload size – max views in session).
  + Servlets and mapping (Faces servlet – web-services servlets).
  + Session Config:
    - Session timeout.
    - Cookie config.
  + Error page (Custom page for specific errors or exceptions and general error page).

## Backend Layer – Business Logic

* Business Logic part of the backend Layer should follow SOA (Service Oriented Architecture) concepts.
* A Base Service class will be used to catch the common core non business functionality between services like (logging – get configuration values – messages/parameterized messages – collections operations - …).
* All services should use the log method in the Base Service for logging even if the current logging methodology is the default logging file of the AS. Should be altered easily without any effect on the services.
* Every Service is responsible for:
  + Group of related functionalities (Business Lead Responsibility).
  + Group of entities (every entity is managed by only one service but could be used by many).
* The service is:
  + Singleton design pattern.
  + Stateless.
  + Static based methods.
* If the service manages operations on more than one entity, then it should organize the operations around the entities. The service should be divided into regions, every region is dedicated for one entity and its structure is as follows:
  + Operations section (Handle or Manage – Insert – Modify – Remove).
  + Validations section.
  + Queries section.
  + Reports section.
* No nested transactions will be allowed (use VAR ARG custom session to pass the same session only when needed).
* In some cases we will need to add this nested behavior (after discussing with the team) so please refer to the section of hibernate session behaviors.
* Services will return error codes via customized exceptions (any error or violation will be handled via exceptions otherwise, transactional methods will return void or the object in hand).
* For huge data retrieval we will use database pagination.
* Print exception stack trace for general and unexpected exceptions only (parameter to the log method).
* We can perform multiple operations on the same object with the same session but do not perform operations on two objects with the same identifier in the same session.
* Empower the usage of enumerators and constants to avoid using hard coded values (high priority for enumerators).
* Service methods are:
  + Public for use by other services or layers.
  + Protected for inheritance only.
  + Private for local use.
* Service Inquiries:
  + Every query or queries will be handled only in one business method.
  + This method will be used by any other business methods that need the query results.
  + For example if we have a query that get items information.
    - This query will be executed by one private method “**search**Items”.
    - This method will be used by wrapper methods in the same class called (**get**ItemById – **get**Items – **get**InvalidItems – …).
    - The wrapper methods will be used by any business method that needs the information.
  + This convention empowers code reusability. Wrappers are used for this method to execute it with different parameters”.
  + If the method should return a List, it should return empty Array List in case of no data found.
  + If the method should return a single object, it should return null in case of no data found.
* Services signatures will use the Data objects that are used from the UI or from the web-services but when passing to the DAL use the original object that is calculated on the fly from the Data object. When something changes in the original object by the DAL (Mostly the ID) the service is the responsible to reflect that change in the Data Object.
* Java Naming Conventions:
  + Class and Interface name should be a noun, and in mixed case with the first letter of each internal word capitalized (i.e. ItemManagement).
  + Method name should be a verb, verbs, in mixed case with the first letter lowercase and with the first letter of each internal word capitalized (i.e. getItemData).
  + Variable name should be a noun, verbs, in mixed case with the first letter lowercase and with the first letter of each internal word capitalized (i.e. itemData).
  + Constant name should be all uppercase with words separated by underscores (“\_”) (i.e. MIN\_AGE).
* All services should be documenting using Java Doc.  
  (Please consult Helper Files\ Generating Java doc.docx).

## Backend Layer - Workflow

* The workflow is based on the popular idea of processes, instances and tasks.
* Our workflow is a property to our team and based on:
  + Entities design to manage the workflow needs:
    - Process Group (Business grouping for each collection of processes).
    - Process (Represent a business process or a workflow of human interactions).
    - Process Step / Position (Used for determining the workflow interactions).
    - Instance (Concrete object of the process).
    - Task (concrete step that belong to an instance).
    - Delegation (To manage the total and partial delegations).
    - Business WF entities (to handle the data managed by the workflow).
  + Base Workflow class that manages all the above entities except the business WF entities.
  + General Steps Workflow class that manages the workflow interactions in a configured and general methodology (steps could be defines and configured and this class run these steps).
  + Business Workflow classes that manages complex workflow interactions.
* Strive for the separation between Business Workflow classes and Service Classes (One way to always control by work flow and prevent calling the workflow from services).
* Generic Inbox, Outbox, Delegation and Steps Management pages should be built to enable the WF users to view and manage their instances and tasks.
* Composite components should be used:
  + Current task (info – notes - refuse reasons).
  + Previous tasks (history for previous tasks along with their actions).
* Version control should be there on the task level to avoid concurrent access on the same task.
* A status for the instance should differentiate between (Running – Done – Completed) instances.

## Backend Layer – Data Access

### Data Access Management

* The target is to follow the standard of JPA “Java Persistence API”, so we will limit the use of hibernate to the minimum (i.e. only session manipulations).
* The Data Access class is the core of the data access layer. It will handle:
  + All the ways that will lead to the database.
  + The configuration of the Session Factory.
  + Obtaining Custom Sessions (The adapter for hibernate session).
  + Entities Operations (Add – Update – Delete).
  + Execute Queries (Named Query – Dynamic Query – Native Query).
  + Database pagination.
  + Database Objects reading/calling (Avoid – No or Min usage):
    - Reading Sequences.
    - Calling function or procedure.
  + Auditing.
* Data Access entities operations:
  + Generic and based on Base Entity class (The base for all entities).
  + Knows nothing about the entity type or content.
  + Used only from business services.
* Base Entity class will play the role of the Marker Interface Design Pattern for all of the ORM entities to enable the Data Access Class to deal with them seamlessly.
* Custom Session (the session Adapter) will be available for retrieval by only the business layer via this layer. This will introduce the transaction control needs for the business layer and in the same time will isolate it from the actual used technology. These controls will be only (Start – Commit – Rollback – Close – Flush used only AFTER discussion).
* While working with multiple databases or with database that require schema name for each object referencing:
  + Add “defaultSchema=schema\_name” to the config.propertie file and make use of it in the data access.
  + Add the defaultSchema configuration to hibernate.cfg.xml for "hibernate.default\_schema" property.
* JPA standard defines three ways to handle queries: Named Queries, Dynamic Queries and Native Queries.
  + Avoid the usage of native queries to stay with the database independence.
  + Avoid the usage of dynamic queries and strive for the named queries for the following reasons:
    - Improve the code organization by separating the query structure from the business logic.
    - Empower the encapsulation concept. It let us handle the query as a black box, only I gave it inputs to get from it outputs and never concern about the query internal structure.
    - Enforce the use of query parameters instead of embedding them dynamically that result in more secure queries.
    - More maintainable while refactoring than maintaining scattered queries in the business layer code.
    - The queries are validated and compiled once at the Context initialization. That will definitely enhance the overall performance by avoiding validating and compiling the queries every time we execute them. Also this will prevent the execution failure as If there were any errors it will be caught at startup.
    - We can replace them or restructure them to enhance their performance without any change in the business layer. They help to have a good analysis of any entity usages in one shot of the associated named queries.
* Query names:
  + Should be defined in an Enumerator to avoid hard code the query name in the business coding.
  + Should have prefixes with module and entity name “OwnerSystem\_EntityName\_functionality”  
    (For example module\_item\_getActiveItems).
* Queries and Parameters:
  + Always analyze the query to get the most optimized performance (look for joins, inner queries …).
  + All named queries that retrieve more than one record should have order by the business need; otherwise order by its id.
  + The dates should be passed as strings and converted in the query with the same used format.
  + When passing an array to a query, take care to use the toArray(new T[original List.size()]) instead of toArray().  
    For example: qParams.put("P\_TASKS\_IDS", tasksIds.toArray(new Long[tasksIds.size()]));  
    Instead of qParams.put("P\_TASKS\_IDS", tasksIds.toArray());
  + When passing an array to a query and ther array contains many values (1000 or more) you should use the GET MANY ENTITIES utility from the base service. Order is your responsibility in that case.
  + Do not use count(\*), always count with ids.
  + Do not use (NOT IN) other than with static values. Instead use count or not exists.  
    For example:  
    Don’t use : select \* from child where child.parent\_id not in (select id from parent where …)  
    But use : select \* from child where (select count(id) from parent where …) = 0  
     or select \* from child where not exist (select \* from parent where …)
  + Always use alias before referring to attributes even if there is only one entity in the query.
  + When comparing dates:
    - If you are comparing dates from the database versus others in the database so you can use the date attribute directly.
    - If you are comparing dates from the database versus application parameters so you must use to\_date while comparing.  
      (:P\_ DATE\_FLAG = '-1' or item.issueDate <= to\_date(:P \_DATE,'MI/MM/YYYY')).
  + For highly used queries, design them as separate queries. But for queries that share the same returned entities and have different parameters, design them as a single query and use -1 flag to escape where clauses.
  + Use DATE\_FLAG and ARRAY\_FLAG with dates and arrays.
  + In case of multiple database in the same project, do not use the ready-made database functions otherwise use a custom functions designed in a unified fashion and written against every database (see helper files).
  + The parameter data type should be the same type as the entity attribute.

|  |
| --- |
| qParams.put("P\_DECISION\_NUMBER", (decisionNumber == **null** || decisionNumber.length() == 0) ? FlagsEnum.ALL.getCode(): decisionNumber); // At the service, this will give an exception because getCode() returns integer value, so an empty string should be concatenated with it.  qParams.put("P\_DECISION\_NUMBER", (decisionNumber == **null** || decisionNumber.length() == 0) ? FlagsEnum.ALL.getCode() + "": decisionNumber); // correct |
| (:P\_DEC\_NO = -1 OR v.decisionNumber = :P\_DEC\_NO) // At JPQL, this will give an exception because the column type is varchar but the sent parameter is an integer, so use ‘-1’ instead of -1 |

* + For constants in queries (-1, ‘-1’, ‘ABC’, etc.), make sure that the constant represent the same data type as the field being compared to.  
    Also make sure not to use a constant and use a query parameter instead in case of the query parameter in comparison with the constant is used in another comparison with other field.

|  |
| --- |
| (:P\_NAME = ‘-1’ or b.name like :P\_ NAME)  // Raise an exception in case that P\_NAME value size more than 2 in some databases like DB2.  (:P\_ NAME = :P\_ESC\_SEARCH\_STR or b.name like :P\_ NAME)  (:P\_ AMOUNT = -1 or b.totalAmount >= :P\_ AMOUNT)  // Raise an exception in case that P\_Amount value than INTEGER maximum value in some databases like DB2.  (:P\_ AMOUNT = :P\_ESC\_SEARCH\_DOUBLE or b.totalAmount >= :P\_ AMOUNT) |

* Data Access Layer will throw a custom exception called DATABASE EXCEPTION. Database exception will be thrown when something goes wrong in the database such as constraint violation.  
  This exception should not be thrown from any service but should be processed and another exception should be thrown (BUSINESS EXCEPTION).
* If needed, JDBC Connections will be used in the application only via the sessions.
* Prevent nested transactions. This will be achieved via moving over the session to all sub methods to always have one start and one commit per any request. This convention eliminates entirely nested transactions problems.

### Hibernate Session Behavior

* Hibernate sessions and JTA transactions by defualt - and this is our methedology also – tracks the database transactions against the threads which initiate the transactions. Always, one and only one DB transaction is active within the thread at any point of time (All fail or all success and also one time commit whatever how many commit statements are called on different JTA transactions).
* Therefore, when there is a need for two independent DB transactions, we need to handle each one at a separate thread of execution. If we need these two independent DB transactions to be run sequentially, we can use the “thread.join()” API as shown at the following example:

|  |
| --- |
| **public** **static** **void** save() **throws** Exception {  CustomSession session1 = DataAccess.*getSession*();  session1.beginTransaction();  Country c1 = **new** Country();  c1.setName("ar name 1");  DataAccess.*addEntity*(c1, session1);  Runnable myRunnable = **new** Runnable() {  **public** **void** run() {  **try** {  CustomSession session2 = DataAccess.*getSession*();  session2.beginTransaction();  Country c2 = **new** Country();  c2.setName("ar name 2");  DataAccess.*addEntity*(c2, session2);  session2.commitTransaction();  session2.close();  } **catch** (Exception e) {  e.printStackTrace();  }  }  };  Thread thread = **new** Thread(myRunnable);  thread.start();  thread.join();  session1.commitTransaction();  session1.close();  } |

### ORM

* ORM Entities will be developed via annotations. Java persistence annotations not hibernate annotations.
* ORM Entities IDs will be generated using JPA Sequence Generators which will depend on Database sequences (this will help in the case that more than AS will run our business).
* For the primary key generation at all entities:
  + Add allocationSize =1 to @SequenceGenerator, because the default value is 50 in some databases.
  + Add strategy = GenerationType.SEQUENCE to @GeneratedValue.
* For complex ID, use the JPA Id Class for mapping.
* No mapping for relationships. This will simplify the generated database queries and efficiently reduce the size of un-needed data retrieval and finally will enhance the overall performance.
* Empower the usage of Data Objects (mainly based on a database view and designed to cover all the needed data from other entities for one entity). These objects will mostly wrap the original object by calculating it on the fly upon any request for it.
* Entities attributes data types should be wrapper classes instead of primitive types as they may be null.
* Entity name should reflect the table/view name but in singular (i.e. Item).
* Append “Data” to the name of the entity that map a view (i.e. ItemData).
* Use annotations on getters not on the fields so that Hibernate would use getters not the fields (To avoid reflection and also if we have any formatting in the getter methods).
* Make sure that the order of the class attributes is the same as the columns in the database table.

### Reporting

* Reports names should be defined in ReportNamesEnum enumerator with the following naming convention:
  + Many conventions could be adopted:
    - [Module Name as in DAL package name]\_[DECISION\_] {0..1}[CATEGORY\_]{0..1} [COLLECTIVE\_]{0..1}[DESCRIPTION]{0..1}
    - [Module Name as in DAL package name]\_ [DESCRIPTION]
  + Files names should be the same as the enumerator.
  + The file extension should be in upper case (.JRXML) not in lower case (.jrxml) as the Linux OS is case sensitive regarding the files names including the extension.
  + For **sub reports**, file extension should be in lower case (.jrxml) not in upper case (.JRXML) as jasper engine always search for sub reports with lower case extension.
* Reports Service:
  + Generic class used for exporting all of our reports in all supported reporting types.
  + This service should be accessible only from the Base Service.
  + This service should contain method for each supported reporting type.
  + Every method should accept the parameters:
    - Report relative path including the report name.
    - Report parameters map.
    - Absolute path for the reports folder (Read from Configuration Service and passed from the Base Service).
    - Default Schema (Read from the configuration file and passed from the Base Service).
  + This service auto compiles sub reports.
* Reports Root:
  + Reports will be in an outside folder (Reports Root) for better maintenance.
  + There will be a configuration available via the configuration service to specify the reports root path.
  + All reports will have P\_REPORTS\_ROOT parameter to use it for referencing its resources (images, sub-reports, fonts …) and passed to the reports from the Reports Service.
* Shema name:
  + All reports and sub reports will have P\_SCHEMA\_NAME parameter.
  + Use the schema name before any table, view, or function name. Write the name using $P!{P\_SCHEMA\_NAME} so the query will use the parameter value without interpreting it.
  + Pass the Schema Name parameter to the subreports like the DECISION\_SIGNATURE subreport.
  + Set a default value to the schema name parameter so the compiler will be able to compile the query and read the fields while developing the report.
* Base Managed Bean will handle returning the report byte array into the response in an centralized methodology.
* Sub reports:
  + When passing return value from a sub report to another sub report, the two sub reports should be separated in two bands for the order of execution.
  + Common fields within the same report and distributed in sub reports should be passed between the sub reports.
* Dates:
  + For All dates (including print dates), the reports will receive it as string parameter from the application.
  + Use TO\_CHAR (date\_to\_be\_formatted, 'fmMI/MM/fmYYYY') to select a well and standard formatted date. Note that ‘fm’ (fill mode) is used to remove the leading zeros from the date (e.g, 01/03/1434 will be 1/3/1434).
* Export the used fonts as jars from IReport and include it in the class path.
* Add the connectivity file (like sqljdbc4-2.0.jar in helper files) to the iReport classpath.
* If you have a report with table that will take several pages and you don’t want the rows to split on pages If the value of some column is too big to fit in at the end of the page, you can set the splitType property of the band which the table in to splitType = Prevent (You can find it in the Properties panel if you choose the band from Report Inspector panel).
* Tips for using while reportd developing:
  + Use String.indexOf(“”) > -1 instead of String.contains(“”).
  + If you have a field contains an inline if expression which return different datatypes, you should cast anyone of them to make both return the same data type.  
    Example: ($P{P\_CATEGORY\_ID} == 1) ? $F{MILITARY\_NUMBER} : $F{JOB\_CODE} WRONG  
    ($P{P\_CATEGORY\_ID} == 1) ? $F{MILITARY\_NUMBER}.toString() : $F{JOB\_CODE} CORRECT
  + Don’t use String.replace(“”,””) at the report expression, instead try to do all the replacements at the query.
  + Don’t define any string at single quotes ‘’, instead use double quotes.  
    Example: ($F{PH\_UNIT\_FULL\_NAME} != null ? $F{PH\_UNIT\_FULL\_NAME} : '-') WRONG  
     ($F{PH\_UNIT\_FULL\_NAME} != null ? $F{PH\_UNIT\_FULL\_NAME} : "-") CORRECT
  + Always write queries, tables, names, columns and aliases in upper case. Take care of case sensitivity in some databases.
  + Use “CASE WHEN” instead of “DECODE”.
  + In case of multiple database in the same project, do not use the ready-made database functions otherwise use a custom functions designed in a unified fashion and written against every database (see helper files).
  + At PKG\_DATE\_TO\_CHAR function, add the keyword “(r0)” before the date format pattern to remove the leading zeros from the date so the pattern will be like “(r0)MI/MM/YYYY” or “(r0)YYYY-MM-MI” instead of using the fill mode “fm”.
  + The tables’ columns to be compared should be with the same data type.
  + Use OUTER JOIN convention instead of (+) join operator.

### Auditing

* Auditing:-
  + Solution Description:-
    - The solution consists of:-
      * A table called “UM\_AUDIT\_LOGS” which will contains:
        + ID.
        + Module ID for logging against many projects.
        + User ID.
        + System name in case the transaction was made automatically via a system.
        + Operation (Insert – Update – Delete).
        + Operation Gregorian date.
        + Content entity for the entity manipulated by the operation.
        + Content ID for the row ID in the corresponding content entity table.
        + Content, JSON object contains the entity data.
      * An entity called “AuditLog” which is the ORM entity corresponding to the table.
      * An entity called “AuditEntity” which is used as a marker for any entity that should be audited. Two abstract methods in this class to enforce child entities to calculate its content ID and its content. Also two methods in this class one used to prevent specific transaction from being audited and the other to convert the content into JSON string.
    - The solution mechanism:-
      * The basic operations at the data access always call the audit method which audits the entity in case that the entity is auditable and there is no prevention for this transaction to be audited.
  + Solution Usage:-
    - Make the entity that you are interested in extends the “AuditEntity” entity.
    - Override the two methods “calculateContentId” and “calculateContent”: the former one used to return the identifier of the entity and the later one used to return the values that you are interested in. The values should be written in two arrays one for fields names and the other for fields values. Then converted into JSON string using the AuditEntity method.
    - Always pass the user / system as string to the Data Access basic operations and mark the entity prevent audit flag in case you do not want to audit a specific transaction.

## Backend Layer - Integration

* Empower the usage of JAX WS as the standard technology for exposing web services.
* Web services will be published using servlet end point listeners.
* JAXB annotations will be used to adjust the soap messages.
* WS Client Generation
  1. JAX-WS used for WS client generation.
  2. How you should generate the WS clients?
     1. Use the following command wsimport -keep -verbose WSDL\_URL -p PACKAGE\_NAME -d TEMP\_DIRECTORY -s TEMP\_DIRECTORY –b FI

|  |  |  |  |
| --- | --- | --- | --- |
| Option | Value | Example | Description |
| -keep |  |  | Keeps generated files |
| -verbose |  |  | Displays compiler messages |
|  | [WSDL\_URL](http://pns.ejada.com:8080/ejadaPns/PushClient?wsdl) | http://pns.ejada.com:8080/ejadaPns/PushClient?wsdl | The file that contains the machine-readable description of how the web service can be called, what parameters it expects, and what data structures it returns |
| -p | PACKAGE\_NAME | com.code.integration.webservicesclients.pushclient | Specifies a target package name to override the WSDL and schema binding customizations, and the default algorithm defined in the specification |
| -d | TEMP\_DIRECTORY | E:\Temp\ | Specifies where to place generated output files |
| -s | TEMP\_DIRECTORY | E:\Temp\ | Specifies where to place generated source files |
| -b | FILE\_PATH | E:\Temp\binding.xml | Specifies external JAX-WS or JAXB binding files |
| -Xnocompile |  |  | Skip compilation |

* + 1. We always use -b option just to make binding customization like asynchronous methods and adaptors for data types customizations like date.
    2. There are examples for the binding file at the location Helper Files/WSClientGeneration/.
* Any other integration technology can be used AFTER discussion. Like when we should integrate with a message queue.
* Web services should not contain any business logic; it should wrap the business service calls. Also web services should depend on the entities objects to be its parameters.
* Web service clients should have a proxy file to separate the application from the client structure.

## Data Repository Layer

* In this section we will talk about many databases conventions and differences.
* Database should be business free. It should not contain any functions, triggers or procedures.   
  This rule may be violated in certain situations AFTER discussions.
* In case of multiple database in the same project, do not use the ready-made database functions otherwise use a custom functions designed in a unified fashion and written against every database (see helper files).
* In most cases using one serial id in each table will be better than using compound primary keys.
* Use the following keywords for joining multiple tables:
  + INNER JOIN
  + LEFT OUTER JOIN
  + RIGHT OUTER JOIN
  + FULL OUTER JOIN
* Naming conventions in tables, views, sequences and constraints should be as the following:
  + Table name should follow “OwnerSystem\_TableName”.
  + View name should follow “OwnerSystem\_VW\_ViewName”.
  + For integration views follow “OwnerSystem\_INTEG\_ViewName”.
  + Table name and view name should be in plural.
  + Table name and view name should not represent functionality or behavior otherwise it should reflect a repository description for the data it contains.
  + Sequence name should follow " OwnerSystem\_TableNameORTableGroupName\_SEQ".
  + Upper letters should be used in all objects unless in postgreSQL lower case letters is used.
* Hijri dates in database:
  + Hijri Dates stored in database in Dates/Timestamp columns for the simplicity and performance in manipulation and comparison operations.
  + In the Date/Timestamp data type there is no such 30/02/YYYY, so we store the field of Hijri days in the field of minutes. Days, seconds and hours in the date are don’t care and should be the same for comparison reasons.
  + So the format in database should be “MI/MM/YYYY” while in Java “mm/MM/yyyy”.
  + In SQL Developer, adjust the formatting of dates to be able to read the date correctly.  
    Tools -> Preferences -> Database -> NLS -> Date Format and Timestamp Format,  
    DD/MM/YYYY HH24:MI:SS.
* The following diagram represents DB2 database installation structure.

**DB2 Product**

Instances….

**Instance**

DBs…

**Database**

**Schema**

Schemas…

* In DB2, you will need to commit or rollback manually after any DDL statement.

### Data Types

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Java | DB2 | Oracle | MS SQL Server | PostgreSQL |
| String | VARCHAR(n)  Use the double needed size for Arabic content  Store empty strings | VARCHR2(n)  Use CHAR not BYTE.  Converts empty strings to null | VARCHAR(n)  Store empty strings | character varying(n)  Store empty strings |
| Integer | INTEGER | NUMBER | Numeric(x,0) | Numeric |
| Long | BIGINT | NUMBER | Numeric(x,0) | Numeric |
| Double | DOUBLE | Number | Numeric(x,y) | Numeric |
| Boolean | DECIMAL(1) | NUMBER(1,0) | Numeric (1,0) | Numeric |
| Date | TIMESTAMP | DATE | Datetime2 | timestamp without time zone |
| Byte[] | BLOB | BLOB | Varbinary(MAX) | bytea |

* In case we are targeting multiple databases, while creating/replacing a view script, we should make sure the script valid for all the databases, also we should pay attention not to use PostgreSQL resultant view script for unifying other databases script as PostgreSQL generates additional syntax for data types in the view script.
* Scale and Precision:
  + You should refer to business for specifying scale and precision exact values.
  + The following are approximate values:
    - X: use 18 for default cases, especially for IDs.
    - Y: use 3 for default cases.
    - N: use 200 for default cases.
* Use setters methods to overcome the problem of storing empty strings in database:

**public** **void** setShieldMobileNumber(String shieldMobileNumber) {

**this**.shieldMobileNumber = "".equals(shieldMobileNumber) ? **null** : shieldMobileNumber;

}

### Table Creation

|  |  |  |
| --- | --- | --- |
| Database | Syntax | Example |
| DB2 | **CREATE TABLE [SCHEMA\_NAME].[TABLE\_NAME] ( [COLUMN\_NAME] [DATA\_TYPE] NOT NULL,  [COLUMN\_NAME] [DATA\_TYPE(SIZE)],  PRIMARY KEY ([COLUMN\_NAME])**  **)** | CREATE TABLE TAHSEELPOC.HCM\_ORG\_UNITS  ( ID **BIGINT** NOT NULL,  NAME **VARCHAR**(**200**),  PARENT\_UNIT\_ID **BIGINT**,  HKEY **VARCHAR**(**20**),  REGION\_ID **BIGINT**,  REMARKS **VARCHAR**(**1000**),  ORDER\_UNDER\_PARENT **INTEGER**,  ACTIVE\_FLAG **DECIMAL**(**1**),  CONSTRAINT PK\_UNITS PRIMARY KEY (ID)  ); |

### Constraints

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Type | Naming Convention | DB2 | Oracle | | MS SQL Server | PostgreSQL |
| Primary Key | **PK\_**[Abbreviated Table Name] | ALTER TABLE [SCHEMA\_NAME].[TABLE\_NAME] ADD CONSTRAINT [CONSTRAINT\_NAME] PRIMARY KEY ([COLUMN\_NAME])  ENFORCED; -- DB2 only. | | | | |
| Unique | **U\_**[Abbreviated Table Name]**\_**[ Abbreviated Column Name] | ALTER TABLE [SCHEMA\_NAME].[TABLE\_NAME]  ADD CONSTRAINT [CONSTRAINT\_NAME] UNIQUE ([COLUMN\_NAME])  ENFORCED; -- DB2 only  For DB2 and nullable columns:  CREATE UNIQUE INDEX [SCHEMA\_NAME].[INDEX\_NAME]  ON [SCHEMA\_NAME].[TABLE\_NAME]  ([COLUMN\_NAME] ASC )  **EXCLUDE NULL KEYS**; | | CREATE UNIQUE NONCLUSTERED INDEX constraint\_name ON schema\_name.table\_name(column\_name) WHERE column\_name IS NOT NULL;  Note that: In earlier versions of MS SQL server, when defining a unique constraint, a single NULL is allowed but multiple NULLs are not. Fortunately, In SQL Server 2008, we can overcome this by defining a unique filtered index based on a predicate that excludes NULLs. | | ALTER TABLE table\_name ADD CONSTRAINT constraint\_name UNIQUE (column\_name); |
| Foreign Key | **FK\_**[Abbreviated Table Name]**\_**[Abbreviated referenced Table Name]**\_**[ Abbreviated Column Name] | ALTER TABLE [SCHEMA\_NAME].[TABLE\_NAME]  ADD CONSTRAINT [CONSTRAINT\_NAME] FOREIGN KEY ([COLUMN\_NAME])  REFERENCES [SCHEMA\_NAME].[TABLE\_NAME] ([COLUMN\_NAME])  -- The following for DB2 only.  ON DELETE RESTRICT ON UPDATE RESTRICT ENFORCED  ENABLE QUERY OPTIMIZATION; | | | | |
| Check | **C\_**[Abbreviated Table Name]**\_**[Abbreviated Column Name]**\_**[ Abbreviated Action] | ALTER TABLE [SCHEMA\_NAME].[TABLE\_NAME]  ADD CONSTRAINT [CONSTRAINT\_NAME] CHECK ([CHECK CONSTRAINT CONDITION])  ENFORCED ENABLE QUERY OPTIMIZATION; -- DB2 only. | | | | |
| Not Null |  | ALTER TABLE [SCHEMA\_NAME].[TABLE\_NAME] ALTER COUMN [COLUMN\_NAME] SET NOT NULL; | ALTER TABLE [TABLE\_NAME] (COLUMN\_NAME NOT NULL); | ALTER TABLE [SCHEMA\_NAME].[TABLE\_NAME] ALTER COUMN [COLUMN\_NAME DATA TYPE] NOT NULL; | | ALTER TABLE [SCHEMA\_NAME].[TABLE\_NAME] ALTER COUMN [COLUMN\_NAME] SET NOT NULL; |

### DB2 Built-In Scalar Functions

|  |  |  |
| --- | --- | --- |
| Function | Example | Notes |
| CONCAT | SELECT **CONCAT**(str1, str2) FROM SYSIBM.SYSDUMMY1; |  |
| LENGTH | SELECT **LENGTH**(str) FROM SYSIBM.SYSDUMMY1; |  |
| NVL | SELECT **NVL**(param1, param2) FROM SYSIBM.SYSDUMMY1; |  |
| REPLACE | SELECT **REPLACE**(str, pattern, replacement) FROM SYSIBM.SYSDUMMY1; | If replacement is null, it returns null |
| SUBSTR | SELECT **SUBSTR**(str, startPosition, subStringLength) FROM SYSIBM.SYSDUMMY1; | stratPosition starts with 1 |
| TO\_CHAR | SELECT **TO\_CHAR**(param, pattern) FROM SYSIBM.SYSDUMMY1; |  |
| TO\_NUMBER | SELECT **TO\_NUMBER**(str) FROM SYSIBM.SYSDUMMY1; |  |
| TO\_DATE | SELECT **TO\_DATE**(str, pattern) FROM SYSIBM.SYSDUMMY1; |  |
| MOD | SELECT **MOD**(param1, param2) FROM SYSIBM.SYSDUMMY1; |  |
| TRIM | SELECT **TRIM**(**L** trimConstant FROM str) FROM SYSIBM.SYSDUMMY1; | B: Both L: LEADING T: TRAILING The default is: B |
| LPAD | SELECT **LPAD**(str, num, pad) FROM SYSIBM.SYSDUMMY1; |  |
| RPAD | SELECT **RPAD**(str, num, pad) FROM SYSIBM.SYSDUMMY1; |  |
| ADD\_MONTHS | SELECT **ADD\_MONTHS**(date, monthesCount) FROM SYSIBM.SYSDUMMY1; |  |
| MONTHS\_BETWEEN | SELECT **MONTHS\_BETWEEN**(date1, date2) FROM SYSIBM.SYSDUMMY1; | date1 – date2 |
| NEXTVAL | VALUES NEXTVAL FOR HCM\_SETUP\_SEQ; |  |

### DB2 Indexes Creation (DBAs)

When you create a table that contains a primary key or a unique constraint, you must create a unique index for the primary key and for each unique constraint. DB2 marks the table definition as incomplete until the explicit creation of the required enforcing indexes, which can be created implicitly depending on whether the table space was created implicitly, the schema processor, or the CURRENT RULES special register. If the required indexes are created implicitly, the table definition is not marked as incomplete.

## Security

* A generic Security Service will handle:
  + Authentication: mainly against an identity management product throw LDAP through Security Utility Class.
  + Authorization:
    - User access from the UI channels: User menus and menu actions should be loaded upon login and saved in the user session then used to verify authorization in the security web filter and managed beans.
    - User access from external channels (like mobile): Session management solution should be implemented and maintained.
    - System access from the same organization network:
      * Empower trusted zones and allow the clients for the target services for certain IPs only.
      * Use a security token saved in database and granted for read to the external system. The token should change with every access.
    - System access from external environment: Security certificates should be used.
* Use SSL for data integrity and confidentiality.
* Make sure of proper usage of URL parameters (always check for authorization [specially in managed beans] if the page data depends on an URL parameter).
* Invalidate the user session after log out and do not enable caching for the data.
* Watch for the following security vulnerabilities:
  + Turn off password autocomplete.
  + ClickJacking attack: Set the response header: (“X-Frame-Options”, “DENY”).
  + MIME-sniffing attack: Set the response header: (“X-Content-Type-OPTIONS”, “nosniff”).
  + Cross Site Scripting:
    - Set the response header: (“X-XSS-Protection”, “1;mode=block”).
    - Set cookie HttpOnly flag to true. This will not allow the cookie to be accessed via a client side script such as JavaScript.
  + Web Content Caching: Set the response headers:  
    (“Cache-Control”,”no-cache, no-store, must-revalidate”).  
    (“Pragma”, “no-cache”).  
    (“Expires”, 0).  
    We can exclude JavaScript resources or all JSF resources from this point.
  + Secure Cookies: Set cookie secure flag to true. Only sent the cookie if the request is being sent over a secure channel such as HTTPS.
  + Always develop general error page to prevent application error disclosure.

# Project Structure

## Projects and Packages design

* When the layers separation realized by concepts in one project, you should take the union of the following packages. In case real segregation was adopted then follow the structure below.
* One project for presentation layer:
  + com.code.contextlistener (for application context listener).
  + com.code.resources (for configuration file).
  + com.code.services (for security service).
  + com.code.integration.webservicesclients.
  + com.code.ui (base – home – components – phaseslistener – business packages).
  + WEBContent.
* One project for each business component (may be one shared project for common services):
  + com.code.resources (for configuration file).
  + com.code.dal.
  + com.code.integration.webservices.
  + com.code.integration.webservicesclients.
  + com.code.services.
  + com.code.services.workflow.
* One project for core non business functionality (all projects will depend on it):
  + com.code.resources (messages and other resources).
  + com.code.enums.
  + com.code.exceptions.
  + com.code.dal.
  + com.code.services.
  + com.code.services.workflow.

## Configuring Projects in Eclipse

* For core project:
  + Make a new **Java Project** (name: core).
  + Make sure from the execution JRE (For example: IBM SDK).
* For business component project:
  + Make a new **Dynamic Web Project** (For example: Billing).
  + Make sure from the target runtime (For example: WebSphere).
  + Uncheck “Add project to an EAR”.
  + Check “generate web.xml”.
* For presentation layer project:
  + Make a new **Dynamic Web Project** (For example: tahseel).
  + Make sure from the target runtime (For example: WebSphere).
  + Uncheck “Add project to an EAR”.
  + Check “generate web.xml”.
  + Add JSF and Primefaces JARs to (tahseel\WebContent\WEB-INF\lib) and add them to the project class path libraries.
* For the Development EAR:
  + Make a new **EAR Application Project** (For example: tahseelDev).
  + Make sure from the target runtime (For example: WebSphere).
  + Choose EAR modules (projects).
  + Write in “Content directory” (EarContent).
  + Check “generate application.xml”.
  + Make a new folder in “EarContent” named “lib” and add to it your common JARs.
* Dynamic Web Project Dependencies:
  + Project Properties 🡪 Deployment Assembly 🡪 Add 🡪 Project 🡪 Select core.
  + Project Properties 🡪 Deployment Assembly 🡪 Add 🡪 Archives from Workspace 🡪Add 🡪 tahseelDev 🡪 EarContent 🡪 lib 🡪 Select your JARs.

# SVN Policy

* It is not allowed at any circumstance to commit any snippet of code contains errors or could cause errors at other parts of the code base.
* Commit only complete tasks.
* Don’t commit any class before “Auto-Formatting” it, but beware while Auto-Formatting entities please select only the java code and not the Named queries.
* Before editing in localization files, update them first then do the changes you want and commit immediately after that to avoid conflicts with others.
* A review strategy should be settled within each project.
* Eclipse plug-ins which affects the code and agreed to be used must be unified within the team (like the one that affects the resource bundles).
* Eclipse plug-ins which will not affect any sources or the final war can be used freely without committing its settings.

Appendix A: Installation Guide JDK11 – WebLogic 14c

|  |  |
| --- | --- |
| JDK 11.0.10 (64 bit) | <https://www.oracle.com/sa/java/technologies/javase-jdk11-downloads.html> |
| WLS 14.1.1.0.0 | <https://www.oracle.com/middleware/technologies/weblogic-server-installers-downloads.html> |
| Eclipse 2020-06 (64 bit) | <https://www.eclipse.org/downloads/download.php?file=/technology/epp/downloads/release/2020-06/R/eclipse-jee-2020-06-R-win32-x86_64.zip&mirror_id=518> |

## A.1 JDK 11.0.10 LTS

1. Uninstall any version of JDK 11 installed at your machine.
2. Install the downloaded JDK 11 update 10.
3. Set environment variable **JAVA\_HOME** in the “system variables” to point to the new JDK installation. For example, “**C:\Program Files\Java\jdk-11.0.10**”.
4. Update the path environment variable by removing any java path and add **“%JAVA\_HOME%\bin;**” at the beginning of the list.

## A.2 WLS 14.1.1.0.0

1. Run your command prompt (cmd) as **administrator**.
2. Change directory to the path that contains the downloaded Weblogic source jar file
3. Execute the command **java -jar fmw\_14.1.1.0.0\_wls\_lite\_generic.jar** and press enter then follow the normal process to install Weblogic.
4. Create a domain in development mode with default configurations (weblogic/weblogic1).
5. Adjusting memory parameters:
   1. Open the file “**commBaseEnv.cmd**” which should be located in your Weblogic installation folder which is by default “**C:\Oracle\Middleware\Oracle\_Home\oracle\_common\common\bin**” and change all the **MEM\_ARGS** and **UTIL\_MEM\_ARGS** to be as the following  
      *set MEM\_ARGS=-Xms1024m -Xmx1024m  
      set UTILS\_MEM\_ARGS=-Xms1024m -Xmx1024m*
   2. Open the file “**setDomainEnv.cmd**” which should be located in your domain folder which is by default “**C:\Oracle\Middleware\Oracle\_Home\user\_projects\domains\base\_domain\bin**” and change all the **WLS\_MEM\_ARGS\_64BIT** and **WLS\_MEM\_ARGS\_32BIT** to be as the following  
      *set WLS\_MEM\_ARGS\_64BIT=-Xms1024m -Xmx1024m  
      set WLS\_MEM\_ARGS\_32BIT=-Xms1024m -Xmx1024m*
6. Define your data sources.
7. Change JTA timeout from 30 seconds to **1200** seconds.  
   (from the console web app -> select the domain “base\_domain” -> select “JTA” tab -> update the field “Timeout Seconds”).

## A.3 Eclipse 2020-06

1. Extract eclipse at any directory you prefer.
2. Add eclipse shortcut to desktop.
3. Make the workspace folder is [/Skills/SkillsDevelopment/](https://ejadasvn.ejada.com/svn/MOFTAHSEEL/E%20-%20Development/Application/Code)BuildingSkillsWorkspace and ignore.metadata folder.
4. Install all the required plugins:
   1. **Oracle Weblogic Server Tools**

Help menu -> Install new software.

Add -> Copy the link “<http://download.oracle.com/otn_software/oepe/12.2.1.10/photon/repository/>” in the location section and type “Oracle” into name.

Select “Tools” and press “Next”.

1. Add new server from “Servers” tab:
   1. Expand “Oracle”, and select “Oracle WebLogic Server”.
   2. Select “Weblogic Home” to be “C:\Oracle\Middleware\Oracle\_Home\wlserver”.
   3. Select “base\_domain”.
2. Don’t import **unused imports**. You can fulfill this requirement by adjusting the following configuration and organize the imports of any class that you will create or edit by using the shortcut “CTRL + SHIFT + O”.
   1. Open Window-> Preferences and search for compiler (you will find it under Java).
   2. Select Errors/Warnings.
   3. Select Unnecessary Code region you will see Unused imports option.
   4. Change the select menu of unused import from Warning to Error.
   5. Click Apply and Close Then choose yes.
3. To **avoid the warning for serialization** in any class that you are sure you don’t need it to be serialized, adjust the following configurations
   1. Open Window-> Preferences and search for compiler (you will find it under Java).
   2. Select Errors/Warnings.
   3. Search for Serializable class without serialVersionUID.
   4. Change the select menu from Warning to Ignore.
   5. Click Apply and Close Then choose yes.
4. To guarantee the code formatting and organizing the imports, we should make these tasks as automatic tasks after modification at any file. We do that by **enabling the Save actions** according to the following the steps.
   1. Open Window-> Preferences and search for Save Actions.
   2. Select the save actions under Java->Editor.
   3. Check the option “Perform the selected actions on save”.
   4. Check the option “Format source code”.
   5. Select the “Format all lines” toggle.
   6. Check the option “Organize imports”.
   7. Click Apply and Close.
5. To enable eclipse auto format using “CTRL + SHIFT + F” and keep the code readable:
   1. Make a new profile “Custom Java Conventions” based on “Java Conventions [built-in]”:

Open Window->Preferences, type formatter in the search box.

Select the formatter under Java->Code Style.

Make the new profile.

Change “Line Wrapping / Maximum line width” to “500”.

Check “Line Wrapping / Never join already wrapped lines”.

Change “Comments / Maximum width for comments” to “500”.

Check “Comments / Never join lines”.

* 1. For xhtml tags formatting:

Open Window->Preferences, type html in the search box.

Select the Editor under Web->HTML Files.

Change line width to 500.

In the Inline Elements list delete all tags in it.

Apply and OK

Appendix B: WAS and DB2

This installation guide is intended for the team members to understand the tools that we are going to use during the project and be able to setup them easily. All the tools will be provided to you and no need to download them.

## B.1 IBM Installation Manager

1. Download the installation manager from the [link](https://delivery04.dhe.ibm.com/sdfdl/v2/sar/CM/RA/07hnz/0/Xa.2/Xb.jusyLTSp44S0eY6gDODD8PqJAeHtzbXNIHWOBoWlzF1l2JQIMER2AX8LIKw/Xc.CM/RA/07hnz/0/agent.installer.win32.win32.x86_64_1.8.9000.20180313_1417.zip/Xd./Xf.LPR.D1VC/Xg.9642766/Xi.habanero/XY.habanero/XZ.d9rXWb3pC6xFExSiLucIdzIkHCo/agent.installer.win32.win32.x86_64_1.8.9000.20180313_1417.zip).
2. Unzip it.
3. Run the installer as administrator and follow the wizard.
4. If you have a problem with the language (i.e. UI is in Arabic instead of English) follow these steps
   1. Before installation:  
      Open \Installation Manager Source Folder\configuration\config.ini  
      After installation  
      Open \Installation Manager Installation Folder\eclipse\configuration\config.ini
   2. At the end of file add   
      osgi.nl=en
   3. Restart installing manager.

## B.2 IBM SDK and WAS

**CELL**

**DMGR**

Deployment Manager

**…………**

**Agent**

**Server 01**

**Server 02**

**Server n**

**…**

**Node 01**

**Agent**

**Server 01**

**Server 02**

**Server n**

**…**

**Node 02**

**Agent**

**Server 01**

**Server 02**

**Server n**

**…**

**Node n**

Installation at PROD environment

**Cell**

**Node**

**Server**

Installation at DEV environment

### B.2.1 Install IBM SDK and WAS

1. Run “IBM Installation Manager” as administrator.
2. Add the following repositories from File -> Preferences

|  |  |  |
| --- | --- | --- |
| Tool | Location | Notes |
| WAS 9.0.0.0 | E:\IBM-Tools\WAS\WAS\_9.0\_Windows\WAS\_ND\_V9.0\_MP\_ML.zip |  |
| IBM SDK 8.0.3.0 | E:\IBM-Tools\WAS\WAS\_9.0\_Windows\sdk.repo.8030.java8.win.zip |  |
| JAVA 8 |  | Extract all the parted zip files at one directory called “was.repo.9000.java8” |
| WAS 9.0.0.7 FP |  |  |
| JAVA 8.0.5.11 UPDATE |  | Extract all the parted zip files at one directory called “ibm-java-sdk-8.0-5.11-all” |



1. Press “Install” and select “IBM WebSphere Application Server Network Deployment” and follow the wizard according to the below screenshots.  
     
     
     
     
     
     
     
   

### B.2.2 Create a Profile

1. Run the “Profile Management Tool” as administrator.  
     
   
2. Select “Application Server”.  
     
   
3. Select “Advanced profile creation”.  
     
   
4. Select “Deploy the administrative console” and “Deploy the Installation Verification Tool application” and deselect “Deploy the default application”  
     
   
5. Let the profile name “AppSrv01” and location as default and select Server runtime performance tuning setting “Development”.  
     
   
6. Set the Node name “**Node01**” and Server name “**server1**” and let the Host name as is but be sure it is identical to your full computer name.  
     
   
7. Select “Enable administrative security” and set the user name “**admin**” and the password “**admin**”  
     
   
8. Select “Create a new default personal certificate” and “Create a new root signing certificate”.  
     
   
9. Set the “expiration period” to the maximum “**15**” years.   
     
   
10. Let the ports as default. We are interested only at the highlighted ports.   
      
    
11. Set the windows service startup type to “manual”  
      
    
12. From Windows -> Open Services and then Start the service named “IBM WebSphere Application Server V9.0 – Node01”.  
      
    
13. Open the URL <http://localhost:9060/admin> and let chrome trust the certificate, it will redirect you the secure URL <https://localhost:9043/ibm/console/logon.jsp> enter the credentials and press “Log in”.  
      
    
14. If the server is not running, you can use the command line to start it manually.
    1. Open the “cmd” as administrator.
    2. Change the directory to the path “C:\Program Files\IBM\WebSphere\AppServer\bin”
    3. Run the command “startServer.bat server1”.
    4. If an error occurred saying that an instance of server is currently running, stop the server first using the command “stopServer.bat server1”. Then start it as previous step by command “startServer.bat server1”.
15. You can find the logs at the following directory  
    “C:\Program Files\IBM\WebSphere\AppServer\profiles\AppSrv01\logs\server1”.
16. Adjust the heap size and enable the debug mode:
    1. Click on “WebSphere application server” and then click on “server1”.  
         
       
    2. Expand “Java and process management” and click on “process definition”.  
         
       
    3. Click on “Java Virtual Machine”.  
         
       
    4. Set the “Initial heap size” and the “Maximum heap size” to be **1024** and check the “Debug Mode” and press “OK” then “Save”.  
         
       

### B.2.3 Data Source

1. Create a JDBC Provider
   1. Expand “Resources”, expand “JDBC”, click on “JDBC providers”, select the scope to be the cell scope and press “New”.  
        
      
   2. Select Database type “**DB2**”, Provider type “**DB2 Using IBM JCC Driver**”, Implementation type “**Connection pool data source**” and set an appropriate name like “**TAHSEEL DB2 Using IBM JCC Driver**” and press Next.  
        
      
   3. Copy the folder “**DB2DRV**” to the location “**C:\Program Files\IBM**”.
   4. Set the three environment variables “${DB2\_JCC\_DRIVER\_PATH}”, “${PUREQUERY\_PATH}” and “${DB2\_JCC\_DRIVER\_NATIVEPATH}” to be “**C:/Program Files/IBM/DB2DRV**” then press Next and Finish.  
        
      
2. Create Data Source:
   1. Expand “Resources”, expand “JDBC”, click on “Data Sources”, select the scope to be the cell scope and press “New”.  
        
      
   2. Enter the data source name and the JNDI name. for example, “TAHSEEL\_POC” and “jdbc/TAHSEEL\_POC”.  
        
      
   3. Enter the Database name and the Server name and press Next.  
        
      
   4. Press Next  
        
      
   5. Press Finish and Save.
   6. Click on your data source.  
        
      
   7. Click on the link “[Global J2C authentication alias](https://localhost:9043/ibm/console/com.ibm.ws.console.security.forwardCmd.do?csrfid=-2049596727&forwardName=JAASAuthData.content.main&contextId=cells:lb055Node01Cell) [Security domains](https://localhost:9043/ibm/console/com.ibm.ws.console.security.forwardCmd.do?csrfid=-2049596727&forwardName=SecDomain.content.main&resourceUri=security.xml&perspective=tab.configuration&contextId=cells:lb055Node01Cell)” to define the credentials.   
        
      
   8. Press New.  
        
      
   9. Enter the credentials for the database and an alias for the user, press OK and then Save.  
        
      
   10. Click on your data source.
   11. Select the created user at the security settings section as shown below and press OK then press Save.  
         
       
   12. Test the connection. If the test failed you may need to restart the server using the following commands; stopServer.bat server1 and startServer.bat server1 (Run the cmd as administrator and change the directory to the path “C:\Program Files\IBM\WebSphere\AppServer\bin”).

### B.2.4 Configuring Encoding

1. On the Application Server page, click on the name of the server you want enabled for UTF-8.
2. Expand “Java and process management” and click on “process definition”.
3. On the Process Definition page, click Java Virtual Machine.
4. On the Java Virtual Machine page, specify -Dfile.encoding=UTF-8 for Generic JVM Arguments and click OK.
5. Click Save on the console taskbar.
6. Restart the application server.

## B.3 Eclipse and plugins

1. Download Eclipse Oxygen 3a from the [URL](https://www.eclipse.org/downloads/download.php?file=/technology/epp/downloads/release/oxygen/3a/eclipse-jee-oxygen-3a-win32-x86_64.zip&mirror_id=1093).
2. Extract eclipse at any directory you prefer.
3. Add eclipse shortcut to desktop.
4. Run as administrator, to make this automatic apply these steps:
   1. right-click on the eclipse shortcut and click properties
   2. From Compatibility tab, in privilege section check 'run this program as an administrator'
5. Make the workspace folder is <https://ejadasvn.ejada.com/svn/MOFTAHSEEL/E%20-%20Development/Application/Code> and do NOT commit .metadata folder.
6. Install all the required plugins:
   1. **Jinto** for resource editing <http://www.guh-software.de/eclipse>
      1. Help menu -> Install new software
      2. Add -> Copy the previous Jinto link in the location section and type any name
      3. Select “Open Source Tools” only.
      4. Prevent Jinto from adding date to messages.  
         Window -> preferences -> uncheck include jinto header in resource files on saving.
   2. **Subclipse** for SVN management (Use Eclipse Marketplace)
      1. Help menu -> Eclipse Marketplace
      2. Search for “Subclipse” and install it.
      3. Select all items.
   3. **JBoss** Tools (Use Eclipse Marketplace)
      1. Help menu -> Eclipse Marketplace
      2. Search for “JBoss Tools”.
      3. Select “JBoss Tools 4.5.3.Final” and install it.
      4. Select the following items:
         1. JBoss Tools Usage Reporting.
         2. JBoss Tools Foundation.
         3. JBoss Tools Java Standard Tools.
         4. JBoss Tools JSF.
         5. JBoss Tools RichFaces.
         6. JBoss Tools Visual Page Editor.
   4. **IBM WebSphere Application Server** V9.x Developer Tools For Oxygen (Use Eclipse Marketplace)
      1. Help menu -> Eclipse Marketplace
      2. Search for “IBM WebSphere Application Server V9.x Developer Tools for Oxygen”.
      3. Select “IBM WebSphere Application Server V9.x Developer Tools for Oxygen” and install it.
      4. Don’t change the default selected items.
      5. In Servers panel -> you can click on pause automatic updates.
7. Open eclipse.ini from eclipse directory and add these 2 lines just before *–vmargs*  
   *-vm  
   C:\Program Files\IBM\WebSphere\AppServer\java\8.0\jre\bin\javaw.exe*
8. Add WebSphere Application Server
   1. From Window -> Perspective -> open perspective -> Java EE
   2. From Servers Panel -> Click add new Server
   3. Choose IBM folder -> WebSphere Application Server traditional V9.0
   4. Enter Installation Directory of WebSphere which is *C:\Program Files\IBM\WebSphere\AppServer* then next.
   5. Type username and password and click Finish.
   6. Right-click the server -> open and change Timeout to be 6000 milliseconds.
9. Don’t import **unused imports**. You can fulfill this requirement by adjusting the following configuration and organize the imports of any class that you will create or edit by using the shortcut “CTRL + SHIFT + O”.
   1. Open Window-> Preferences and search for compiler (you will find it under Java).
   2. Select Errors/Warnings.
   3. Select Unnecessary Code region you will see Unused imports option.
   4. Change the select menu of unused import from Warning to Error.
   5. Click Apply and Close Then choose yes.
10. To **avoid the warning for serialization** in any class that you are sure you don’t need it to be serialized, adjust the following configurations
    1. Open Window-> Preferences and search for compiler (you will find it under Java).
    2. Select Errors/Warnings.
    3. Search for Serializable class without serialVersionUID.
    4. Change the select menu from Warning to Ignore.
    5. Click Apply and Close Then choose yes.
11. To guarantee the code formatting and organizing the imports, we should make these tasks as automatic tasks after modification at any file. We do that by **enabling the Save actions** according to the following the steps.
    1. Open Window-> Preferences and search for Save Actions.
    2. Select the save actions under Java->Editor.
    3. Check the option “Perform the selected actions on save”.
    4. Check the option “Format source code”.
    5. Select the “Format all lines” toggle.
    6. Check the option “Organize imports”.
    7. Click Apply and Close.
12. To enable eclipse auto format using “CTRL + SHIFT + F” and keep the code readable (suitable line length in java and separated tags in xhtml), change the default settings in eclipse as follows:
    1. For java line length:
       * + 1. Open Window->Preferences, type formatter in the search box.
           2. Select the formatter under Java->Code Style.
           3. Click import and select the [file](https://ejadasvn.ejada.com/svn/MOFTAHSEEL/D%20-%20Technical%20Design/Application/Lessons/HCM_Java_Conventions_Oxygen.xml)
    2. For xhtml tags formatting:
       * + 1. Open Window->Preferences, type html in the search box.
           2. Select the Editor under Web->HTML Files.
           3. Change line width to 500.
           4. In the Inline Elements list delete all tags in it.
           5. Apply and OK

## B.4 IBM Database Client for DB2

1. Download “ibm\_data\_server\_driver\_package\_win64\_v11.1.exe” from the [URL](https://www-01.ibm.com/marketing/iwm/iwm/web/preLogin.do?source=swg-idsdpds).
2. Install as administrator “ibm\_data\_server\_driver\_package\_win64\_v11.1.exe” and let everything as default at the installation wizard.
3. Verify the installation of the data server driver by executing the command “*db2cli validate*” at the path “*C:\Program Files\IBM\IBM DATA SERVER DRIVER\bin*”. You should get a result similar to the following screenshot.  
     
   

## B.5 Toad for DB2

### B.5.1 Installation

1. Download “ToadforDB2\_6.5.0.125.x64.msi” freeware version from the [URL](https://www.toadworld.com/download/toad-for-ibm-db2/freeware).
2. Install “ToadforDB2\_6.5.0.125.x64.msi” and let everything as default at the installation wizard. You will need to open the command prompt at administrator and run the file inside it.

### B.5.2 Configuration

1. Disable the auto commit: Options -> Database -> General  
     
   
2. Change the editor encoding to UTF-8: Options -> Editor -> General  
     
   
3. Change the date format to be shown at the table viewer (grid) to be “*dd/MM/yyyy HH:mm:ss*”: Options -> Environment -> Grid  
     
   

## B.6 IBM DS

### B.6.1 Installation

1. Run “IBM Installation Manager” as administrator.
2. Add the following repositories from File -> Preferences

|  |  |  |
| --- | --- | --- |
| Tool | Location | Notes |
| ibm\_ds4130\_win | E:\IBM-Tools\DB2\\ibm\_ds4130\_win\disk1\diskTag.inf |  |

1. Press “Install” and select “IBM Data Studio client” and follow the wizard without changing anything.

## B.7 iReport

1. Creating new Connection:
   1. Add db2 JDBC drivers from iReport -> tools -> options -> iReport -> classPath
   2. add jars (db2jcc4.jar, db2jcc\_license\_cu.jar) that are in the path 'C:\Program Files\IBM\DB2DRV'
   3. do NOT check reloadable.
   4. Add new connection and enter these information:
      1. JDBC Driver: com.ibm.db2.jcc.DB2Driver
      2. URL: jdbc:db2://192.168.8.116:50000/TAHSEEL
      3. username: db2inst1
   5. Make sure to test connection

Appendix C: WebLogic 12.2.1.0.0

1. Prerequisites:

|  |  |
| --- | --- |
| JDK 8 update 51 (64 bit) | <http://download.oracle.com/otn/java/jdk/8u51-b16/jdk-8u51-windows-x64.exe> |
| WLS 12.2.1.0.0 | <http://download.oracle.com/otn/nt/middleware/12c/1221/fmw_12.2.1.0.0_wls_Disk1_1of1.zip> |
| Eclipse Neon (64 bit) SR1 | <https://www.eclipse.org/downloads/download.php?file=/technology/epp/downloads/release/neon/1a/eclipse-jee-neon-1a-win32-x86_64.zip&mirror_id=1068> |

1. JDK Installation:
   1. Uninstall any version of JDK 8 installed at your machine.
   2. Install the downloaded JDK 8 update 51.
   3. Set environment variable **JAVA\_HOME** to point to the new JDK installation. For example, “C:\Program Files\Java\jdk1.8.0\_51”.
   4. Update the **path** environment variable by removing “C:\ProgramData\Oracle\Java\javapath;” and add “**%JAVA\_HOME%\bin;**” if it doesn’t exist.
2. WLS 12.2.1.0.0 Installation:
   1. Run your command prompt (cmd) as **administrator**.
   2. Change directory to the path that contains the downloaded Weblogic source jar file
   3. Execute the command **java –jar fmw\_12.2.1.0.0\_wls.jar** and press **enter** then follow the normal process to install Weblogic and create a domain in **development** mode.
   4. Adjusting memory parameters:
      1. Open the file “**commBaseEnv.cmd**” which should be located in your Weblogic installation folder which is by default “C:\Oracle\Middleware\Oracle\_Home\oracle\_common\common\bin” and change all the MEM\_ARGS and UTIL\_MEM\_ARGS to be as the following  
         set MEM\_ARGS=-Xms1024m -Xmx1024m -XX:PermSize=512m -XX:MaxPermSize=512m  
         set UTILS\_MEM\_ARGS=-Xms1024m -Xmx1024m -XX:PermSize=512m -XX:MaxPermSize=512m
      2. Open the file “**setDomainEnv.cmd**” which should be located in your domain folder which is by default “C:\Oracle\Middleware\Oracle\_Home\user\_projects\domains\base\_domain\bin” and change all the WLS\_MEM\_ARGS\_64BIT and WLS\_MEM\_ARGS\_32BIT to be as the following  
         set WLS\_MEM\_ARGS\_64BIT=-Xms1024m -Xmx1024m -XX:PermSize=512m -XX:MaxPermSize=512m  
         set WLS\_MEM\_ARGS\_32BIT=-Xms1024m -Xmx1024m -XX:PermSize=512m -XX:MaxPermSize=512m
   5. Define the “BGETR” and “BGETR\_TEST” data sources.
   6. Change JTA timeout from 30 seconds to 1200 seconds.  
      (from the console web app -> select the domain “base\_domain” -> select “JTA” tab -> update the field “Timeout Seconds”)
3. Eclipse Configurations:
   1. Extract eclipse at any directory you prefer.
   2. Open eclipse at the same workspace to preserve all the configurations that has been used at Kepler.
   3. Install updates for eclipse if exist
      1. Select “Check for updates” from the “Help” menu and install all the updates.
   4. Install all the required plugins:
      1. Jinto for resource editing <http://www.guh-software.de/eclipse>
         1. Select “Open Source Tools” only.
      2. Subclipse for SVN management (Use Eclipse Marketplace)
         1. Search for “Subclipse” and install it.
         2. Select all items.
      3. JBoss Tools (Use Eclipse Marketplace)
         1. Search for “JBoss Tools”.
         2. Select “JBoss Tools 4.4.1.Final” and install it.
         3. Select the following items:
            1. JBoss Tools Usage Reporting.
            2. JBoss Tools Foundation.
            3. JBoss Tools Java Standard Tools.
            4. JBoss Tools JSF.
            5. JBoss Tools LiveReload.
            6. JBoss Tools RichFaces.
            7. JBoss Tools Visual Page Editor.
      4. Oracle Weblogic Server Tools (Use Eclipse Marketplace)
         1. Search for “Oracle Weblogic Server Tools”.
         2. Select “Oracle Weblogic Server Tools” and install it.
         3. Don’t change the default selected items.
   5. Update the **formatter** file [https://ejadasvn.ejada.com/svn/BGETR/BG ETR Docs/Lessons Learned/Helper Files/HCM Java Conventions \_neon.xml](https://ejadasvn.ejada.com/svn/BGETR/BG%20ETR%20Docs/Lessons%20Learned/Helper%20Files/HCM%20Java%20Conventions%20_neon.xml) and **reimport** it again to eclipse.
   6. Delete the old Weblogic server instance (10.3.6).
   7. Add a new Weblogic server instance (12.2.1.0.0).
4. Project:
   1. Update your project to get all the new configuration.
   2. Right click on the project and select “Migrate Project Runtime”.
   3. Change the compiler level of the project from “1.6” to “1.8”.
   4. Change the java facet of the project from “1.6” to “1.8”.
   5. You may need to clean and rebuild the project again if you find any build errors.
   6. Sometimes the debug on server doesn’t lunch automatically so when the publishing finish, you can use the application normally.
5. IReport Configurations:
   1. IReport 5.0.1 is not compatible with JDK 8. Open the file “**ireport.conf**” at the path “**C:\Program Files (x86)\Jaspersoft\iReport-5.0.1\etc**” as **administrator** and uncomment this line “#jdkhome="/path/to/jdk"” and let it point to your JDK 6 installation for example “**jdkhome="C:\Program Files\Java\jdk1.6.0\_45"**”.
6. Reports:
   1. Some of the expressions that has been used at our reports are not working now due to some compatibility issues. So we will need to test **ALL** the reports.
   2. Here is a listing for some issues and its suggested workaround
      1. If you are using String.contains(“”) -> replace it with String.indexOf(“”) > -1
      2. If you have a field contains an inline if expression which return different datatypes, you should cast anyone of them to make both return the same data type.  
         Example:  
         If you have an expression like:  
         ($P{P\_CATEGORY\_ID} == 1) ? $F{MILITARY\_NUMBER} : $F{JOB\_CODE}  
         you should change it to  
         ($P{P\_CATEGORY\_ID} == 1) ? $F{MILITARY\_NUMBER}.**toString()** : $F{JOB\_CODE}  
         as “$F{JOB\_CODE}” return a String object and “$F{MILITARY\_NUMBER}” return a BigDecimal object.
      3. Don’t use String.replace(“”,””) at the report expression, instead try to do all the replacements at the query.
      4. Don’t define any string at single quotes ‘’, instead use double quotes.  
         Example:  
         if you have expression like:  
         ($F{PH\_UNIT\_FULL\_NAME} != null ? $F{PH\_UNIT\_FULL\_NAME} : **'-'**)  
         you should change it to  
         ($F{PH\_UNIT\_FULL\_NAME} != null ? $F{PH\_UNIT\_FULL\_NAME} : **"-"**)

Appendix D: Working on Multiple database

1. **Database Layer**

* **Functions:** Implementing the following **U**ser **D**efined **F**unctions (**UDF**) at all databases to be used instead of the oracle built-in functions:
  + PKG\_CONCAT
  + PKG\_LENGTH
  + PKG\_NVL
  + PKG\_REPLACE
  + PKG\_SUBSTRING
  + PKG\_DATE\_TO\_CHAR
  + PKG\_CHAR\_TO\_DATE
  + PKG\_NUMBER\_TO\_CHAR
  + PKG\_CHAR\_TO\_NUMBER
  + PKG\_MOD
  + PKG\_RPAD
  + PKG\_LPAD
  + PKG\_ADD\_MONTHS
  + PKG\_MONTHS\_BETWEEN
  + PKG\_RTRIM

The scripts for these functions for each database exist at Helper Files\Packaging

1. **Application Servers**
   * **WebLogic:**
   * **SQL Server – Data Source:**
     + Add **mssql-jdbc-6.2.1.jre8.jar** at: C:\Oracle\Middleware\Oracle\_Home\wlserver\server\lib   
       (You can find this jar at the WEB-INF\lib at the project workspace)
     + Modify the file **startWebLogic.cmd** at C:\Oracle\Middleware\Oracle\_Home\user\_projects\domains\*domain\_name*\bin by adding these two lines after the line containing “set CLASSPATH=%SAVE\_CLASSPATH%”:

|  |
| --- |
| set MSSQL\_PATH=%WL\_HOME%\server\lib\mssql-jdbc-6.2.1.jre8.jar  set CLASSPATH=%MSSQL\_PATH%;%CLASSPATH% |

* + - When creating the data source, select the Microsoft driver not the oracle driver. The driver name is: Microsoft's MS SQL Server Driver (Type 4) versions: 2005 and later
  + **PostgreSQL – Data Source:** 
    - Add **postgresql-42.1.4.jar** at: C:\Oracle\Middleware\Oracle\_Home\wlserver\server\lib  
      (You can find this jar at the WEB-INF\lib at the project workspace)
    - Modify the file **startWebLogic.cmd** at C:\Oracle\Middleware\Oracle\_Home\user\_projects\domains\*domain\_name*\bin by adding these two lines after the line containing “set CLASSPATH=%SAVE\_CLASSPATH%”:

|  |
| --- |
| set PG\_PATH=%WL\_HOME%\server\lib\postgresql-42.1.4.jar  set CLASSPATH=%PG\_PATH%;%CLASSPATH% |

1. **Application JARs:**
   * + Upgrade to **hibernate 5.2.10** by including the jars:

\*Note: The upgrade step was required because the current used hibernate version (4.1.10) supports till SQL Server 2005 dialect but we needed a support for SQL Server 2012 so we can use the Sequence to generate the primary key and this feature is supported starting from SQL Server 2008 dialect.

|  |
| --- |
| - antlr-2.7.7.jar  - classmate-1.3.0.jar  - dom4j-1.6.1.jar  - hibernate-commons-annotations-5.0.1.Final.jar  - hibernate-core-5.2.10.Final.jar  - hibernate-jpa-2.1-api-1.0.0.Final.jar  - jandex-2.0.3.Final.jar  - javassist-3.20.0-GA.jar  - jboss-logging-3.3.0.Final.jar  - jboss-transaction-api\_1.2\_spec-1.0.1.Final.jar  - ojdbc7.jar  - mssql-jdbc-6.2.1.jre8.jar |

* + - Modify the **weblogic.xml** to prefer the upgraded version of JBoss because weblogic is using an old version of it:

|  |
| --- |
| <package-name>org.jboss.logging.\*</package-name> |

1. **Data Access Layer:**

* **hibernate.cfg.xml:**
* **Oracle:**

|  |
| --- |
| <property name=*"connection.datasource"*>jdbc/*ETR\_HCM\_PKG*</property>  <property name=*"hibernate.transaction.coordinator\_class"*>org.hibernate.resource.transaction.backend.jta.internal.JtaTransactionCoordinatorBuilderImpl</property>  <property name=*"hibernate.transaction.jta.platform"*>org.hibernate.engine.transaction.jta.platform.internal.WeblogicJtaPlatform</property>  <property name=*"dialect"*>com.code.dal.dialects.HcmOracle12cDialect</property> |

* **SQL Server:**

|  |
| --- |
| <property name=*"connection.datasource"*>jdbc/*ETR\_HCM\_PKG\_SQL\_MS*</property>  <property name=*"hibernate.transaction.coordinator\_class"*>org.hibernate.resource.transaction.backend.jta.internal.JtaTransactionCoordinatorBuilderImpl</property>  <property name=*"hibernate.transaction.jta.platform"*>org.hibernate.engine.transaction.jta.platform.internal.WeblogicJtaPlatform</property>  <property name=*"dialect"*>com.code.dal.dialects.HcmSQLServer2012Dialect</property>  <property name=*"hibernate.default\_schema"*>dbo</property> |

* **PostgreSQL:**

|  |
| --- |
| <property name=*"connection.datasource"*>jdbc/*ETR\_HCM\_PKG\_PG*</property>  <property name=*"hibernate.transaction.coordinator\_class"*>org.hibernate.resource.transaction.backend.jta.internal.JtaTransactionCoordinatorBuilderImpl</property>  <property name=*"hibernate.transaction.jta.platform"*>org.hibernate.engine.transaction.jta.platform.internal.WeblogicJtaPlatform</property>  <property name=*"dialect"*>com.code.dal.dialects.HcmPostgreSQL95Dialect</property>  <property name=*"hibernate.default\_schema"*>ETR\_HCM\_PKG</property> |

* **DataAccess.java:**
* At **init**(): Build the session factory using:

|  |
| --- |
| StandardServiceRegistry standardRegistry = **new** StandardServiceRegistryBuilder().configure("com/code/dal/hibernate.cfg.xml").build();  Metadata metadata = **new** MetadataSources(standardRegistry).getMetadataBuilder().build();  *sessionFactory* = metadata.getSessionFactoryBuilder().build(); |

* At **executeQuery** method:
  + - 1. Use parameterized type query. The type should be the returned result set type Query<T>.
      2. Use createNativeQuery instead of createSQLQuery.
      3. Use q.setParameter and specify the parameter type manually. For example:

|  |
| --- |
| **if** (value **instanceof** Integer)  q.setParameter(paramName, value, org.hibernate.type.IntegerType.***INSTANCE***);  **else** **if** (value **instanceof** String)  q.setParameter(paramName, value, org.hibernate.type.StringType.***INSTANCE***);  **else** **if** (value **instanceof** Long)  q.setParameter(paramName, value, org.hibernate.type.LongType.***INSTANCE***); |

* At **getNextValFromSequence** method:

1. Generate the sequence next value using a database stored procedure implemented at all databases which takes the sequence name as a parameter and returns the next value as an output. The schema name is required for the stored procedure for both SQL Server and PostgreSQL, and it’s required for the sequence name for PostgreSQL.
2. The hibernate source code to access the stored procedure is:

|  |
| --- |
| Session session = *sessionFactory*.openSession();  **try** {  ResourceBundle config = ResourceBundle.*getBundle*("com.code.resources.config");  StoredProcedureQuery query = session.createStoredProcedureQuery(config.getString("defaultSchema") + ".**PKG\_GET\_SEQUENCE\_NEXT\_VALUE**")  .registerStoredProcedureParameter(1, String.**class**, ParameterMode.***IN***)  .registerStoredProcedureParameter(2, Long.**class**, ParameterMode.***OUT***)  .setParameter(1, config.getString("defaultSchema") +"."+ sequenceName);    query.execute();  **return** (Long) query.getOutputParameterValue(2);  } **catch** (Exception e) {  **throw** **new** DatabaseException(e.getMessage());  } **finally** {  session.close();  } |

* **config.properties:**
  + - Add the **defaultSchema** configuration: defaultSchema=*schema\_name* which is the same value configured at **hibernate.cfg.xml** for "hibernate.default\_schema" property.
* **Dialects:**
  + - Use custom dialects to be able to parse the JPQL with the modified functions’ calls.
      * Oracle:

|  |
| --- |
| **class** HcmOracle12cDialect **extends** Oracle12cDialect |

* + - * SQL Server:

|  |
| --- |
| **class** HcmSQLServer2012Dialect **extends** SQLServer2012Dialect |

* + - * PostgreSQL:

|  |
| --- |
| **class** HcmPostgreSQL95Dialect **extends** PostgreSQL95Dialect |

* + - Each dialect contains the registrations of each **UDF** as the following sample:

|  |
| --- |
| registerFunction("PKG\_NVL", **new** StandardSQLFunction(*config*.getString("defaultSchema") + ".PKG\_NVL"));  registerFunction("PKG\_LENGTH", **new** StandardSQLFunction(*config*.getString("defaultSchema") + ".PKG\_LENGTH"));  registerFunction("PKG\_CONCAT", **new** StandardSQLFunction(*config*.getString("defaultSchema") + ".PKG\_CONCAT"));  registerFunction("PKG\_SUBSTRING", **new** StandardSQLFunction(*config*.getString("defaultSchema") + ".PKG\_SUBSTRING"));  registerFunction("PKG\_REPLACE", **new** StandardSQLFunction(*config*.getString("defaultSchema") + ".PKG\_REPLACE")); |

* **ORM:**
  + - Modify all entities to make the JPQL uses the database **U**ser **D**efined **F**unctions (**UDF**) instead of Oracle built-in functions. We only introduce (**UDF**) for any operation other than the aggregate functions and comparison operators.
    - For the primary key generation at all entities:
* At **@SequenceGenerator**: add **allocationSize = 1** because the default value is 50 at the SQL Server and PostgreSQL databases.
* At **@GeneratedValue**: add **strategy = GenerationType.SEQUENCE** because the default strategy at SQL Server is GenerationType.IDENTITY which use the identity column strategy to generate the next value.
  + - The fields to be compared with any database column or the columns to be compared with each other should be with the same data type. i.e. both values should be numbers or strings because PostgreSQL database cannot handle the datatypes differences like what Oracle and SQL server handle. This will enforce us to change the parameter type sent to the JPQL or change the column type. We need to revisit all the queries and the methods sent parameters. For example:

|  |
| --- |
| qParams.put("P\_DECISION\_NUMBER", (decisionNumber == **null** || decisionNumber.length() == 0) ? FlagsEnum.ALL.getCode(): decisionNumber); // At the service, this will give an exception because getCode() returns integer value, so an empty string should be concatenated with it.  qParams.put("P\_DECISION\_NUMBER", (decisionNumber == **null** || decisionNumber.length() == 0) ? FlagsEnum.ALL.getCode() + "": decisionNumber); // correct |
| and (:P\_DEC\_NO = -1 OR v.decisionNumber = :P\_DEC\_NO) // At JPQL, this will give an exception because the column type is varchar but the sent parameter is an integer, so the sent parameter should be changed at the service to be String instead of int |

* + - When passing an array to a query, take care to use the toArray(new T[original List.size()]) instead of toArray().  
      For example:   
      qParams.put("P\_TASKS\_IDS", tasksIds.toArray(**new** Long[tasksIds.size()]));  
      Instead of  
      qParams.put("P\_TASKS\_IDS", tasksIds.toArray());
* **Manipulating Views:**
* At **AttachmentsService.java**, it’s required to insert the security key to the view instead of a table but PostgreSQL needs a trigger to do that.

|  |
| --- |
| CREATE OR REPLACE FUNCTION etr\_hcm\_pkg.cust\_sec\_web\_show\_vw\_dml()  RETURNS TRIGGER AS $function$  BEGIN  IF TG\_OP = 'INSERT' THEN  INSERT INTO etr\_hcm\_pkg.CUST\_SEC\_WEB\_SHOW VALUES(NEW.SEC\_KEY);  RETURN NEW;  END IF;  RETURN NEW;  END;  $function$ LANGUAGE plpgsql; |
| CREATE TRIGGER cust\_sec\_web\_show\_vw\_dml\_trig INSTEAD OF INSERT ON  etr\_hcm\_pkg.CUST\_VW\_SEC\_WEB\_SHOW FOR EACH ROW EXECUTE PROCEDURE etr\_hcm\_pkg. cust\_sec\_web\_show\_vw\_dml(); |

* **Reports:**
  + - At **ReportService.java**, send the **P\_SCHEMA\_NAME** parameter at **getReportData** method to be sent for all jasper files.

|  |
| --- |
| parameters.put("P\_SCHEMA\_NAME", BaseService.getConfig("defaultSchema")); |

* Add the file **sqljdbc4-2.0.jar** to the iReport classpath for SQL Server database connectivity. The file is located at: <https://ejadasvn.ejada.com/svn/BGETR/BG%20ETR%20Docs/Lessons%20Learned/Helper%20Files/Packaging/sqljdbc4-2.0.jar>.
* Change the query to use the database **U**ser **D**efined **F**unctions (**UDF**) for any operation other than the aggregate functions and comparison operators.
* Add a String parameter “**P\_SCHEMA\_NAME**” to all reports and subreports (This parameter is sent from the ReportService.java to all jasper files like the **P\_REPORTS\_ROOT** parameter).
* Uncheck the automatic field retrieval option in Report query window while changing query in case the Database type of the connection is PostgreSQL or Always develop the report query using Oracle connection as reports fields names are generated in lowercase while automatic reading from PostgreSQL.
* Use the schema name before any table, view, or function name. But access it using **$P!{P\_SCHEMA\_NAME}** so the query will use the parameter value without interpreting it.
* Send the Schema Name parameter to the subreports like the DECISION\_SIGNATURE subreport.
* Set a default value to the schema name parameter so the compiler will be able to compile the query and read the fields.
* The tables and views’ aliases and columns’ names are case sensitive. So, make sure that all reports are using capital letters.
* Convert “DECODE” to “CASE WHEN” statement.
* At **PKG\_DATE\_TO\_CHAR** function, add the keyword “**(r0)**” before the date format pattern to remove the leading zeros from the date so the pattern will be like “(r0)MI/MM/YYYY” or “(r0)YYYY-MM-MI” instead of using the fill mode “fm”.
* The tables’ columns to be compared should be with the same data type (as mentioned at previous section).
* Convert the (+) join operator to LEFT JOIN.

Appendix E: Conversion from Richfaces to Primefaces

1. **Components Conversion:**

|  |  |  |  |
| --- | --- | --- | --- |
| **RichFaces Tag** | **PrimeFaces Tag** | **Sample Screen** | **Notes** |
| a4j:ajax | p:ajax | FileUpload.xhtml |  |
| a4j:status | p:ajaxStatus | Template.xhtml | Should be exist at **Template** only |
| a4j:commandButton | p:commandButton |  | Shouldn’t be used at the application |
| rich:calendar | p:calendar |  | Should be exist at **AuditInquiry** only |
| rich:fileUpload | p:fileUpload | ImageUpload.xhtml |  |
| rich:dataTable | p:dataTable | VacationsCollectiveApproval.xhtml |  |
| rich:dataScroller | paginator="true" | VacationsCollectiveApproval.xhtml |  |
| rich:column | p:column | VacationsCollectiveApproval.xhtml |  |
| rich:columnGroup | p:columnGroup | DecisionsPrivileges.xhtml | use <p:row> for each line |
| rich:placeholder | p:watermark | Login.xhtml |  |
| rich:popupPanel | p:dialog | Template.xhtml |  |
| rich:component('name') | PF('name') | Template.xhtml | The ‘name’ used at primefaces is the "widgetVar" not the "Id" |
| rich:notifyStack | p:growl | Template.xhtml |  |
| rich:notifyMessages | p:growl | Template.xhtml |  |
| rich:tree | p:tree | UnitCreation.xhtml |  |
| rich:treeNode | p:treeNode | UnitCreation.xhtml |  |
| rich:collapsiblePanel | p:fieldset | OrganizationHierarchy.xhtml | RegularVacation.xhtml has issue of disabling the toggle |

1. **datatable Conversion:**

|  |  |
| --- | --- |
| **RichFaces datatable Attributes** | **PrimeFaces datatable Attributes** |
| rowKeyVar | rowIndexVar |
| onrowclick="changeSelectedRowStyle(this);" | selectionMode="single" rowKey="#{index}" |
| rich:dataScroller component | paginator="true" paginatorPosition="bottom" |
| If there is “execute” on the dataScroller | Add <p:ajax event="page" skipChildren="false" /> inside the datatable |
| onrowmouseover="changeRowOverStyle(this);"  onrowmouseout="resetRowOverStyle(this);"  rowClasses="gridRowOdd,gridRowEven" styleClass="gridMaster" | Replaced with CSS classes overriding the default primefaces styles |

1. **collapsiblePanel Conversion:**

|  |  |
| --- | --- |
| **RichFaces collapsiblePanel Attributes** | **PrimeFaces fieldset Attributes** |
| Header | legend |
| Expanded | collapsed |
|  | Add toggleable="true" because the default is false |

1. **fileUpload Conversion:**

|  |  |
| --- | --- |
| **RichFaces fileUpload Attributes** | **PrimeFaces fileUpload Attributes** |
| immediateUpload | auto |
| context parameter “org.richfaces.fileUpload.maxRequestSize” | sizeLimit |
| sizeExceededLabel | invalidSizeMessage |
| maxFilesQuantity | fileLimit |
| acceptedTypes (comma separated string) | allowTypes (regular expression) |
| ontyperejected | invalidFileMessage |
| doneLabel | handled manually (refer to ImageUpload.xhtml) |

1. **tree Conversion:**

|  |  |
| --- | --- |
| **RichFaces tree Attributes** | **PrimeFaces tree Attributes** |
|  | dynamic="true" to send ajax requests when expanding the tree nodes (not static data) |
|  | cache="false" to get the node children from the DB even if the node was expanded before |
| toggleListener | <p:ajax event="expand" global="true" ... /> |
| treeNode h:commandLink action | <p:ajax event="select" global="true" ... /> |
| treeNode h:commandLink | h:outputText |
| treeNode title | p:tooltip for the treeNode |
| treeNode iconExpanded, iconCollapsed, iconLeaf | treeNode icon (which is a style class not image path) |

1. **Notes:**
   1. Remove all unmask statements. No need to unmask after any ajax request even if the component firing the event will be re-rendered. Unless the UI component that fire the ajax request catches itself the ajax event.
   2. Make sure that all the datatables columns have widths because primefaces will set equal widths for all columns by default if no widths set.
   3. For p:ajax requests, the keyword “execute” is replaced with “process”, and “render” with “update”.
   4. Add the PF namespace: xmlns:p=<http://primefaces.org/ui> and remove the richfaces and a4j namespaces.