

Extensibility Guide
Oracle Banking Digital Experience
Patchset Release 22.2.4.0.0

Part No. F72987-01

June 2024

Extensibility Guide

June 2024

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1. Preface

1.1 Intended Audience

This document is intended for the following audience:

- Customers
- Partners

1.2 Documentation Accessibility

For information about Oracle's commitment to accessibility, visit the Oracle Accessibility Program website at <http://www.oracle.com/pls/topic/lookup?ctx=acc&id=docacc>.

1.3 Access to Oracle Support

Oracle customers have access to electronic support through My Oracle Support. For information, visit

<http://www.oracle.com/pls/topic/lookup?ctx=acc&id=info> or visit

<http://www.oracle.com/pls/topic/lookup?ctx=acc&id=trs> if you are hearing impaired.

1.4 Structure

This manual is organized into the following categories:

Preface gives information on the intended audience. It also describes the overall structure of the User Manual.

The subsequent chapters describes following details:

- Introduction
- Preferences & Database
- Configuration / Installation.

1.5 Related Information Sources

For more information on Oracle Banking Digital Experience Patchset Release 22.2.4.0.0, refer to the following documents:

- Oracle Banking Digital Experience Installation Manuals

2. Objective and Scope

2.1 Background

OBDX is designed to help banks respond strategically to today's business challenges, while also transforming their business models and processes to reduce operating costs and improve productivity across both front and back offices. It is a one-stop solution for a bank that seeks to leverage Oracle Fusion experience across its core banking operations across its retail and corporate offerings.

OBDX provides a unified yet scalable IT solution for a bank to manage its data and end-to-end business operations with an enriched user experience. It comprises pre-integrated enterprise applications leveraging and relying on the underlying Oracle Technology Stack to help reduce in-house integration and testing efforts.

2.2 Objective

While most product development can be accomplished via highly flexible system parameters and business rules, further competitive differentiation can be achieved via IT configuration & extension support. Time consuming, custom coding to enable region specific, site specific or bank specific customizations can be minimized by offering extension points and customization support which can be implemented by the bank and / or by partners.

Extensibility objective

OBDX when extended & customized by the Bank and / or Partners results in reduced dependence on Oracle. As a result of this, the Bank does not have to align plans with Oracle's release plans for getting certain customizations or product upgrades. The bank has the flexibility to choose and do the customizations themselves or have them done by partners.

One of the key considerations towards enabling extensibility in OBDX has been to ensure that the developed software can respond to future growth. This has been achieved by disciplined software development leading to cleaner dependencies, well defined interfaces and abstractions with corresponding reduction in high cohesion & coupling. Hence, the extensions are kept separate from Core – Bank can take advantage of OBDX Core upgrades as most extensions done for a previous release can sit directly on top of the upgraded version. This reduces testing effort thereby reducing overall costs of planning & taking up an upgrade. This would also improve TTM significantly as the bank enjoys the advantage of getting universal features through upgrades.

The broad guiding principles w.r.t. providing extensibility in OBDX are summarized below:

- Strategic intent for enabling customers and partners to extend the application.
- Internal development uses the same principles for client specific customizations.
- Localization packs.
- Extensions by Oracle Consultants, Oracle Partners, Banks or Bank Partners.
- Extensions through the addition of new functionality or modification of existing functionality.
- Planned focus on this area of the application.
- Standards based.

- Leverage large development pool for standards based technology.
- Developer tool sets provided for as part of JDeveloper and Eclipse for productivity.

2.3 **Scope**

The scope of this document is to explain the **customization & extension** of OBDX for the following use cases:

- Customizing OBDX application services and implement composite application services
- Adding pre-processing or post processing validations in the application services extension
- Adding Business Logic in pre hook or post hook points in the application services extension
- Altering the product behavior at customizations hooks provided as adapter calls in functional areas that are prone to change and in between modules that can be replaced (e.g. alerts, content management)
- Adding new fields to the OBDX domain model and including it on the corresponding screen.
- Defining the security related access and authorization policies
- Defining different security related rules, validator and processing logics
- Customizing OBDX UI
- Adding a new field or a table on the screen
- Removing fields from the UI

This document would be a useful tool for Oracle Consulting, bank IT and partners for customizing and extending the product.

The document is a developer's extensibility guide and does not intend to work as a replacement of the functional specification which would be the primary resource covering the following:

- OBDX installation & configuration.
- OBDX parameterization as part of implementation.
- Functional solution and product user guide.

Out of scope

The scope of extensibility does not intend to suggest that OBDX is forward compatible.

2.4 **Structure**

This document is organized into following chapters

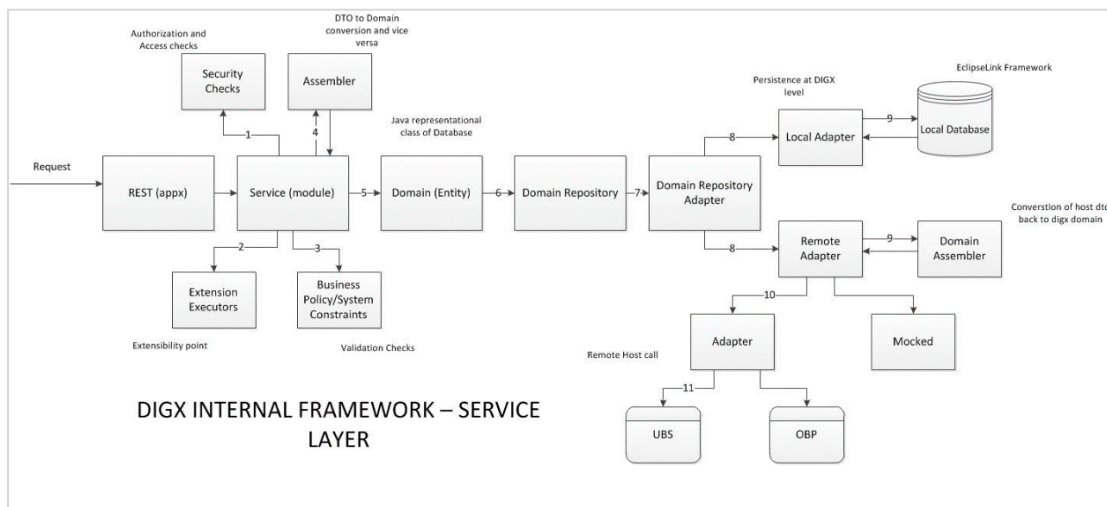
- Architecture of Service Tier: Provides overall architecture of the service tier of OBDX platform. This chapter will set the context for further chapters and also will introduce you to various terminologies that you will encounter throughout this document
- Extensible Points in Service Tier: Provides in depth knowledge about various extensible hooks available in the service tier.
- Architecture of GUI Tier: Provides overall architecture of the GUI tier of OBDX platform. This chapter will introduce you to various terminologies that you will encounter for UI extensibility.
- Extensible points in GUI Tier: Provides in depth knowledge about various extensible hooks available in the GUI tier.
- Libraries: Provides a listing of various libraries provided by OBDX out of the box along with their usage
- Deployment: Provides information in packaging and deployment of the customized code on Weblogic server
- GUI Tier – Workspace Setup: Provides step by step guidelines for setting up workspace for GUI tier extensibility
- GUI Tier – Deployment: Provides information on packaging and deployment of customized GUI code on HTTP server
- Use Cases: This chapter discusses some of the extensibility points covered in earlier chapters with the help of some use cases.

Home

3. Architecture of Service Tier

Let's go through the building blocks of OBDX framework (also known as DIGX framework). To build a REST API, each of these framework components (as mentioned below) needs to be addressed and that's why it becomes important to have a holistic idea about each of them. The arrangement of all of these framework components can be clearly understood in the following diagram:

Figure 1 DIGX Service Layer



1. **REST:** The endpoint layer which gets invoked whenever a request URI is called. Also known as the layer which contains REST annotations and path to resources or sub-resources of an application
2. **Service:** Also called as module layer of the framework. Generally, the core modules of DIGX application will have their own service implementation classes responsible for implementing core business logic, validation and security checks
3. **Assemblers:** These are the mapping classes which convert data object containing request or response parameters into domain or database compatible form. These classes help us to get the required domain objects which can be further used in object-relational mapping
4. **Business Policy/ System Constraints:** Before letting the query data read or persisted in the core application, certain business policies need to be validated. This separate layer of constraints check let the application behave as per the policies configured
5. **Domain/Entity:** Represents the Java Object form of Database. This domain layer also contains data to be persisted or query response fetched through Object relational mapping
6. **Domain Repository:** The term 'repository' denotes any data storage component. Each module of the application will have its own repository to manage its CRUD operations and that can be easily done using this component of the DIGX framework
7. **Domain Repository Adapter:** Adapters are the connecting points to some external system and as the name suggests, this part of the framework contacts two kinds of repositories of DIGX application – Local Repository and Remote Repository. Eventually, the configured one out of these two will be invoked
8. **Adapters:** Finally these are the adapter classes that can call either Local Database (DIGX specific tables) or Remote Repository (external system).

9. **External System/ Host: The core banking application such as UBS/FCORE or OBP or any third-party application which operates final banking transactions.**

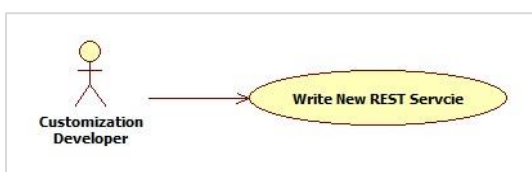
[Home](#)

4. Extensible Points in Service Tier

Various extensible points / hooks provided by OBDX framework, are explained in detail in this section

4.1 REST Tier

Customization developer can extend the REST tier by writing new REST services. This new REST service will consume new or existing application service. Please note that it is not possible to customize the REST services provided out of the box. Extensibility in REST tier is limited to writing new services.



4.1.1 Guidelines

- OBDX REST tier follows façade pattern, meaning that it is just an endpoint built on top of application service(s).
- A REST service should not have any business logic. It should consume one or more application services and prepare the response.
- Before coding a new REST service, developer should decide the resource(s) and sub-resources(s) that s/he needs to develop. Based on this, the developer can design required URIs. E.g. A 'Demand Deposit Account' is a resource in the system and /accounts/demandDeposit/{accountId} is the REST URI to access it.
- The service should be annotated suitably using JAX-RS annotations.
- The service should wrap its operation in 'Channel Interaction'.
- The service should use adequate logging.

4.1.2 HTTP Standards

HTTP Methods

OBDX resources support following HTTP methods. New services also should use these methods appropriately.

Method	Purpose
GET	Retrieve / fetch the resource
POST	Create a new resource
PUT	Update / modify an existing resource. The payload is expected to have full resource.
PATCH	Update / modify very small part of an existing resource. The payload is expected to have only the fields to be updated.
DELETE	Delete a resource

HTTP Response Codes

Following HTTP response codes are used. New REST services should return appropriate response code based on result of the operation.

Code	Status	Description
200	OK	Request successfully executed and the response has content
201	Created	Resource successfully created
202	Accepted	Request has been accepted for processing but processing has not been completed
204	No Content	Request successfully executed and the response doesn't have content
304	Not Modified	The resource has not been modified for a conditional GET request
400	Bad Request	The request could not be understood by the server due to malformed syntax

Code	Status	Description
401	Unauthorized	The request requires user authentication, or authorization has been refused for the credential passed in the request
404	Not Found	The requested resource was not found
500	Internal Server Error	The server encountered an unexpected condition which prevented it from fulfilling the request

4.2 Service Extensions

This extension point should be used when the customization developer needs additional business logic for an application service. This additional logic, which is not available as part of the digital experience product functionality, but could be a client requirement. For these purposes, two hooks are provided in the application code:

Pre-extension hook

This extension point is available in application service before it performs any validations and executes business logic. This hook can be important in the following scenarios:

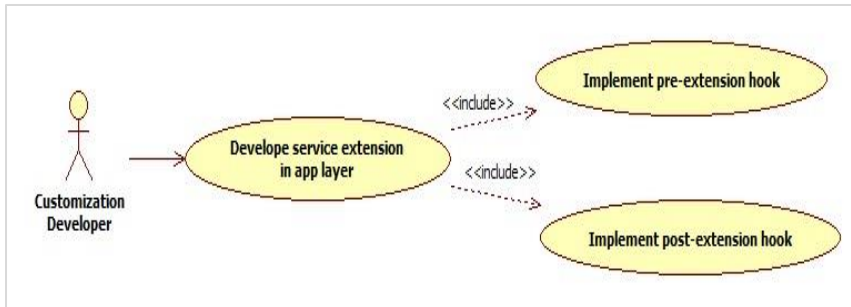
- Additional input validations
- Execution of business logic, which necessarily has to happen before going ahead with normal service execution.

Post-extension hook

This extension point is available in the application service after it has executed business logic. This hook can be important in the following scenarios:

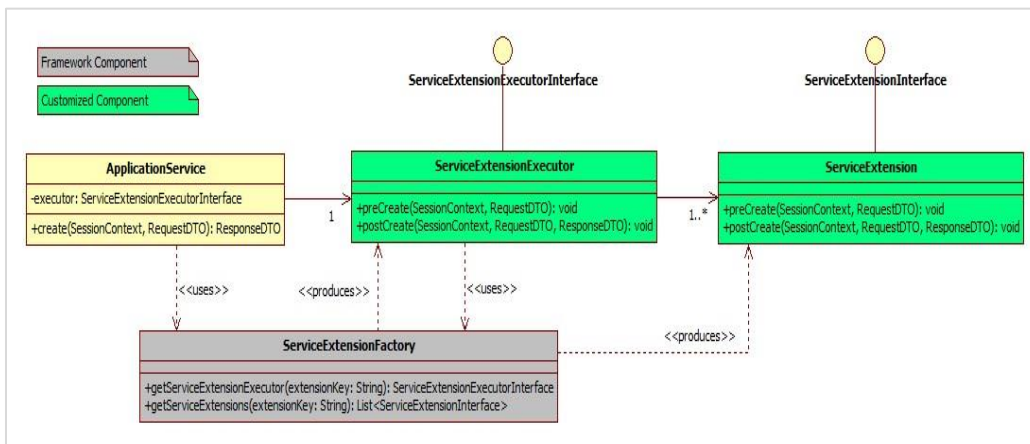
- Output response manipulation
- Custom data logging for subsequent processing or reporting.

Both 'pre' and 'post' service extensions are available in the application service layer (also known as the 'app' layer) of OBDX.



This hook is implemented using service extension executor and service extensions. These components are explained in detail below. Customization developer can use these components suitably based on the requirement.

Below class diagram depicts the relationship between application service, extension executor and extensions. The diagram considers a sample 'create' method in application service.



Note: The RequestDTO and ResponseDTO components depicted in above diagram are explained in subsequent sections. For now, note that the RequestDTO contains inputs to the application service method and ResponseDTO contains output generated by the method.

4.2.1 Service Extension Interface

This interface has a pair of pre and post method definitions for each application service method of the present. A service extension class has to implement this interface. The 'pre' method is the pre-extension hook as explained before. Similarly the 'post' method is the post-extension hook.

Multiple implementations can be defined for a particular service. The service extensions executor invokes all the implementations defined for the particular service both before and after the actual service executes. The signatures of these methods are:

```
public void pre<Method_Name>(SessionContext, <Method_Parameters>) throws Exception;
```

```
public void post<Method_Name>(SessionContext, <Method_Parameters>, ResponseDTO) throws Exception;
```

Naming Convention

The naming convention of service extension interface is

I<Service_Name>Ext

For example, consider below code sample.

```
public interface ILoanApplicationExt {
    /**
     * Extension point for LoanApplication.create. The method is intended to keep all the extensions required before
     * creating loan applications from the Service class {@code LoanApplicationApplicationService}.
     */
    @throws Exception
    /**
     * Extension point for LoanApplication.create. The method is intended to keep all the extensions required after
     * creating loan applications from the Service class {@code LoanApplicationApplicationService}.
     *
     * @param sessionContext
     *     The session context of request in the form of {@link SessionContext}.
     *
     * @param loanApplicationCreateRequestDTO
     *     The instance of type {@link LoanApplicationCreateRequestDTO} used for creating loan application
     *     request.
     *
     * @param loanApplicationResponseDTO
     *     The instance of type {@link LoanApplicationCreateResponseDTO} used for creating loan application
     *     response.
     *
     * @throws Exception
     */
    public void preCreate(SessionContext sessionContext, LoanApplicationCreateRequestDTO loanApplicationCreateRequestDTO)
        throws Exception;

    /**
     * Extension point for LoanApplication.create. The method is intended to keep all the extensions required after
     * creating loan applications from the Service class {@code LoanApplicationApplicationService}.
     *
     * @param sessionContext
     *     The session context of request in the form of {@link SessionContext}.
     *
     * @param loanApplicationUpdateRequestDTO
     *     The request DTO of type {@link LoanApplicationUpdateRequestDTO} used for updating loan application of
     *     any party.
     *
     * @throws Exception
     */
    public void postCreate(SessionContext sessionContext,
        LoanApplicationCreateRequestDTO loanApplicationCreateRequestDTO,
        LoanApplicationCreateResponseDTO loanApplicationResponseDTO) throws Exception;

    /**
     * Extension point for LoanApplication.update. The method is intended to keep all the extensions required before
     * updating loan applications from the Service class {@code LoanApplicationApplicationService}.
     *
     * @param sessionContext
     *     The session context of request in the form of {@link SessionContext}.
     *
     * @param loanApplicationUpdateRequestDTO
     *     The request DTO of type {@link LoanApplicationUpdateRequestDTO} used for updating loan application of
     *     any party.
     *
     * @throws Exception
     */
}
```

4.2.2 Service Extension Executor Interface

This acts as an interface for the application service to access service extensions. The implementing class creates an instance each of all the extensions defined in the service extensions configuration file. If no extensions are defined for a particular service, the executor creates an instance of the default extension for the service. The executor also has a pair of pre and post methods for each method of the actual service. These methods in turn call the corresponding methods of all the extension classes defined for the service (extension chaining).

Naming convention

The naming convention for extension executor class is as below:

Interface : I<Service_Name>ExtExecutor

Implementation : <Service_Name>ExtExecutor

For example, consider below code sample:

```
public interface ILoanApplicationExtExecutor {
    /**
     * Executor point for LoanApplication.create. It executes the extensions available before creating loan applications
     * from the Service class {@code LoanApplicationApplicationService}.
     */
    public void preCreate(SessionContext sessionContext, LoanApplicationCreateRequestDTO loanApplicationCreateRequestDTO)
        throws Exception;

    /**
     * Executor point for LoanApplication.create. It executes the extensions available after creating loan applications
     * from the Service class {@code LoanApplicationApplicationService}.
     *
     * @param sessionContext
     *     The session context of request in the form of {@link SessionContext}.
     *
     * @param loanApplicationCreateRequestDTO
     *     The request DTO of type {@link LoanApplicationCreateRequestDTO} used for creating loan application
     *     of any party.
     *
     * @param loanApplicationCreateResponseDTO
     *     The response DTO of type {@link LoanApplicationCreateResponseDTO} returned by the service
     *     for creating loan application.
     *
     * @throws Exception
     */
    public void postCreate(SessionContext sessionContext,
        LoanApplicationCreateRequestDTO loanApplicationCreateRequestDTO,
        LoanApplicationCreateResponseDTO loanApplicationCreateResponseDTO) throws Exception;

    /**
     * Executor point for LoanApplication.update. It executes the extensions available before updating loan applications
     * from the Service class {@code LoanApplicationApplicationService}.
     *
     * @param sessionContext
     *     The session context of request in the form of {@link SessionContext}.
     *
     * @param loanApplicationUpdateRequestDTO
     *     The request DTO of type {@link LoanApplicationUpdateRequestDTO} used for updating loan application of
     *     any party.
     *
     * @throws Exception
     */
}
```


4.2.3 Default Extension (Void Extension)

This class, named as `Void<Service_Name>Ext`, is provided out of the box for each application service. This class implements the aforementioned service extension interface without any business logic viz. the implemented methods are empty.

The default extension is a useful & convenient mechanism to implement the pre and / or post extension hooks for specific methods of an application service. Instead of implementing the entire interface, one should extend the default extension class and override only required methods with the additional business logic. Product developers do not implement any logic, including product extension logic, inside the default extension classes.

For example:

```

import com.ofss.digx.app.origination.dto.submission.application.LoanApplicationCreateRequestDTO;

/**
 * Represents the Extension Interface for Loan applications Service. Extensions for initiating and updating loan
 * application, getting all the offer related information in the loan application, selecting and updating offers,
 * updating insurance and service charges related information, information about loan and re-payment instructions can be
 * specified in this class. Instance of the interface of this class returns the extensions list required by the
 * application service Extension Executor Class.
 */
public class VoidLoanApplicationExt implements ILoanApplicationExt {

    /**
     * Extension point for LoanApplication.create. The method is intended to keep all the extensions required before
     * creating loan applications from the Service class {@code LoanApplicationApplicationService}.
     *
     * @param sessionContext
     *     The session context of request in the form of {@link SessionContext}.
     *
     * @param loanApplicationCreateRequestDTO
     *     The request instance of type {@link LoanApplicationCreateRequestDTO} for creating loan application
     *     request.
     *
     * @throws Exception
     */
    @Override
    public void preCreate(SessionContext sessionContext, LoanApplicationCreateRequestDTO loanApplicationCreateRequestDTO)
        throws Exception {

    }

    /**
     * Extension point for LoanApplication.create. The method is intended to keep all the extensions required after
     * creating loan applications from the Service class {@code LoanApplicationApplicationService}.
     *
     * @param sessionContext
     *     The session context of request in the form of {@link SessionContext}.
     *
     * @param loanApplicationCreateRequestDTO
     *     The instance of type {@link LoanApplicationCreateRequestDTO} used for creating loan application
     *     request.
     *
     * @param loanApplicationResponseDTO
     *     The instance of type {@link LoanApplicationCreateResponseDTO} used for creating loan application
     *     response.
     *
     * @throws Exception
     */
    @Override
    public void postCreate(SessionContext sessionContext,
        LoanApplicationCreateRequestDTO loanApplicationCreateRequestDTO,
        LoanApplicationCreateResponseDTO loanApplicationResponseDTO) throws Exception {
    }
}

```

4.2.4 Custom Extension

Below is an example of customized service extension class that implements methods of application service extension interface. This class contains pre hook and post hook point for the service. The pre method of this customized extension is executed before the actual service method and the post method of this is executed after the service method.

```
private static final String THIS_COMPONENT_NAME = VoidCollaborationExtDemo.class.getName();

/**
 * Holds the instance of {@link MultiEntityLogger} used for sending messages on the console.
 */
private com.ofss.fc.infra.log.impl.MultiEntityLogger formatter = com.ofss.fc.infra.log.impl.MultiEntityLogger
    .getUniqueInstance();

/**
 * Instance of type {@link java.util.logging.Logger} used for Logging in Collaboration service.
 */
private static transient Logger logger = com.ofss.fc.infra.log.impl.MultiEntityLogger.getUniqueInstance()
    .getLogger(THIS_COMPONENT_NAME);

@Override
public void preCreate(SessionContext sessionContext, CollaborationDTO collaborationDTO) throws Exception {
    // calling a custom class to check DTO integrity.
    this.checkCollaborationDTO();

    try{
        NameValuePairDTO[] valuePairDTO = new NameValuePairDTO[1];
        valuePairDTO[0] = new NameValuePairDTO("mobileCustomer", "9595959595", "String");
        valuePairDTO[0].setGenericName("com.ofss.digx.domain.collaboration.entity.customdemo.CustomCollaborationDomainObject.mobileCustomer");

        Dictionary[] dictionary = new Dictionary[1]; //array of dictionary
        dictionary[0] = new Dictionary();
        dictionary[0].setNameValuePairDTOArray(valuePairDTO);
        collaborationDTO.setDictionaryArray(dictionary);
    }catch(java.lang.Exception e)
    {
        logger.log(Level.FINE, formatter.formatMessage("Pre-Create extension implementation sample"));
    }
}

private void checkCollaborationDTO() {
    System.out.println("Sample validation performed");
}

@Override
public void postCreate(SessionContext sessionContext, CollaborationDTO collaborationDTO,
    CollaborationResponseDTO collaborationResponseDTO) throws Exception {
    // TODO Auto-generated method stub
}

@Override
public void preRead(SessionContext sessionContext, CollaborationDTO collaborationDTO) throws Exception {
    // TODO Auto-generated method stub
}
}
```

Note: The concept of 'Dictionary' is explained in detail in subsequent section.

4.2.5 Service Extension Configurations

Set the property id and the property values in the digx_fw_config_all_b table. The property id will be the fully qualified name of the service and the value will be the fully qualified name of the custom extension created.

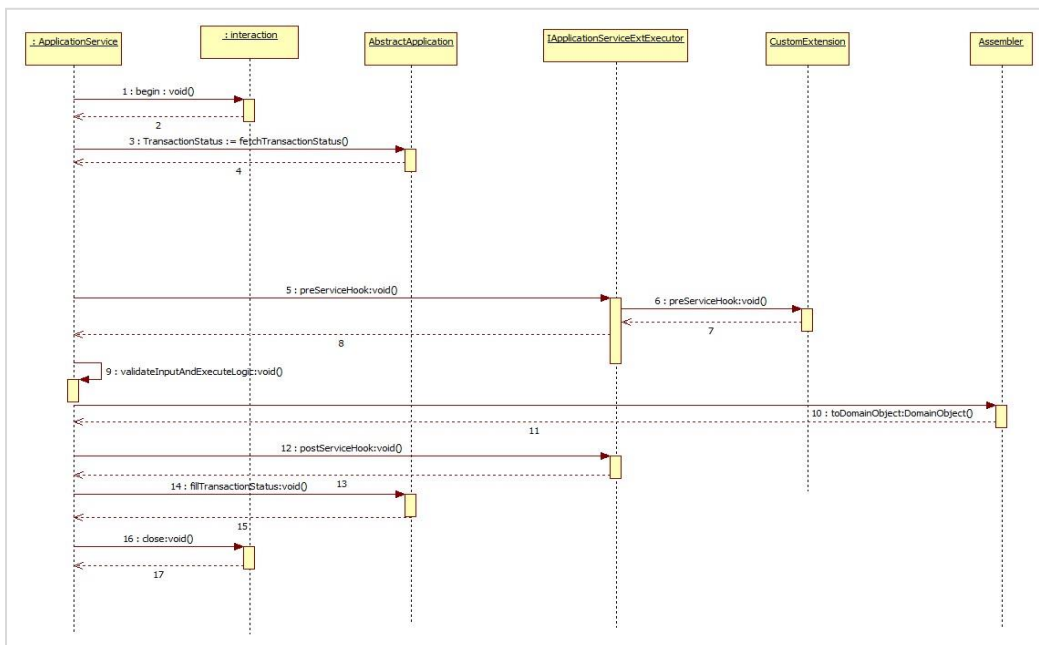
For example:

```
insert into digx_fw_config_all_b (PROP_ID, CATEGORY_ID, PROP_VALUE,
FACTORY_SHIPPED_FLAG, PROP_COMMENTS, SUMMARY_TEXT, CREATED_BY,
CREATION_DATE, LAST_UPDATED_BY, LAST_UPDATED_DATE, OBJECT_STATUS_FLAG,
OBJECT_VERSION_NUMBER)
```

```
values ('com.ofss.digx.app.origination.service.submission.applicant.Applicant',
'ServiceExtensionsConfig',
'com.ofss.digx.app.origination.service.submission.application.ext.CustomLoanApplicationExtensi
on', 'N', 'asdf', 'asdf', 'asdf', '', 'asdf', '', 'Y', 1);
```

4.2.6 Sequence of events in service extension

Every application service method has a standard set of framework method calls as shown in the sequence diagram below:



The pre hook is provided after the invocation of *fetchTransactionStatus* call inside the application service. At this step, the current task code is received, any additional manipulation of the input received from the User interface channel can be done in the pre hook. Apart from this additional data coming from the screen specific to client requirements can be handled in the pre hook.

The post hook is provided after the business logic corresponding to the application service invoked has executed and before the successful execution of the entire service is marked in the status object. This ensures that the status marking takes into consideration any execution failures of post hook prior to reporting the result to the calling source. Both, the pre and the post hooks accept the service input parameters as the inputs. The post hook also accepts the Response parameter as the input.

4.3 Business Policy

OBDX supports three types of validations

DTO field validations: These are the field level validations such as syntax check of the input. These validations are achieved by using field level annotations in request DTO. These validations are not available for extension. Below is the list of out of box annotations available

Annotation	Description
@Email	This annotation is used to validate the respective field with email regular- expression. If the field doesn't satisfy the mentioned regular-expression then the respective error code is thrown
@Mandatory	This annotation marks the fields as mandatory. Once marked, if the field is null then respective error-code is thrown Eg. @Mandatory(errorCode = DemandDepositErrorConstants.DDA_MANDATORY_ACCOUNT_ID) private Account accountId;
@Length	This annotation marks the lengths of the fields. Once marked, if the validation is violated then the respective error code is thrown. Eg. @Length(min = 2, max = 20, errorCode = PartyErrorConstants.PI_LENGTH_EXTERNAL_REF_ID)
@NonNegative	This annotation checks that the value is non-negative
@Regex	This annotation checks if the value matches regular expression provided

System Constraints: System performs these checks mandatorily. It is not possible to override or bypass these checks.

Business Policies: These are typically the business validations required to be performed before executing business logic. OBDX framework allows customization developer to override business policies as per the requirement.

4.3.1 Adding new business policy

Customization developer can add new business policy for new or existing services. System support multiple business policies for a single service.

Following are the steps to add a new business policy:

1. Create new business policy DTO. This DTO is supposed to encapsulate all the input fields upon which validation is to be performed.
2. Create new business policy. BusinessPolicy class must have constructor which accepts one parameter of type IBusinessPolicyDTO. This class must extend com.ofss.fc.framework.domain.policy.AbstractBusinessPolicy class and implement the validatePolicy() method.
This method should have the validation logic and if the validation fails, then it should call addValidationError() method with a new instance of ValidationError as parameter. One of the parameter to the constructor of ValidationError is error code. A new error could be added by following guidelines provided in Error Messages section.
3. Use of **isPolicyToBeValidated()** method
In case multiple business policies configured for one service then policy execution can be controlled by overriding isPolicyToBeValidated() method in CustomBusinessPolicy class. By default, all Business Policies configured in DB will be executed as isPolicyToBeValidated() method in AbstractBusinessPolicy will always return true.
To control the business policy validation based on data check, please override method isPolicyToBeValidated() in your BusinessPolicyClass.
4. **Configure new business policy(s)**. The business policy class created in above step should be configured in digx_fw_config_all_b table with category_id as 'CustomBusinessPolicy' and prop_id as the policy identifier.

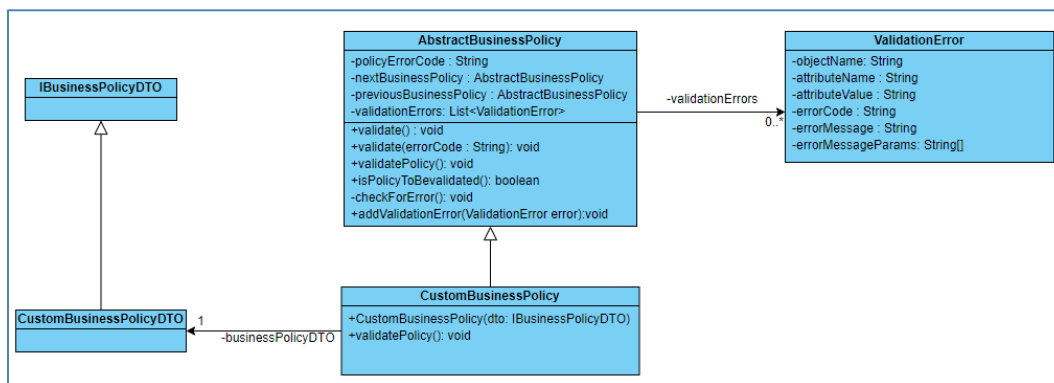
```
insert INTO digx_fw_config_all_b ( prop_id, category_id, prop_value, actory_shipped_flag,
prop_comments, summary_text, created_by, reation_date, last_updated_by,
last_updated_date, object_status_flag, object_version_number)VALUES ('<service_id>',
CustomBusinessPolicy ',
```

```
'<CustomBusinessPolicy1>,<CustomBusinessPolicy2>', 'N', 'Comments', 'Summary', 'ofssuser', sysdate, 'ofssuser', sysdate, 'Y', 1);
```

For example:

```
insert INTO digx_fw_config_all_b ( prop_id, category_id, prop_value, actory_shipped_flag,
prop_comments, summary_text, created_by, reation_date, last_updated_by,
last_updated_date, object_status_flag, object_version_number)VALUES
('com.ofss.digx.app.report.service.ReportRequest.create ', ' CustomBusinessPolicy
', 'com.ofss.digx.cz.domain.td.entity.policy.CustomBusinessPolicy1,com.ofss.digx.cz.domain.t
d.entity.policy.CustomBusinessPolicy2', 'N', 'Comments', 'Summary', 'ofssuser', sysdate,
'ofssuser', sysdate, 'Y', 1);
```

The class diagram for new custom business policy.



4.3.2 Extending existing business policy

OBDX provides out of box business policies for all services. If only a part of the validation is to be modified or a new validation is to be added in addition to the validations that the existing business policy does, then it is possible to extend existing business policy and override existing validation.

Please note that this capability depends on how the original business policy is coded. If the out of box business performs all its validations in validatePolicy() method, then this approach may not be useful. On the other hand, if the out of box business policy has separate individual methods for validations and validatePolicy() method calls these methods one by one, then extension of the business policy is useful.

The steps to be followed as same as mentioned in earlier section, except the difference that the custom business policy class will extend the out of box business policy class and override its methods as per the requirement.

4.4 Dictionary

Dictionary is not an extension point in itself, but it plays an important role in enabling extensibility of domain. Hence, it is worth understanding the 'Dictionary' before proceeding to subsequent sections

Data transfer object (DTO)

Data transfer object (DTO) is a design pattern used to transfer data between an external system and the application service. All the information may be wrapped in a single DTO containing all the details and passed as input request as well as returned as an output response. The client can then invoke accessory (or getter) methods on the DTO to get the individual attribute values from the Transfer Object. All request response classes in OBDX application services are modelled as data transfer objects.

```

public abstract class DataTransferObject extends Validatable implements Serializable {

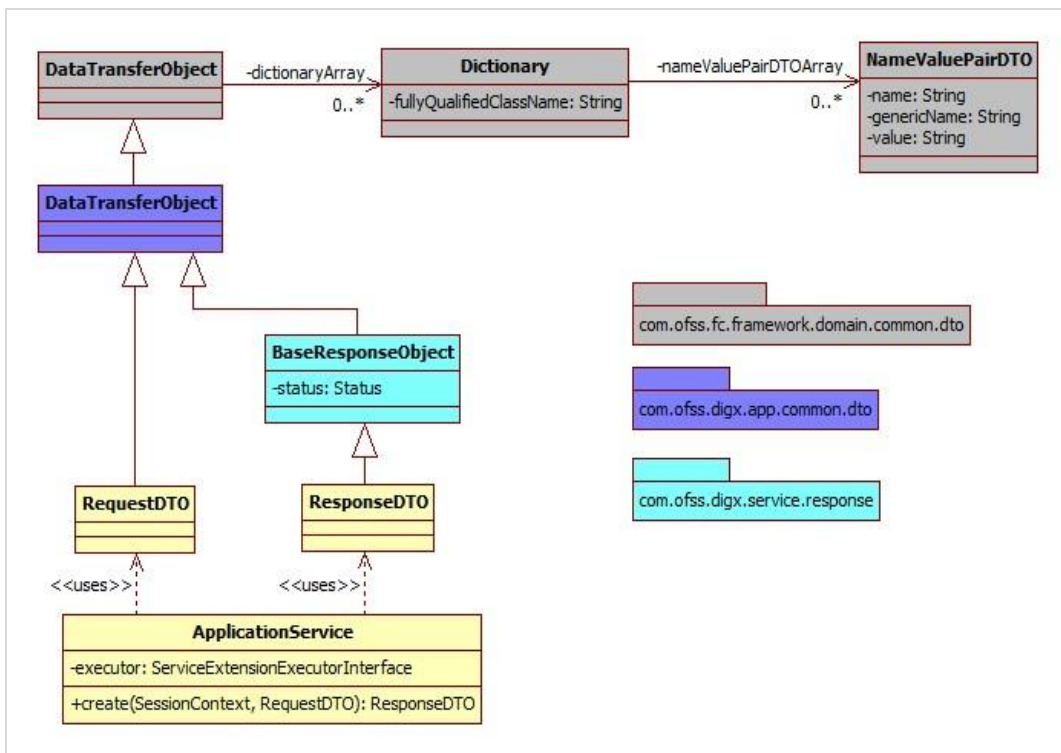
    /**
     *
     */
    private static final long serialVersionUID = -6584908885732656582L;
    /**
     * Subclasses of the Customized AbstractDomainObject corresponding to this
     * AbstractDomainObject<br>
     * are defined with the help of this attribute. This concept can be extended
     * to have joined or<br>
     * union subclass heirarchy in subsequent releases.
     */
    private Dictionary[] dictionaryArray;

    /**
     * Returns data for subclasses of the Customized Domain Object as name value
     * pair data with the<br>
     * name being a fact.
     *
     * @return
     */
    public Dictionary[] getDictionaryArray() {
        return dictionaryArray;
    }

    public void setDictionaryArray(Dictionary[] dictionaryArray) {
        this.dictionaryArray = dictionaryArray;
    }
}
    
```

Dictionary

All data transfer objects extend a base class **DataTransferObject** which holds an array of Dictionary object. The Dictionary encapsulates an array of **NameValuePairDTO** which is used to pass data of custom data fields or attributes from the UI layer to the host middleware. Below class diagram shows the relationship between these classes



Dictionary class looks like

```

Dictionary.class  CustomLoanApplicationExtension.java
1  package com.ofss.fc.framework.domain.common.dto;
2
3  import java.io.Serializable;
4
5  import javax.xml.bind.annotation.XmlType;
6
7  @XmlType(namespace="http://dto.common.domain.framework.fc.ofss.com")
8  public class Dictionary implements Serializable {
9
10     /**
11      *
12      */
13     private static final long serialVersionUID = 640766746819694755L;
14     private NameValuePairDTO[] nameValuePairDTOArray;
15
16     public NameValuePairDTO[] getNameValuePairDTOArray() {
17         return nameValuePairDTOArray;
18     }
19
20     public void setNameValuePairDTOArray(NameValuePairDTO[] nameValuePairDTOArray) {
21         this.nameValuePairDTOArray = nameValuePairDTOArray;
22     }
23
24
25 }
26

```

Following image shows use of dictionary with NameValuePairDTO and added it to the Data Transfer Object.

```

@Override
public void preCreate(SessionContext sessionContext, CollaborationDTO collaborationDTO) throws Exception {
    // calling a custom class to check DTO integrity.
    this.checkCollaborationDTO();

    try{
        NameValuePairDTO[] valuePairDTO = new NameValuePairDTO[1];
        valuePairDTO[0] = new NameValuePairDTO("mobileCustomer", "9595959595", "String");
        valuePairDTO[0].setGenericName("com.ofss.digx.domain.collaboration.entity.customdemo.CustomCollaborationDomainObject.mobileCustomer");

        Dictionary[] dictionary = new Dictionary[1]; //array of dictionary
        dictionary[0] = new Dictionary();
        dictionary[0].setNameValuePairDTOArray(valuePairDTO);
        collaborationDTO.setDictionaryArray(dictionary);
    }catch(java.lang.Exception e)
    {
        logger.log(Level.FINE, formatter.formatMessage("Pre-Create extension implementation sample"));
    }
}

```


4.5 Domain Extensions

The Domain layer is a central layer in designing entities in OBDX. The design philosophy is called domain driven design. In this, the domain object (also referred as 'entity' in OBDX context) is central to the design. The domain captures all attributes of the real time entity that it models.

OBDX provides infrastructure to customize existing domains. It also allows to add new domains.

4.5.1 Custom Domain Objects

OBDX framework (leveraging undelaying OBP infrastructure) provides a standard mechanism to customize the domain objects that are provided out of the box. The Dictionary object plays an important role in this mechanism.

This section describes how consultants or other third parties can extend domain and achieve Extensibility. This provides true domain model extension capabilities by allowing addition of custom data fields to the underlying domain objects.

Translating Dictionary data into custom domain object

If dictionary is added to DTO then it is necessary to get customized domain Object which extends base Domain Object. Method `getCustomizedDomainObject` in `AbstractAssembler` is used for the same.

Following image shows call to get Customized domain Object if additional data (Dictionary) is added to the request DTO.

```

public Collaboration toDomainObject(CollaborationDTO collaborationDTO) {
    Collaboration collaboration;
    if (collaborationDTO.getDictionaryArray() != null) {
        try {
            collaboration = (Collaboration) getCustomizedDomainObject(collaborationDTO);
        } catch (java.lang.Exception e) {
            collaboration = new Collaboration();
        }
    } else {
        collaboration = new Collaboration();
    }

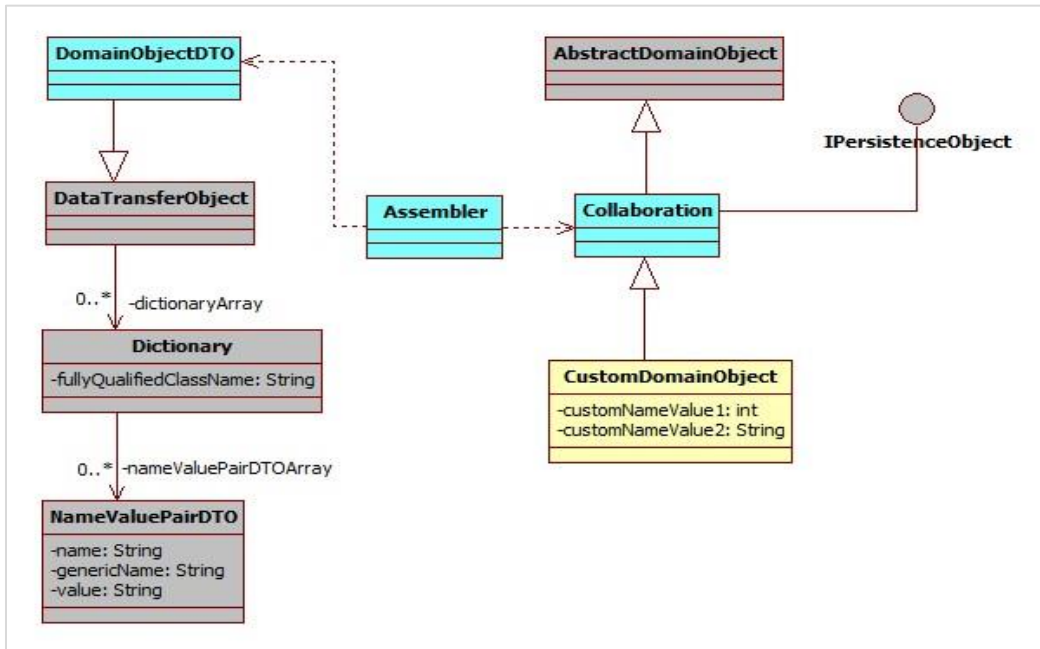
    CollaborationKey collaborationKey = new CollaborationKey();
    if (collaborationDTO.getId() != null) {
        collaborationKey.setId(collaborationDTO.getId());
    }
    collaboration.setExternalRefId(collaborationDTO.getExternalRefId());
    collaboration.setAuthorId(collaborationDTO.getAuthorId());
    collaboration.setAuthorName(collaborationDTO.getAuthorName());
    collaboration.setUrl(collaborationDTO.getUrl());
    collaboration.setExpiryDate(collaborationDTO.getExpiryDate());
    collaboration.setNoOfParticipants(collaborationDTO.getNoOfParticipants());
    collaboration.setCollaborationChannel(collaborationDTO.getCollaborationChannel());
    List<Participant> participantsList = new ArrayList<Participant>();
    if (collaborationDTO.getParticipants() != null && !collaborationDTO.getParticipants().isEmpty()) {
        for (ParticipantDTO participantDTO : collaborationDTO.getParticipants()) {
            Participant participant = new Participant();
            ParticipantKey participantKey = new ParticipantKey();
            participant.setKey(participantKey);
            participant.setInternalPartyId(participantDTO.getInternalPartyId());
            participant.setName(participantDTO.getName());
            participant.setPublishingId(participantDTO.getPublishingId());
            participant.setIsPublished(participantDTO.getIsPublished());
            participantsList.add(participant);
        }
        collaboration.setParticipants(participantsList);
    }
    collaboration.setCollaborationKey(collaborationKey);
    return collaboration;
}

```

Writing Custom Domain Object

The custom domain object must extend existing domain object class. Mapping for same should be done in database as Customized Abstract Domain Object Configuration. This class contains additional fields added at UI layer and getter, setter for the same.

Below diagram shows the custom domain object and also depicts the role of Dictionary in mapping additional fields from DTO to this custom domain object.



For Example:

```

package com.ofss.digx.domain.collaboration.entity.customdemo;

import com.ofss.digx.domain.collaboration.entity.Collaboration;

/**
 * custom domain objet to handle the changes ate UI or pre hoot level
 */
public class CustomCollaborationDomainObject extends Collaboration{

    /**
     */
    private static final long serialVersionUID = 1L;

    /**
     * store the mobile number to call on.
     */
    private String mobileCustomer;

    /**
     * @return the mobileCustomer
     */
    public String getMobileCustomer() {
        return mobileCustomer;
    }

    /**
     * @param mobileCustomer the mobileCustomer to set
     */
    public void setmobileCustomer(String mobileCustomer) {
        this.mobileCustomer = mobileCustomer;
    }
}

```

Configure Customized domain object in database

The domain object created needs to be mapped as a custom domain object for the existing domain object. For example:

```
insert into digx_fw_config_all_b (PROP_ID, CATEGORY_ID, PROP_VALUE,
FACTORY_SHIPPED_FLAG, PROP_COMMENTS, SUMMARY_TEXT, CREATED_BY,
CREATION_DATE, LAST_UPDATED_BY, LAST_UPDATED_DATE, OBJECT_STATUS_FLAG,
OBJECT_VERSION_NUMBER)
```

```
values ('com.ofss.digx.domain.origination.entity.submission.lending.application',
'CustomizedAbstractDomainObjectConfig',
'com.ofss.digx.domain.origination.entity.submission.lending.application.ext.Application', 'N', 'asdf',
'asdf', 'asdf', "", 'asdf', "", 'Y', 1);
```

Three main columns that need to be fed with new information are.

- CATEGORY_ID : "CustomizedAbstractDomainObjectConfig"
- PROP_VALUE:" CLASS NAME of the class implementing the custom domain object "
- PROP_ID:" CLASS NAME of the DomainObject".

ORM Mapping

If this domain needs to be persisted in local database, then you need to create Eclipselink ORM mapping to map fields in the domain to database table. Follow these steps:

- Create new ORM file to handle Customized Domain Object.
- This ORM file should contain entries for all custom columns, which are present in the extension domain.
- The extension domain table will be a secondary table, which will have a primary key join column with the base domain.
- Add an entry for this ORM XML in the mapping configuration XML
- Create new table corresponds to newly created Domain Object.

Newly created ORM file will look like (CollaborationDemo.orm.xml):

```
1 <?xml version="1.0" encoding="UTF-8" standalone="no"?>
2 <entity-mappings xmlns="http://www.eclipse.org/eclipselink/xsds/persistence/orm" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="2.5"
3 xsi:schemaLocation="http://www.eclipse.org/eclipselink/xsds/persistence/orm http://www.eclipse.org/eclipselink/xsds/eclipselink_orm_2_5.xsd">
4   <entity class="com.ofss.digx.domain.collaboration.entity.CustomCollaborationDomainObject" name="CustomCollaborationDomainObject">
5     <secondary-table name="DIGX_CO_COLLABORATION_EXT">
6       <!-- primary key join column with user group table -->
7       <primary-key-join-column name="id" reference-column-name="ID">
8     </secondary-table>
9     <attributes>
10      <basic attribute-type="java.lang.Integer" name="mobileCustomer">
11        <column name="MOBILE_INFO" table="DIGX_CO_COLLABORATION_EXT"/>
12      </basic>
13    </attributes>
14  </entity>
15 </entity-mappings>
```

Now add the newly created mapping ORM entry for the extension domain in your custom jar mapping configuration xml.:

```

1 <?xml version="1.0" encoding="UTF-8"?>
2 <mappings>
3   <mapping resource="orm/eclipselink/mappings/collaboration/ CollaborationDemo. orm. xml" />
4 </mappings>

```

Create/Update “module-cfg.properties” file in your custom jar and add mapping configuration xml file name in it.

```

1 collaboration-mapping-cz.cfg.xml

```

Here Assembler should fetch customized domain object. Following example shows Assembler calls **getCustomizedDomainObject** which returns customized domain object with mapping of **nameValuePairDTOArray** to this customized domain Object internally.

For example:

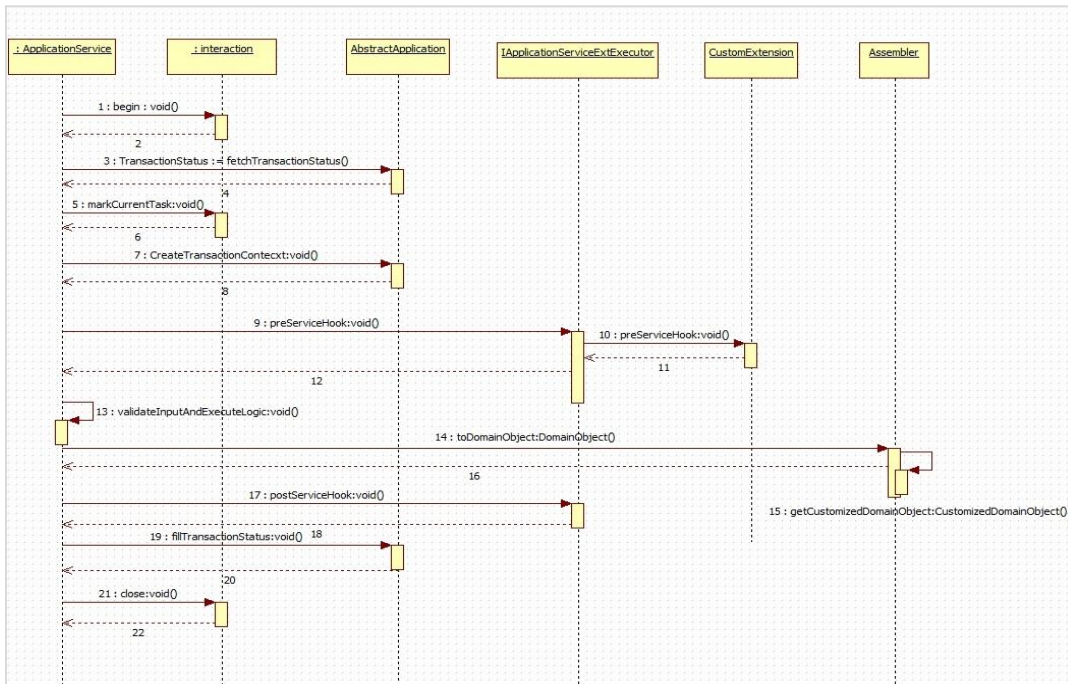
```

public Collaboration toDomainObject(CollaborationDTO collaborationDTO) {
    Collaboration collaboration;
    if (collaborationDTO.getDictionaryArray() != null) {
        try {
            collaboration = (Collaboration) getCustomizedDomainObject(collaborationDTO);
        } catch (java.lang.Exception e) {
            collaboration = new Collaboration();
        }
    } else {
        collaboration = new Collaboration();
    }

    CollaborationKey collaborationKey = new CollaborationKey();
    if (collaborationDTO.getId() != null) {
        collaborationKey.setId(collaborationDTO.getId());
    }
    collaboration.setExternalRefId(collaborationDTO.getExternalRefId());
    collaboration.setAuthorId(collaborationDTO.getAuthorId());
    collaboration.setAuthorName(collaborationDTO.getAuthorName());
    collaboration.setUrl(collaborationDTO.getUrl());
    collaboration.setExpiryDate(collaborationDTO.getExpiryDate());
    collaboration.setNoOfParticipants(collaborationDTO.getNoOfParticipants());
    collaboration.setCollaborationChannel(collaborationDTO.getCollaborationChannel());
    List<Participant> participantsList = new ArrayList<Participant>();
    if (collaborationDTO.getParticipants() != null && !collaborationDTO.getParticipants().isEmpty()) {
        for (ParticipantDTO participantDTO : collaborationDTO.getParticipants()) {
            Participant participant = new Participant();
            ParticipantKey participantKey = new ParticipantKey();
            participant.setKey(participantKey);
            participant.setInternalPartyId(participantDTO.getInternalPartyId());
            participant.setName(participantDTO.getName());
            participant.setPublishingId(participantDTO.getPublishingId());
            participant.setIsPublished(participantDTO.getIsPublished());
            participantsList.add(participant);
        }
        collaboration.setParticipants(participantsList);
    }
    collaboration.setCollaborationKey(collaborationKey);
    return collaboration;
}

```

Sequence Diagram



Configuring this custom domain object at appropriate entity level

```
insert into digx_me_entity_determinant_b (DOMAIN_OBJECT_NAME, DETERMINANT_TYPE,
REPRESENTED_FIELD, IS_FEATURE_ENABLED)
```

```
values ('<Fully qualified domain name>', '<Determinant Type>', '<Represented Name>', 'Y');
```

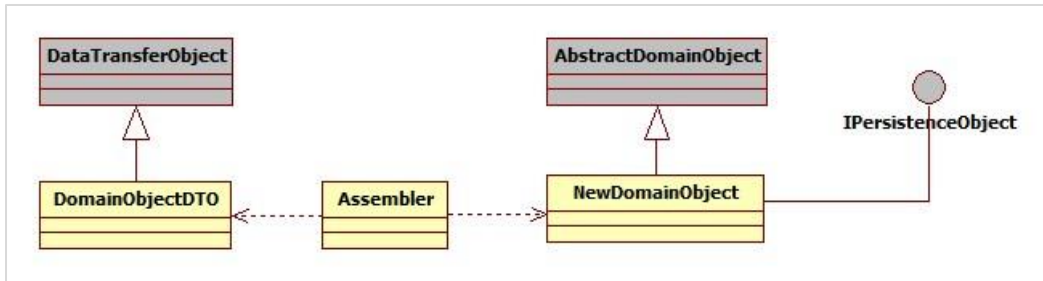
There are four possible determinant types as follows:

- Enterprise (ENT)
- Legal Entity (LGE)
- Market Entity (MKE)
- Business Unit (BNU)

4.5.2 Adding new Domain

The customization developer can add new domain. Below are the steps to add a new domain.

1. Create new domain class. The new domain class must extend AbstractDomainObject and implement IPersistenceObject
2. Identify attributes and operations supported by the domain and add them to above domain class accordingly
3. The domain object will typically have associated DTO that encapsulates same fields as in domain. This DTO will be used in request and responses. An assembler will be used to map fields between domain object and the DTO. Below diagram depicts this relationship.



4. Configure this new domain for appropriate entity level

```
insert into digx_me_entity_determinant_b (DOMAIN_OBJECT_NAME, DETERMINANT_TYPE,
REPRESENTED_FIELD, IS_FEATURE_ENABLED)
```

```
values ('<Fully qualified domain name>', '<Determinant Type>', '<Represented Name>', 'Y');
```

For example,

```
insert into digx_me_entity_determinant_b (DOMAIN_OBJECT_NAME, DETERMINANT_TYPE,
REPRESENTED_FIELD, IS_FEATURE_ENABLED)
```

```
values (' com.ofss.digx.cz.domain.payment.entity.payee.Payee', 'BNU', 'New Payee', 'Y');
```

4.6 Error Messages

If an API fails, it returns an error code and an error message which briefly specifies the failure reason of the API call. Error message is returned from service to convey the cause of transaction failure.

4.6.1 **Adding Error Message**

Error codes with their error messages are stored in DIGX_FW_ERROR_MESSAGES table. One can add a new error message in the table with a unique error code.

ERROR_CODE column should contain unique value.

ERROR_MESSAGE column contains the error message which need to be added.

4.6.2 **Mapping Host Error Code To OBDX Error Code**

When a transaction fails in host, it provides an error code in response to the failed transaction. This error code provided by the host could be mapped with OBDX error code to provide a user friendly error message.

This host error code and OBDX error code mapping is done in DIGX_FW_ERR_COD_MAP table.

THIRD_PARTY_ERR_COD column holds the host error code.

LOCAL_ERR_COD column holds OBDX error code which must be present in DIGX_FW_ERROR_MESSAGES table from where error message will be picked.

4.7 **Adapter Tier**

An adapter, by definition, helps the interfacing or integrating components adapt. In software it represents a coding discipline that helps two different modules or systems to communicate with each other and helps the consuming side adapt to any incompatibility of the invoked interface work together. Incompatibility could be in the form of input data elements which the consumer does not have and hence might require defaulting or the invoked interface might be a third party interface with a different message format requiring message translation. Such functions, which do not form part of the consumer functionality, can be implemented in the adapter layer.

4.7.1 **Service Provider Interface (SPI) Approach**

This section provides information about the SPI approach and how adapters are packaged and derived at runtime based on current entity and domain under consideration.

Service Provider Interface (SPI) is an API intended to be implemented or extended by a third party. It can be used to enable framework extension and replaceable components.

- <https://docs.oracle.com/javase/tutorial/ext/basics/spi.html>
- <http://www.developer.com/java/article.php/3848881/Service-Provider-Interface-Creating-Extensible-Java-Applications.htm>

All the external facing adapters will be loaded using SPI.

Benefits of SPI

- No database entries are required.
- No need of adapter factories.
- Can add adapters at run-time.
- Provides the list of available implementations from which we can use the best suited one.

In this approach adapter is selected using the following call.

```
ExtxfaceAdapterFactory.getInstance().getAdapter(Interface.class, "method", DeterminantType);
```

Here,

- 'Interface.class' is object of interface implemented by the host (external system) adapter.
- 'Method' is name of method which we are intended to call of that adapter.
- DeterminantType is determinant type of the domain from which this call is made.

Sample code is as follows:

```
/**
 * Used to insert/persist LoanApplication Object into database
 *
 * @param object
 *         LoanApplication Object to be persisted
 * @return LoanApplication object that was created.
 * @throws com.ofss.digx.infra.exceptions.Exception
 *
 * @see com.ofss.digx.domain.origination.entity.submission.lending.application.repository.adapter.
 *      ILoanApplicationRepositoryAdapter
 *      #createLoanApplication(com.ofss.digx.domain.origination.entity.submission.lending.application.LoanApplication)
 */
@Override
public LoanApplication createLoanApplication(LoanApplication object) throws Exception {
    ILoanApplicationRequirementAdapter adapter = ExtxfaceAdapterFactory.getInstance().getAdapter(
        ILoanApplicationRequirementAdapter.class, "create",
        DeterminantResolver.getInstance().getDeterminantTypeForObject(LoanApplication.class.getName()));
    LoanApplicationAssembler assembler = new LoanApplicationAssembler();
    LoanApplicationCreateResponseDTO response = adapter.create(object.getKey().getSubmissionId(), assembler.fromDomainObject(object));
    return assembler.toDomainObject(response.getLoanApplicationRequirementDTO());
}
```

Adapter configuration:

For adapter configurations, the preference **ExtxfaceAdapterPreference** is used. This preference contains Entity as key and External System (Host Name + Version) as value. So we can use select external systems (Hosts) on the basis of entity. E.g. For entity 000 we want to use UBS 12.4 and for entity 001 use OBP 2502 then the entries will be

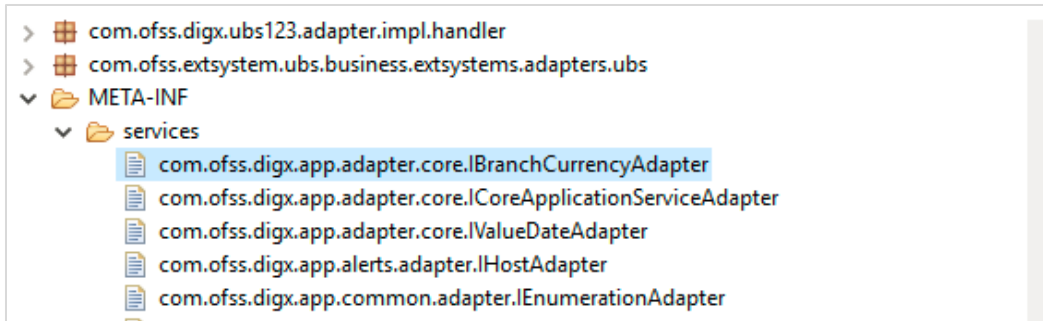
PROP_ID	CATEGORY_ID	PROP_VALUE	FACTORY_SHIPPED_FLAG	PROP_COMMENTS
1 000	extxfaceadapterconfig	UBS12.4	N	(null)
2 001	extxfaceadapterconfig	OBP2502	N	(null)

We can also give multiple External System separated by comma “,” for an entity, and then adapter will get selected on the basis sequences of external systems given in value.

E.g. if the value is UBS12.4,B11.0 then first implementation is searched in UBS 12.4 jar if is not found then it will look in B11.0 jar.

Adapter Registration:

After adding adapter java file in project it need to be register as provider. To register your service provider, create a provider configuration file, which is stored in the META-INF/services directory of the project. The name of the configuration file is the fully qualified class name of the service provider(interface implemented by adapter), and file content which is fully qualified name of the adapter class.



How will system derive adapter?

In the external system interface implementation project like (com.ofss.digx.extxface.ubs124.impl), inside **src/META-INF** folder, we will have a **MANIFEST.MF** file inside which we will define the following attributes:-

Implementation-Title: UBS

Implementation-Version: 12.4

It will tell us that the adapters are for external system UBS 12.4. While adding a new interface implementation project, we need to create MANIFEST.MF file too, defining implementation title and version.

While calling an adapter, we provide three parameters 1. Interface class name 2.method name 3.determinant type(for particular domain class).

Determinant type for particular domain class (digx_me_entity_determinant_b).

DOMAIN_OBJECT_NAME	DETERMINANT_TYPE	REPRESENTED_FIELD	IS_FEATURE_ENABLED
1 com.ofss.digx.domain.payment.entity.merchant.Merchant	LGE	Merchant Maintenance	Y
2 com.ofss.digx.domain.collaboration.entity.mailbox.usergroupsubjectmap	LGE	User Group Subject Map	Y
3 com.ofss.digx.domain.config.entity.ConfigVarBDomain	BNU	ConfigVarB Details	Y
4 com.ofss.digx.domain.report.entity.ReportAdhocRequest	LGE	Report Request	Y
5 com.ofss.digx.domain.fileupload.entity.FileIdentifierRegistration	BNU	FI Registration	Y
6 com.ofss.digx.domain.fileupload.entity.FileDetails	BNU	Uploaded File Details	Y

We match determinant type to market entity, then business unit and then legal entity.

On the first match, we derive the external systems using ExtxfaceAdapterPreference explained above. Then we derive external systems corresponding to others(lower order ones). Thus we have a list(list 1) of external systems in order.

For example, if 1st match is market entity. Then we will have external systems corresponding to entries for market entity, then business unit and finally legal entity if entries are found.(in order).

If 1st match is business unit, then we will have external systems corresponding to entries for business unit and legal entity if found(in order).

Here in the diagram above, for domain class ConfigVarBDomain, determinant_type is BNU(business unit). lets suppose corresponding determinant value is 000.

PROP_ID	CATEGORY_ID	PROP_VALUE	FACTORY_SHIPPED_FLAG	PROP_COMMENTS	SUMMARY...	CREATED_BY	CREATION_DATE	LAST_UPDATED_BY	LAST_UPDATED_DATE
100	extxfaceadapterconfig	UBS12.3,ipm1.0	N	(null)	(null)	ofsuser	26-SEP-17 06:42:09.000000000 AM	ofsuser	26-SEP-17 06:42:09.000000000 AM
001	extxfaceadapterconfig	TP1.0	N	(null)	(null)	Filter...er	26-SEP-17 06:42:09.000000000 AM	ofsuser	26-SEP-17 06:42:09.000000000 AM
301	extxfaceadapterconfig	UBS12.4,ipm1.0	N	(null)	(null)	ofsuser	20-SEP-17 11:31:25.000000000 AM	ofsuser	20-SEP-17 11:31:25.000000000 AM

Now, for prop_id=000, it will fetch extsystems as UBS12.3,ipm1.0.

Now for legal entity(LGE), lets suppose corresponding determinant value is 001. so it will fetch external system as TP1.0.

So we have external system list (list 1) as {UBS12.3,imp1.0,TP1.0};

Also If none matches, we derive external system corresponding to enterprise. for eg. for enterprise, lets suppose corresponding determinant value as 01. so external system list(list 1) will be {UBS12.4,ipm1.0}.

How the adapters are loaded:

Now we will load all those adapter classes, that will implement the interface whcih we get as first parameter. Now we will maintain another list or map (list 2) of external systems to adapter, that we will resolve from all those adapter classes. (How will system know that a adapter belongs to which external system or host?).

We will iterate through list 1(list of external systems that we got from preference entry) in order. When we find the first matching external system in list 2, we will return the corresponding adapter.

For example, we iterate through list 1 : {UBS12.3,imp1.0,TP1.0}. it will first find if loaded adapter class contains adapter that belongs to external system UBS12.3. then it will retun that adapter. if not found, it will search if any loaded adapter class belongs to imp1.0. if found it will return that adapter. if not, then it will similarly go for TP1.0.

How to override an adapter?

One can enter (interface class name + "."+ method name or only interface class name) in ExtxfaceAdapterPreference against which one can specify the adapter that one want to be overridden by.

E.g.

```
Insert into digx_fw_config_all_b
(PROP_ID,CATEGORY_ID,PROP_VALUE,FACTORY_SHIPPED_FLAG,PROP_COMMENTS,S
UMMARY_TEXT,CREATED_BY,CREATION_DATE,LAST_UPDATED_BY,LAST_UPDATED_D
ATE,OBJECT_STATUS,OBJECT_VERSION_NUMBER,EDITABLE,CATEGORY_DESCRIPTOR
N)
```

```
values (<Fully qualified adapter interface name>,'extxfaceadapterconfig', <Fully qualified adapter
implementation name>,'N',null,',','ofsuser', sysdate,'ofsuser', sysdate,'Y',1,'N',null);
```

sample:-

```
Insert into digx_fw_config_all_b
(PROP_ID,CATEGORY_ID,PROP_VALUE,FACTORY_SHIPPED_FLAG,PROP_COMMENTS,S
UMMARY_TEXT,CREATED_BY,CREATION_DATE,LAST_UPDATED_BY,LAST_UPDATED_D
ATE,OBJECT_STATUS,OBJECT_VERSION_NUMBER,EDITABLE,CATEGORY_DESCRIPTOR)
```

```
values ('com.ofss.digx.app.loan.adapter. ILoanAccountAdapter','extxfacadapterconfig',
'com.ofss.digx.extxfac.loan.impl.LoanAccountMockAdapter','N',null,',','ofssuser',
sysdate,'ofssuser', sysdate,'Y',1,'N',null);
```

4.7.2 Adding a custom adapter

Please follow below steps for adding a new custom adapter:

- Create a new project for customized adapter interfaces. Typically, there will be only one customized adapter interfaces project. The name of the project should have the phrase 'cz' indicating that it is customized version. For example, com.ofss.digx.cz.extxfac
- Add required adapter interfaces in this project
- Create another new project for customized adapter implementation classes. Typically, one project will need to be created per entity, however if the core banking host is same for different entities, then one project can be used for multiple entities. This decision should be taken based on implementation scenario. If you are interfacing with any other external system apart from core banking system (e.g. content management system), then separate project should be created for adapters interfacing with such systems.
- Name of the project should be having the phrase 'cz' indicating that it is part of the customization. The name should also include external system name and version. This will bring clarity about contents of the project by looking at the name. The same name will be used for the JAR packaged out of this project. For example, name of the project for customized adapters for UBS 12.4 will be com.ofss.digx.cz.extxfac.ubs124.impl
- The MANIFEST.MF file within this project should have implementation title and implementation version. The implementation title should also capture the phrase 'CZ' to indicate that it is a customized adapter package.

Implementation-Title: CZUBS

Implementation-Version: 12.4

- Write required adapter implementation classes that implement appropriate adapter interface
- Create folder 'META-INF/services' under the 'src' folder.
- Create a file under this 'services' folder with the name as fully qualified name of the adapter interface.
- In this file, write the fully qualified name of the adapter implementation class
- Package the adapter interface in JAR
- Package the adapter implementation project(s) in JAR(s)
- Configure the adapter implementation package in digx_fw_config_all_b. The prop_value should have comma separated external system IDs. For example,

```
Insert into digx_fw_config_all_b
(PROP_ID,CATEGORY_ID,PROP_VALUE,FACTORY_SHIPPED_FLAG,PROP_COMMENTS,SUMMARY_TEXT,CREATED_BY,CREATION_DATE,
LAST_UPDATED_BY, LAST_UPDATED_DATE,OBJECT_STATUS,OBJECT_VERSION_NUMBER,EDITABLE,CATEGORY_DESCRIPTION)
```

```
values ('01','extfaceadapterconfig', 'CZUBS12.4,UBS12.4,ipm1.0','N',null,',','ofssuser',
sysdate,'ofssuser', sysdate,'Y',1,'N',null);
```

- Package all customized adapters in obdx.cz.extsystem.domain.ear and deploy it as a library

Customizing existing adapters (Custom Adapter)

If an added functionality or replacement functionality is required for an existing adapter or existing method in an adapter, the customization developer has to develop a new adapter and corresponding adapter factory and override the method in a new custom adapter class. The custom adapter would have to override and implement the methods which need changes.

```
20 Copyright (c) 2012, Oracle and/or its affiliates. All rights reserved.[]
4 package com.ofss.fc.app.adapter.party;
5
6 import java.util.List;
7
8 import com.ofss.fc.app.context.SessionContext;
9 import com.ofss.fc.app.loan.dto.LoanBalanceInquiryResponse;
10 import com.ofss.fc.app.loan.dto.account.unified.inquiry.LoanAccountUnifiedInquiryResponse;
11 import com.ofss.fc.app.loan.dto.disbursement.loghistory.LoanDisbursementLogHistoryResponse;
12 import com.ofss.fc.app.party.dto.LoanAccountAttributesDTO;
13 import com.ofss.fc.app.party.dto.relation.account.preferences.ChannelFacilitiesDTO;
14 import com.ofss.fc.enumeration.loan.LoanAccountStatusType;
15 import com.ofss.fc.framework.context.ApplicationContext;
16 import com.ofss.fc.infra.exception.FatalException;
17
18 /**
19  * This class serves as the adapter class for the Party and loans Integration mainly for the Single Party View<br>
20  *
21  * @author VallabhM
22  */
23 public interface ICustomerLoansAdapter {
24
25     /**
26      * Service to return all the loans Account information to be displayed in SPIV<br>
27      *
28      * @param applicationContext
29      * @param partyId
30      * @return LoanAccountAttributesDTO
31      */
32     public abstract LoanAccountAttributesDTO[] fetchLoanAccountsInformation(ApplicationContext applicationContext, String partyId);
33
34     public abstract void fetchLNInformation(String accountId);
35
36     /**
37      * Maintain primary Account Holder ID for Loan Account.
38      *
39      * @param accountId
40      * @param newPartyId
41      */
42     public void primaryAccountHolderIDMaintenance(String accountId, String newPartyId);
43
44     /**
45      * @param loanAccounts
46      * @param LoanAccountStatusType
47      */
48     public abstract void modifyStatusOfLoanAccounts(List<String> loanAccounts, LoanAccountStatusType LoanAccountStatusType);
49
50     /**
51      * Method to fetch Outstanding, RPA and unclear balances for a given loan account
52      * @param accountId
53      * @throws FatalException
54      */
55
56     public abstract LoanBalanceInquiryResponse inquireLoanBalance(ApplicationContext applicationContext, String accountId) throws FatalException;
57
58 }
```

Custom Adapter Example

We take the example of `LoanApplicationRequirementAdapter`. For example the requirement is to send an email alert when the requirements of a particular loan application are updated. The OBDX application by default does not provide any integration with an SMTP/Email server. The additional interfacing with the gateway can be done in the custom adapter. . The following steps would have to be followed for implementation of a custom `LoanApplicationRequirementAdapter`.

Develop a `CustomLoanApplicationRequirementAdapter` and `CustomLoanApplicationRequirementAdapterFactory`. As a guideline, the custom adapter should extend the existing adapter and override the methods which needs to be replaced with new functionality.

For Example:

```

29         logger.log(
30             Level.SEVERE,
31             formatter
32                 .formatMessage(
33                     "Remote Webservice call Failed while "
34                     + "updating loan requirements for submission id: %s in update method of LoanApplicationRequirementAdapter",
35                     submissionId));
36     }
37     responseHandler.translateAndThrow(e, this.getClass());
38 }
39 } catch (FatalException e) {
40     if (logger.isLoggable(Level.SEVERE)) {
41         logger.log(
42             Level.SEVERE,
43             formatter
44                 .formatMessage(
45                     "Failed while "
46                     + "updating loan requirements for submission id: %s in update method of LoanApplicationRequirementAdapter",
47                     submissionId));
48         logger.log(Level.SEVERE, formatter.formatMessage("Error: ", e));
49     }
50     responseHandler.exceptionForUpdate(e, e.getFaultInfo());
51 }
52 responseHandler.fillTransactionStatus(response.getStatus());
53 loanApplicationRequirement.setFacilityId(response.getFacilityId());
54 loanApplicationRequirement.setProductGroupSerialNumber(response.getProductGroupSerialNumber());
55 loanUpdateResponse.setLoanApplicationRequirementDTO(loanApplicationRequirement);
56
57 // Your code for the SMTP mail client invocation goes here.
58 Properties props = new Properties();
59 props.setProperty("mail.smtp.host", "smtp.example.com");
60
61 Session session = Session.getInstance(props, null);
62 Transport transport = session.getTransport("smtp");
63 transport.connect("user", "password");
64
65 Message message = new MimeMessage(session);
66 message.setSubject("Test");
67 message.setText("Hello : )");
68 message.setFrom(new InternetAddress("you@example.com"));
69 message.setRecipient(Message.RecipientType.TO, new InternetAddress("your-friend@example.com"));
70 transport.sendMessage(message, message.getAllRecipients());
71
72 if (logger.isLoggable(Level.FINE)) {
73     logger.log(Level.FINE, formatter.formatMessage(
74         "Exiting from method create of LoanApplicationRequirementAdapter loanCreationResponse = %s",
75         loanUpdateResponse));
76 }
77 return loanUpdateResponse;
78 }
79
80 /**
81  * Reads the loan requirement set by the party from the application resource. Returns the instance of loan
82  * requirement that is set by the party. Fetches all lending product details and return first lending product ,if

```

Custom Adapter Configuration

insert into digx_fw_config_all_b (PROP_ID, CATEGORY_ID, PROP_VALUE, FACTORY_SHIPPED_FLAG, PROP_COMMENTS, SUMMARY_TEXT, CREATED_BY, CREATION_DATE, LAST_UPDATED_BY, LAST_UPDATED_DATE, OBJECT_STATUS_FLAG, OBJECT_VERSION_NUMBER)

values ('IS_LOAN_APPLICATION_REQUIREMNT_ADAPTER_CUSTOM', 'customadapterconfig', 'true', 'N', 'asdf', 'asdf', 'asdf', '', 'asdf', '', 'Y', 1);

4.7.3 Host adapter extension to populate pagination information

This extension feature helps developer to provide information regarding pagination from the host system. This will be typically used in inquiry transactions where large number of records is expected in response. To display such large data, pagination approach is used in user interface to display limited number of records at a time. Based on user action the subsequent records are fetched. The pagination information provided by this extension can be used in UI layer to display pagination response as per developer's requirement. The supported extension parameters are –

- *more* : a Boolean field to represent if any more data is available in response
- *totalRecords* : an Integer containing total number of records for the respective query
- *startSequence* : an Integer which can typically contain the sequence number of the first record in the next pagination records list.

To use the above extension following steps need to be executed.

- The response DTO of service should implement '*com.ofss.digx.app.dto.Ipaginable*' interface and should override all the methods of this interface.
- Add following snippet in respective *extxface* adapter after calling '*HostAdapterManager.processRequest(hostRequest)*'.

```
Map<Class<?>, PaginationResponseInfo> paginationInfo = new HashMap<>();
if (ThreadAttribute.get(ThreadAttribute.PAGINATION_INFO_MAP) != null
    && ThreadAttribute.get(ThreadAttribute.PAGINATION_INFO_MAP) instanceof HashMap) {
    paginationInfo = (Map<Class<?>, PaginationResponseInfo>) ThreadAttribute
        .get(ThreadAttribute.PAGINATION_INFO_MAP);
}

PaginationResponseInfo paginationValueDTO = new PaginationResponseInfo();
paginationValueDTO.setMore(hostResponse.hasMore());
paginationValueDTO.setTotalRecords(hostResponse.totalRecords());
paginationValueDTO.setStartSequence(hostResponse.startSequence());

paginationInfo.put(DemandDepositFinancialStatementItemDTO.class, paginationValueDTO);
ThreadAttribute.set(ThreadAttribute.PAGINATION_INFO_MAP, paginationInfo);
```

The host specific adapter should return values for 'hasMore', 'totalRecords', 'startSequence' in order to set the same in the Thread attribute.

- The extension parameters set in the thread attribute will be available in the REST response as follows:

```
{
  "status": {
    "result": "SUCCESSFUL",
    "contextID": "005XFr0LFdnFw0K6yVvX6G00002q0000KR,0&#x3a;1",
    "..."
  },
  "accountingEntryBasisType": "T",
  "more": true,
  "items": [
    {
      "postingDate": "2014-01-03T00:00:00",
      "valueDate": "2014-01-03T00:00:00",
      "..."
    }
  ],
  "party": {
    "partyId": {
      "displayValue": "***366",
      "value": "002366"
    },
    "partyName": "Jack Johnson"
  },
  "startSequence": 12,
  "status": {
    "result": "SUCCESSFUL",
    "contextID": "005XFr0LFdnFw0K6yVvX6G00002q0000KR,0&#x3a;1",
    "..."
  },
  "totalRecords": 67
}
```

4.8 Outbound web service extensions

The outbound webservice configurations are set of properties defined to invoke services from the host. The host is the core bank system where the business logic for core banking facilities is written and contains the corresponding services to access that data. The existing OBDX application has an Adapter layer which directly interacts with the host. There are extension endpoints available for configuring a different host in the adapter layer. Following steps need to be followed:

Using your own web service constants

The web service constants will change depending on the WSDL specification provided by the host system. An Example WebServiceConstants file is shown below:

```

1 package com.ofss.digx.common;
2
3 /**
4  * Constants for web service invocation from the adapter implementation.
5  */
6 public class WebserviceConstants {
7
8     /**
9      * Holds the service name to be invoked from the adapter.
10    */
11
12    public static final String PRODUCT_MANUFACTURING_APPLICATION_SERVICE = "ProductManufacturingApplicationServiceSpi";
13
14    /**
15     * Holds the Offer Inquiry Application service name to be invoked from the adapter.
16     */
17    public static final String OFFER_INQUIRY_APPLICATION_SERVICE_SPI = "OfferInquiryApplicationServiceSpi";
18    /**
19     * Holds the Purpose Application Service Spi name to be invoked from the adapter.
20     */
21    public static final String PURPOSE_APPLICATION_SERVICE_SPI = "PurposeApplicationServiceSpi";
22    /**
23     * Holds the Submission Creation Application Service Spi name to be invoked from the adapter.
24     */
25    public static final String SUBMISSION_CREATION_APPLICATION_SERVICE_SPI = "SubmissionCreationApplicationServiceSpi";
26
27    /**
28     * Holds the Submission Product Application Service Spi name to be invoked from the adapter.
29     */
30    public static final String SUBMISSION_PRODUCT_APPLICATION_SERVICE_SPI = "SubmissionProductApplicationServiceSpi";
31
32    /**
33     * Holds the Detailed Application Tracker Application Service Spi name to be invoked from the adapter.
34     */
35    public static final String DETAILED_APPLICATION_TRACKER_APPLICATION_SERVICE_SPI = "DetailedApplicationTrackerApplicationServiceSpi";
36
37    /**
38     * Holds the operation name to fetch list of all product groups.
39     */
40    public static final String FETCH_ALL_PRODUCT_GROUPS = "fetchAllProductGroups";
41
42    /**
43     * Holds the operation name to fetch list of all products for the group code.
44     */
45    public static final String FETCH_ALL_PRODUCTS_FOR_GROUP_CODE = "fetchAllProductsForGroupCode";
46
47    /**
48     * Holds the method name of host to fetch offers linked to product.
49     */
50    public static final String FETCH_OFFERS_LINKED_TO_PRODUCT = "fetchOffersLinkedToProduct";
51    /**
52     * Holds the method name of host to fetch purpose code linked to a group code.
53     */
54    public static final String FETCH_PURPOSE_CODES_FOR_GROUP_CODE = "fetchPurposeCodesForGroupCode";

```

Web service configuration

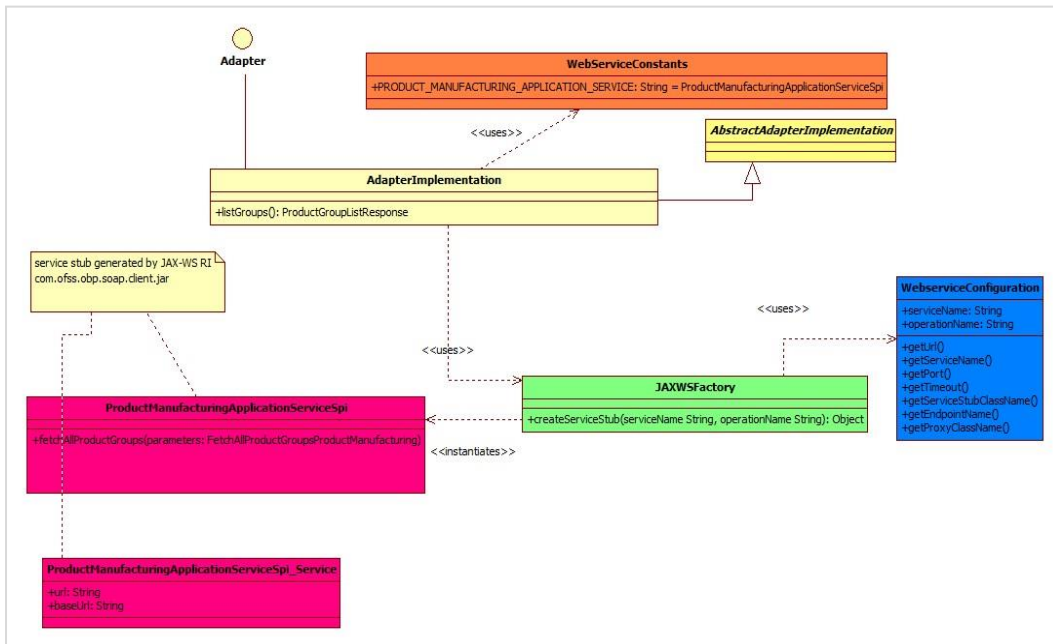
digx_fw_config_out_ws_cfg_b. Holds the entries for the host service endpoints.

For Example:

```
insert into digx_fw_config_out_ws_cfg_b (SERVICE_ID, PROCESS, URL, ENDPOINT_URL,
NAMESPACE, TIME_OUT, SERVICE, STUB_CLASS, SECURITY_POLICY,
ENDPOINT_NAME, STUB_SERVICE, HTTP_BASIC_AUTH_CONNECTOR,
HTTP_BASIC_AUTH_REALM, PROXY_CLASS_NAME, IP, PORT, USERNAME, PASSWORD,
CREATED_BY, LAST_UPDATED_BY, CREATION_DATE, LAST_UPDATED_DATE,
OBJECT_STATUS, OBJECT_VERSION_NUMBER, ANONYMOUS_SECURITY_POLICY,
ANONYMOUS_SECURITY_KEY_NAME)
```

```
values ('inquireApplication', 'BaseApplicationServiceSpi',
'http://ofss310406.in.oracle.com:8001/com.ofss.fc.webservice/services/origination/BaseApplicati
onServiceSpi?wsdl', '',
'http://application.core.service.origination.appx.fc.ofss.com/BaseApplicationServiceSpi',
1200000, 'BaseApplicationServiceSpi', '', '', 'BaseApplicationServiceSpiPort',
'com.ofss.fc.appx.origination.service.core.application.baseapplicationservice
```

Class Diagram



Client Jar

Generate the corresponding service stubs from the WSDL specifications using The JAX-WS RI tool. Package the generated code as a jar and include it in the Adapter implementation.

Custom Adapter

Lastly create a custom adapter to handle the changes made in the host configurations. The custom adapter will be using the JAXWSFactory to create instances of the desired service stubs. The rest of the custom adapter implementation is the same as mentioned in the section 5.3

For example:

```

100 duration.setDays(loanApplicationRequirement.getRequestedTenure().getDays());
101 duration.setMonths(loanApplicationRequirement.getRequestedTenure().getMonths());
102 duration.setYears(loanApplicationRequirement.getRequestedTenure().getYears());
103
104 loanProduct.setRequestedAmount(money);
105 loanProduct.setRequestedTenor(duration);
106 loanProduct.setPurpose(loanApplicationRequirement.getPurpose());
107 loanProduct.setPurposeType(PurposeTypes.valueOf(loanApplicationRequirement.getPurposeType()));
108 loanProduct.setIsCapitalizeFeesOpted(loanApplicationRequirement.getIsCapitalizeFeesOpted());
109 loanProduct.setIsSettlementRequired(loanApplicationRequirement.getIsSettlementRequired());
110 loanProduct.setProductGroupId(loanApplicationRequirement.getProductGroupId());
111 loanProduct.setProductGroupName(loanApplicationRequirement.getProductGroupName());
112
113 AddNewLoanProductSubmissionProduct newProduct = new AddNewLoanProductSubmissionProduct();
114 newProduct.setSessionContext(AdapterContextHelper.getInstance().getContext());
115 newProduct.setSubmissionId(submissionId);
116 newProduct.setLoanProductDTO(loanProduct);
117 LoanProductResponse response = null;
118
119 SubmissionProductApplicationServiceSpi clientProcess = null;
120 try {
121     clientProcess = (SubmissionProductApplicationServiceSpi) JAXWSFactory.createServiceStub(
122         webserviceConstants.SUBMISSION_PRODUCT_APPLICATION_SERVICE_SPI,
123         webserviceConstants.ADD_NEW_LOAN_PRODUCT);
124     response = clientProcess.addNewLoanProduct(newProduct).getReturn();
125 } catch (WebServiceException e) {
126     if (Logger.isLoggable(Level.SEVERE)) {
127         logger.log(
128             Level.SEVERE,
129             formatter
130                 .formatMessage(
131                     "Remote Webservice call Failed while "
132                     + "creating loan requirements for submission id: %s in create method of LoanApplicationRequirementAdapter",
133                     submissionId));
134     }
135     responseHandler.translateAndThrow(e, this.getClass());
136 } catch (FatalException e) {
137     if (Logger.isLoggable(Level.SEVERE)) {
138         logger.log(
139             Level.SEVERE,
140             formatter
141                 .formatMessage(
142                     "Failed while "
143                     + "creating loan requirements for submission id: %s in create method of LoanApplicationRequirementAdapter",
144                     submissionId));
145         logger.log(Level.SEVERE, formatter.formatMessage("Error: ", e));
146     }
147     responseHandler.exceptionForCreate(e, e.getFaultInfo());
148 }
149 responseHandler.fillTransactionStatus(response.getStatus());
150 loanCreationResponse.setSubmissionId(submissionId);
151 loanApplicationRequirement.setFacilityId(response.getFacilityId());
152 loanApplicationRequirement.setProductGroupSerialNumber(response.getProductGroupSerialNumber());

```

4.9 Security Customizations

OBDX comprising of several modules has to interface with various systems in an enterprise to transfer/share data which is generated during business activity that takes place during teller operations or processing. While managing the transactions that are within OBDX, it is needed to consider security & identity management and the uniform way in which these services need to be consumed by all applications in the enterprise.

OBDX provides a mechanism for creating permissions and role based authorization model that controls access of the user to OBDX services.

4.9.1 Out of box seeding of policies

When the application is installed, access policies are seeded for Day 0 configuration and access point definition by default.

The application is shipped with a CSV file – Day0Policy.csv, the policy data to be seeded by default.

4.10 Taxonomy Validations

For extensions in taxonomy validations, please refer to **Oracle Banking Digital Experience Taxonomy Configuration Guide.pdf**

4.11 Authentication Extensibility

OBDX now supports authentication extensibility for users based on enterprise roles. This can be done by following the below steps -

1. Need to write own Java class to implement authentication. Different classes can be used for different enterprise roles.
2. The custom classes must implement **com.ofss.digx.app.sms.handlers.credentials.ICredentialsManager**. Below methods need to be implemented -

create - This method is to be used to create a user on the external system

```
public void create(AbstractUser user) throws Exception;
```

update - This method is to be used to update the user on the external system

```
public boolean update(User user, boolean isPasswordSystemGenerated) throws Exception;
```

verify - This method is to be used to authenticate the user on the external system

```
public boolean verify(String name, String newPassword, String currentPassword) throws Exception;
```

3. The classes' fully qualified names have to be updated in **DIGX_FW_CONFIG_ALL_B** against prop_ids - **credentials_manager_administrator**, **credentials_manager_corporateuser**, **credentials_manager_retailuser**. By default all three currently have **com.ofss.digx.app.sms.handlers.credentials.LocalCredentialsManager** as prop_value.

4.12 Miscellaneous

This section lists some other features in OBDX platform that can be extended

4.12.1 Task Configurations

Task Registration:

Every new service to be integrated as a part of **OBDX** needs to provide a task code. This task code is required while integrating the service with various infrastructural aspects applicable to the service. Few examples of infrastructural aspects or cross cutting concerns provided out of the box with **OBDX** are:

- **Limits**
- **Approvals**
- **Two Factor Authentication**
- **Transaction Blackout**
- **Working Window**
- **Account Relationship**

Guidelines for formulating a task code are as follows:

A task code should ideally comprise of 3 parts:

1. **Module Name** : The first 2 alphabets representing the module to which the service in question belongs. eg TD represents Term Deposits module.
2. **Task Type(type of service)** : OBDX supports the following 6 types of services.
 - a. **FINANCIAL_TRANSACTION(F)** : Any transaction as a result of which there is a change in the status of the finances of accounts of the participating parties. In general any transaction that involves monetary transfer between parties via their accounts. Few examples include Self transfer, New deposit(Open term deposit), Bill payment etc.
 - b. **NONFINANCIAL_TRANSACTION(N)** : Any transaction that pertains to an account but there is no monetary payment or transfer involved in it. For example Cheque book request.
 - c. **INQUIRY(I)** : Any read only transaction supported in OBDX that does not manipulate any business domain of the financial institution. For example list debit cards, read loan repayment details, fetch term deposit penalties etc.

- d. **ADMINISTRATION(A)** : Transactions performed by bank admins and corporate admins for a party come under this category. Few examples of such transactions include limit definition, limit package definition, user creation, rule creation and various others.
 - e. **MAINTENANCE(M)** : Maintenances done by a party for itself fall under this category. Maintenance transactions performed by a non admin user which does not involve any account or monetary transaction comprise of this transaction type. Example add biller.
 - f. **COMMON(C)** : Common transactions include transactions which do not fall under any of the above mentioned categorization. Example login.
So 1 alphabet F,N,I,A,M or C for each of the above mentioned task types respectively forms the second part of the task code.
3. **Abbreviation for service name** : A 3 to 10 lettered abbreviation for the service name. Example OTD for Open Term Deposit.
All the above mentioned 3 parts are delimited by an underscore character.
Example : TD_F_OTD where TD represents module name. F represents that its a financial transaction i.e. task type and OTD is the abbreviated form of the transaction(service) name.

Task Aspects:

An 'aspect' of a task is a behavior or feature supported by the task. OBDX framework defines a set of aspects that can be supported by a task in the system. These aspects need to be configured in table DIGX_CM_TASK_ASPECTS. So if a task supports given aspect, then only its entry should be made in this table. If for any task, entry does not exist in this table for given aspect, then system treats it as that aspect is not supported by the task.

Additionally an aspect can be temporarily disabled using the 'ENABLED' column of this table. If the 'ENABLED' value is set as 'N', then system will treat it as this aspect is not supported by the task. Note that if a task is never going to support an aspect, then its entry should not be there in DIGX_CM_TASK_ASPECTS table. The 'ENABLED'='N' option for disabling aspect should be used only when the task generally supports the aspect but it needs to be disabled for small duration.

Note that just having an entry in this table does not imply that the feature will be enabled for the task. The entry in this table only tells that system that the task supports this feature. Individual feature might need further configurations for them to work properly.

List of aspects supported by OBDX framework is listed below. Please note that aspects are not extensible – in other words it is not possible to add new aspects as part of customization.

Aspect	Description
grace-period	<p>Indicates that the task supports grace period. Grace period is an additional period offered by Approval framework for approving a transaction</p> <hr/> <p>Note: Grace Period will be applicable for the transactions with due date only.</p>

ereceipt	Indicates that the task supports generation of e-receipts
audit	Indicates that the task supports audit logging
2fa	Indicates that the task supports two factor authentication
working-window	Indicates that the task supports working window
approval	Indicates that the task supports approval
blackout	Indicates that the task supports blackout
limit	Indicates that the task supports limit
Account Relationship	Indicates that the task supports account relationship check

Steps to register a task with OBDX:

The task code needs to be configured in the database table DIGX_CM_TASK. For example if we consider Open Term Deposit then the below query fulfills the requirement mentioned in this step.

```
Insert into DIGX_CM_TASK (ID, NAME, PARENT_ID, EXECUTABLE, TASK_TYPE, MODULE_TYPE,
CREATED_BY,
CREATION_DATE, LAST_UPDATED_BY, LAST_UPDATED_DATE, OBJECT_STATUS,
OBJECT_VERSION_NUMBER) values ('TD_F_OTD', 'New Deposit', 'TD_F', 'Y',
'FINANCIAL_TRANSACTION', 'TD', 'ofssuser', sysdate, 'ofssuser', sysdate, null, 1);
```

As evident from the above query example Tasks have a hierarchy. Every task might have a parent task denoted by the task code value held by the PARENT_ID column of DIGX_CM_TASK. In most of the cases its a 3 level hierarchy.

- Leaf level tasks to which services are mapped at the lowest level
- Task representing the module to which the service belongs at the mid level
- Task representing the task type at the root level

For instance consider the task code AP_N_CUG which represents the Usergroup creation service under module approvals(AP). So the PARENT_ID column of task AP_N_CUG(leaf level task) has task code as AP(mid level task). If we look at the entry for task code AP(mid level task) then the value in the PARENT_ID column of DIGX_CM_TASK has MT(root level task) which is the task code representing task type ADMINISTRATION. The leaf level task has 'Y' as the value in its EXECUTABLE column. The mid level and root level tasks have 'N' as the value in its EXECUTABLE column.

Step 2 – Configure aspects supported by the task. For example, if above task supports blackout, approval and working window, then following entries should be made.

```
Insert into DIGX_CM_TASK_ASPECTS (TASK_ID,ASPECT,ENABLED)
values ('TD_F_OTD','approval','Y');
```

```
Insert into DIGX_CM_TASK_ASPECTS (TASK_ID,ASPECT,ENABLED)
values ('TD_F_OTD','working-window','Y');
```

```
Insert into DIGX_CM_TASK_ASPECTS (TASK_ID,ASPECT,ENABLED)
values ('TD_F_OTD','blackout','Y');
```

Step 3 - Register the newly created service against this task.

For this step firstly, you need to get the service id for your service(transaction). Service id is the fully qualified name of the

class appended by the dot character (.) and the method name. For example taking open term deposit into consideration, the business

logic for the service is encapsulated in the method named create of the service

class com.ofss.digx.app.td.service.account.core.TermDeposit.

Hence the service id is derived as

: com.ofss.digx.app.td.service.account.core.TermDeposit.create

Secondly the below query fulfills the requirement mentioned in this step.

```
insert into DIGX_CM_RESOURCE_TASK_REL (ID, RESOURCE_NAME, TASK_ID,
CREATED_BY, CREATION_DATE, LAST_UPDATED_BY, LAST_UPDATED_DATE,
OBJECT_STATUS, OBJECT_VERSION_NUMBER) values ('1',
'com.ofss.digx.app.td.service.account.core.TermDeposit.create', 'TD_F_OTD', 'ofssuser',
sysdate, 'ofssuser', sysdate, null,1);
```

The aforesaid procedure enrolls your newly created service as a task in OBDX.

Managing Task Aspects for Custom Requirements

Out of the Box behaviour:

Every DML service in OBDX application is associated with a Task. A Task in obdx can be associated to one or more Task Aspects like Approval, Limits, Two Factor Authentication etc.

Probable Requirement: In a special scenario while invoking a service a financial institution might want to toggle a task aspect for a task.

For such requirements we provide a configuration called taskEvaluatorFactories. This config can be checked in the application using below query.

```
select * from digx_fw_config_all_b where category_id = 'taskEvaluatorFactories';
```

Every TaskEvaluatorFactory is configured against a TASK_ID.

Every TaskEvaluatorfactory class configured here implements the below interface:

```
com.ofss.digx.framework.task.evaluator.ITaskEvaluatorFactory
```

which has the below method declaration

```
public ITaskEvaluator getEvaluator(TaskAspect taskAspect);
```

Inputs: TaskAspect for which the default behaviour is needed to be changed. For example if TaskAspect approvals need to be toggled then only that evaluator can be implemented and its instance can be returned. Rest all TaskAspects can continue using their default evaluators.

Output: Implementation of class ITaskEvaluator explained below.

that means TaskEvaluatorFactory takes a Task Aspect as an input and returns a TaskEvaluator. Every TaskEvaluator is a class that implements the ITaskEvaluator

which has the below method declaration

public String evaluateTaskCode(String taskCode, List<Object> serviceInputs) throws Exception;

Inputs: taskCode - the current task code configured in the system as per the service invoked.

serviceInputs - the arguments passed to the first service called from rest. These arguments help in deducing the logic whether the special condition is met or not in which we wish to toggle the TaskAspect.

Output: String that is a new TaskCode(not the one passed as an input) for which we have configured the TaskAspect in a way different than the default taskcode(the one passed as an input to evaluateTaskCode).

Hypothetical Sample Requirement:

OBDX application should not ask for the configured 2nd Factor Authentication in case of payments made for less than a pre-configured amount.

Process:

Step 1: insert a new TaskCode in the application by making an entry in the table digx_cm_task.

Step 2: configure the TaskAspects for this new task such that 2fa is disabled by making appropriate entries in the table digx_cm_task_aspects.

Step 3: Write a TaskEvaluator as mentioned above such that with the help of serviceInputs it figures out that the amount getting transferred in this payment is less than pre-configured amount and hence returns the Task Code created in Step 1. If the amount is greater than the pre-configured amount, then it returns the task code passed as an input.

Step 4: Write a TaskEvaluatorFactory as explained above. This new TaskEvaluatorFactory can extend the preconfigured(default) TaskEvaluatorFactory such that for TaskAspects other than TWO_FACTOR_AUTHENTICATION it can return same TaskEvaluator as the preconfigured TaskEvaluatorFactory. For TaskAspect TWO_FACTOR_AUTHENTICATION it returns the newly created TaskEvaluator written in Step 3.

Step 5: Configure this TaskEvaluatorFactory in the Database against the TaskCode for payments such that this gets called instead of the one provided by OBDX out of the box.

Limit Configuration

The below procedure describes the steps required to enable Limits for a newly developed service.

A prerequisite to this configuration is that this newly developed service should be registered as a task in OBDX. Refer "[Task Registration](#)" section for further details. **The types of Limits supported by the system are:**

- Periodic Limit(Cumulative) : Limits that get reset after the expiration of a period. Example Daily-limits.
- Duration Limit(Cooling Period) : Limits that get applicable after the occurrence of an event, for instance payee creation, and then are applicable for the specified duration after commencement of the event.

- Transaction Limit : Limits applicable to each invocation of a transaction. Holds minimum and maximum amount that can be transacted in a single transaction invocation.

Limits are applicable to targets. The types of targets supported by OBDX are Task and Payee.

- Task : Any service developed as a part of OBDX and registered as a task as mentioned in earlier sections
- Payee : A payee resource created via Payee creation transaction in OBDX.

To enable limits for a service, rather for a task mapped to the service to be precise, we need to follow the below mentioned steps:

- Ensure that the 'limit' aspect is configured in DIGX_CM_TASK_ASPECTS table and ENABLED column is updated as 'Y' for your task id.
- **Step 2.** Register taskEvaluatorFactory for your task code.
This needs an insert in **DIGX_FW_CONFIG_ALL_B** table under the category_id '**taskEvaluatorFactories**' as shown below

```
Insert into DIGX_FW_CONFIG_ALL_B (PROP_ID, CATEGORY_ID, PROP_VALUE,
FACTORY_SHIPPED_FLAG, PROP_COMMENTS, SUMMARY_TEXT, CREATED_BY,
CREATION_DATE, LAST_UPDATED_BY, LAST_UPDATED_DATE, OBJECT_STATUS,
OBJECT_VERSION_NUMBER) values (<<taskcode>>, 'taskEvaluatorFactories',
'com.ofss.digx.framework.task.evaluator.DefaultTaskEvaluatorFactory', 'N',
null, 'Task Evaluator Factory for Mixed FT', 'ofssuser', sysdate, 'ofssuser', sysdate,
'Y', 1);
```

4. Code a LimitDataEvaluator for the task. LimitDataEvaluator is a class that extends AbstractLimitDataEvaluator class present in com.ofss.digx.finlimit.core.jar. This class is an abstract class which has only 1 abstract method having signature as shown below:

```
/**
 * provide {@link AbstractAspectData} of currently executing task.
 *
 * @param serviceInputs
 *       the service inputs
 * @return {@link AbstractAspectData} required for limit utilization and validation
 * @throws Exception
 */
public T evaluate(List<Object> serviceParameters) throws Exception
```

This method receives a List<Object> as an input. This list has all the arguments that were passed to the newly coded service for which limits needs to be enabled. For instance, consider the service to open a termed deposit. Signature of the service is as shown below.

```
public TermDepositAccountResponseDTO create(SessionContext sessionContext,
TermDepositAccountDTO termDepositAccountDTO) throws Exception
```

In this case when the LimitDataEvaluator coded for open term deposit task i.e. TD_F_OTD is invoked by the OBDX framework, the serviceInputs argument of evaluate method will contain 2 objects in the list namely SessionContext and TermDepositAccountDTO. The return type of evaluate method is LimitData. The state of a LimitData object comprises of three variables:

- **CurrencyAmount** : an Object of type CurrencyAmount which represents the monetary amount involved in the ongoing transaction along with the currency in the transfer or payment is made.
- **payee** : An object of type PayeeDTO. Needs to be populated in case a payee is involved in the transaction.
- **limitTypesToBeValidated** : A list of LimitTypes. For all unexceptional practical purposes this needs to be populated as shown below:

```
limitTypesToBeValidated = new
ArrayList<LimitType>(Arrays.asList(LimitType.PERIODIC,LimitType.DURATION,LimitType.TRAN
SACTION));
```

These 3 fields in case applicable needs to be derived from the argument serviceInputs and populated in the returned LimitData object.

- Register the LimitDataEvaluator coded in Step 3.

This needs an insert in **DIGX_FW_CONFIG_ALL_B** table under the category_id **'limitDataEvaluator'** as shown below

```
Insert into DIGX_FW_CONFIG_ALL_B (PROP_ID, CATEGORY_ID,PROP_VALUE,
FACTORY_SHIPPED_FLAG, PROP_COMMENTS, SUMMARY_TEXT, CREATED_BY,
CREATION_DATE,
LAST_UPDATED_BY, LAST_UPDATED_DATE, OBJECT_STATUS,
OBJECT_VERSION_NUMBER)
values (<<task code>>, 'limitDataEvaluator', <<limitDataEvaluator>>, 'N',
'Limit data evaluator for <<service name>> service', null, 'ofssuser', sysdate, 'ofssuser',
sysdate, 'A', 1);
```

In the above query <<task code>> is the task code for the service, <limitDataEvaluator> is the fully qualified name of the class coded in Step 3. <<service name>> is a descriptive name for the service.

- **Step 5.** Code a TargetEvaluator for your task.

Note: This step is needed only if your task requires limits involving Payees. Example Duration Limits and payee limits.

Payee limits are Periodic and Transactional limits applied on a Payee.

TargetEvaluator is a class that implements ITargetEvaluator interface. ITargetEvaluator is a functional interface that has only 1 method as shown below :

```
/**
 * Evaluates the Target details for the given evaluated task code and service inputs in the form of
 * {@link TargetDTO}.
 *
 * @param evaluatedTaskCode
 * the given evaluated task code
 * @param serviceInputs
 * inputs of the service using this evaluator
 * @return target details of the target for this task code and service inputs in the form of {@link
 * TargetDTO}.
 * @throws Exception
 * exception while evaluating {@link TargetDTO}
 */
public TargetDTO evaluate(String evaluatedTaskCode, List<Object> serviceInputs) throws
Exception;
```

This method accepts the task code and serviceInputs in case something needs to be derived from the arguments passed to the service.

It returns a TargetDTO. TargetDTO has an id, name, value and TargetTypeDTO. TargetType tells whether the target is of type task or payee. If the TargetType is TASK then the variable value of TargetDTO holds the task code for the service.

If the TargetType is PAYEE then the variable value of TargetDTO holds the payeeld of the payee involved in the service.

As this step is required only for limits pertaining to payees so TargetType will be PAYEE and targetDTO's value will be payeeld.

Register the TargetEvaluator coded in Step 5.

Note: This step is needed only if your task requires limits involving Payees. Example Duration Limits and payee limits.

Payee limits are Periodic and Transactional limits applied on a Payee.

This needs an insert in **DIGX_FL_TARGET_EVALUATOR** table as shown below:

```
Insert into DIGX_FL_TARGET_EVALUATOR (TASK_CODE, TARGET_TYPE, EVALUATOR,
PROP_COMMENTS, SUMMARY_TEXT, CREATED_BY, CREATION_DATE,
LAST_UPDATED_BY, LAST_UPDATED_DATE, OBJECT_STATUS,
OBJECT_VERSION_NUMBER) values (<<task code>>, 'PAYEE', <<TargetEvaluator>>, null,
'target evaluator for <<service name>> service', 'ofssuser', sysdate, 'ofssuser', sysdate, 'Y',
1);
```

In the above query <<task code>> is the task code for the service, <<TargetEvaluator>> is the fully qualified name of the class coded in Step 5. <<service name>> is a descriptive name for the service.

The aforesaid procedure enables limits for a task in OBDX.

Approval Configuration

The below procedure describes the steps required to enable Approvals for a newly developed service.

A prerequisite to this configuration is that this newly developed service should be registered as a task in OBDX. Refer "[Task Registration](#)" section for further details.

To enable approvals for a service, rather for a task mapped to the service to be precise, we need to follow the below mentioned steps:

- Ensure that the 'approval' aspect is configured in DIGX_CM_TASK_ASPECTS table and ENABLED column is set to 'Y' for your task id.
- Note : If the newly created task is of type ADMINISTRATION and the maintenance is not specific to a party then this step is not required. Examples of such transaction are 2 Factor Authentication maintenance, limit maintenance and limit package maintenance. Tasks of type ADMINISTRATION which are specific to a party like Rule management tasks, workflow management tasks etc require this step. Tasks of type FINANCIAL_TRANSACTION, NONFINANCIAL_TRANSACTION, MAINTENANCE, INQUIRY and COMMON require this step.

Code an approval assembler for the new task. An approval assembler is a class that extends AbstractApprovalAssembler.

There are 4 methods in abstract approval assembler out of which the one with the below signature:

```
public abstract T toDomainObject(D requestDTO) throws Exception;
```

will encapsulate the logic required to populate Transaction domain which is used by approvals framework.

Rest of the methods need to be overridden with empty or null implementations.

As evident from the signature quoted above this method accepts a requestDTO (an object that IS A DataTransferObject) and a transaction (an object that IS A Transaction).

requestDTO is the same DataTransferObject that was passed to your newly created service. For instance consider the service to open a termed deposit. Signature of the service is as shown below.

public TermDepositAccountResponseDTO create(SessionContext sessionContext, TermDepositAccountDTO termDepositAccountDTO) throws Exception

In this case when the ApprovalAssembler coded for open term deposit task i.e. TD_F_OTD is invoked by the OBDX framework, the requestDTO argument of toDomainObject method will be the same as termDepositAccountDTO.

This method populates the transaction object on the basis of the requestDTO and returns the transaction domain. The guidelines to override this method are as follows:-

- **Instantiation:**

The transaction object passed will be null and needs to be instantiated. If the task type of the newly created service is FINANCIAL_TRANSACTION then the transaction needs to be instantiated as an object of AmountAccountTransaction.

```
transaction = new AmountAccountTransaction();
```

If the task type of the newly created service is NONFINANCIAL_TRANSACTION then the transaction needs to be instantiated as an object of AccountTransaction.

```
transaction = new AccountTransaction();
```

If the task type of the newly created service is MAINTENANCE then the transaction needs to be instantiated as an object of PartyTransaction.

```
transaction = new PartyTransaction();
```

If the task is of type ADMINISTRATION and the maintenance is specific to a party then the transaction needs to be instantiated as an object of PartyTransaction.

```
transaction = new PartyTransaction();
```

If the task is of type ADMINISTRATION and the maintenance is not specific to a party then the transaction needs to be instantiated as an object of Transaction.

```
transaction = new Transaction();
```

- **Call to AbstractApprovalAssembler :**

Call

transaction = super.toDomainObject(requestDTO, transaction);

This populates the generic state of transaction domain which does not change with the task for which approvals is being configured.

c. Populate the state of the transaction domain which is specific to the task for which approvals is being configured. Cast the requestDTO to the type being accepted by the service. For example cast it to TermDepositAccountDTO as per the aforesaid example.

Use this DTO to populate the service specific state of the transaction domain like amount, account etc.

- **Step 3.** Register an approval assembler for your service or task. To register an approval assembler for your service an entry needs to be made in the database table *DIGX_FW_CONFIG_ALL_B* with the value of column *CATEGORY_ID* as 'approval_assembler'.

If the newly created task is of type *ADMINISTRATION* and the maintenance is not specific to a party then the approval assembler to be registered against your service is *om.ofss.digx.framework.domain.transaction.assembler.GenericDTOTransactionAssembler*. 2 Factor Authentication Maintenance is a fine example of such transactions. The service id for this transaction is *com.ofss.digx.app.security.service.authentication.maintenance.AuthenticationMaintenance*.

create

The below query fulfills the requirement of this step:

```

Insert into DIGX_FW_CONFIG_ALL_B
(PROP_ID,
CATEGORY_ID,
PROP_VALUE,
FACTORY_SHIPPED_FLAG,
PROP_COMMENTS,
SUMMARY_TEXT,
CREATED_BY,
CREATION_DATE,
LAST_UPDATED_BY,
LAST_UPDATED_DATE,
OBJECT_STATUS,
OBJECT_VERSION_NUMBER)
values
('com.ofss.digx.app.security.service.authentication.maintenance.AuthenticationMaintenance.
create',
'approval_assembler',
'com.ofss.digx.framework.domain.transaction.assembler.GenericDTOTransactionAssembler'
,
'N',
'assembler class for conversion from UserSegmentTFAMaintenanceDTO to Transaction
domain',
'assembler class for conversion from UserSegmentTFAMaintenanceDTO to Transaction
domain',
'ofssuser',
sysdate,
'ofssuser',
sysdate,
'A',
1);

```

In all other cases where you have implemented a custom approval assembler as per the guidelines in step 2, the fully qualified class name of that approval assembler will be registered against your service. The below query fulfills the requirement of this step:

```

Insert into DIGX_FW_CONFIG_ALL_B
(PROP_ID,
CATEGORY_ID,
PROP_VALUE,
FACTORY_SHIPPED_FLAG,
PROP_COMMENTS,
SUMMARY_TEXT,
CREATED_BY,
CREATION_DATE,
LAST_UPDATED_BY,
LAST_UPDATED_DATE,
OBJECT_STATUS,
OBJECT_VERSION_NUMBER)
values
(<<service id>>,
'approval_assembler',
<<ApprovalAssembler>>,
'N',
'assembler class for conversion from DataTransferObject to Transaction domain',
'assembler class for conversion from DataTransferObject to Transaction domain',
'ofssuser',
sysdate,
'ofssuser',
sysdate,
'A',
1);

```

In the above query <<service id>> is the fully qualified name of the class appended by the dot character (.) and the method name. <<ApprovalAssembler>> denotes the fully qualified class name of the approval assembler coded in Step 2.

The aforesaid procedure enables approvals for a task in OBDX.

Account Relationship

Using this aspect, one can control accounts for a transaction.

1. Account Number List Filtration

To filter the account list based on Account Relationship configuration, task code should be provided in REST call in following manner

```
../digx/v1/accounts/demandDeposit?taskCode=TD_F_OTD
```

Above REST will return only allowed accounts for 'New Deposit' transaction.

2. Account Number Validation

Here we validate account number(s) using Account Relationship Configuration.

Following changes need to be done to achieve this

Evaluator class – If 'Account Relationship Check' is enabled for a transaction, then application looks for registered evaluator class. This class is used to identify account number(s) from incoming request object and converts it into input which is required for account relationship checking.

Evaluator class should implement interface

`'com.ofss.digx.app.accountrelationship.evaluator.mapping.IAccountRelationshipDataEvaluator'`

Example - `'com.ofss.digx.app.td.evaluator.accountrelationship.TDAccountRelationshipEvaluator'` is an evaluator class which is used for 'New Deposit' transaction.

Inside 'evaluate' method of this class, account number from request object `'com.ofss.digx.app.td.dto.account.TermDepositAccountDTO'` is being get converted into list of `'com.ofss.digx.app.party.dto.relation.account.PartyToAccountRelationshipDTO'`.

Following database entry has been made to register evaluator class

`'com.ofss.digx.app.td.evaluator.accountrelationship.TDAccountRelationshipEvaluator'` with task code 'TD_F_OTD' of 'New Deposit' transaction.

Insert into DIGX_FW_CONFIG_ALL_B

(PROP_ID, CATEGORY_ID, PROP_VALUE, FACTORY_SHIPPED_FLAG,
PROP_COMMENTS, SUMMARY_TEXT, CREATED_BY, CREATION_DATE,
LAST_UPDATED_BY, LAST_UPDATED_DATE, OBJECT_STATUS,
OBJECT_VERSION_NUMBER, EDITABLE,

CATEGORY_DESCRIPTION) values

('TD_F_OTD', 'accountRelationshipEvaluator',
'com.ofss.digx.app.td.evaluator.accountrelationship.TDAccountRelationshipEvaluator',

'N', 'Account Relationship evaluator for TD', null, 'ofssuser', sysdate, 'ofssuser',

sysdate, 'A', 1, 'N', null);

5. Extensible Points in Approval

This article explains extensible points in Approval framework.

5.1 Adding a new Rule Criteria

Every rule in the system is created against a TaskType. TaskType decides which Rule Criteria are to be associated with a Rule being created. Examples of existing Rule Criteria are Transaction, Account, Amount and Currency.

If the existing Rule Criteria does not meet your requirement, then a new Rule Criteria can be extended in the system by following the steps given below:

5.1.1 Adding New Rule Criteria

Add a new rule criteria in the Table DIGX_AP_RULE_CRITERIA shown below against the TASK_TYPE to which the customized Task belongs:

ID	NAME	WEIGHTAGE	DATA_TYPE	USER_TYPE	TASK_TYPE	CREATED_BY	CREATION_DATE	LAST_UPDATED_BY	LAST_UPDATED_DATE
1	RULE_CRITERIA_001	TRANSACTION	5	STRING	CUSTOMER	FINANCIAL_TRANSACTION	(null)	(null)	(null)
2	RULE_CRITERIA_002	TRANSACTION	5	STRING	CUSTOMER	NONFINANCIAL_TRANSACTION	(null)	(null)	(null)
3	RULE_CRITERIA_003	TRANSACTION	5	STRING	CUSTOMER	MAINTENANCE	(null)	(null)	(null)
4	RULE_CRITERIA_004	TRANSACTION	5	STRING	ADMIN	FINANCIAL_TRANSACTION	(null)	(null)	(null)
5	RULE_CRITERIA_005	TRANSACTION	5	STRING	ADMIN	NONFINANCIAL_TRANSACTION	(null)	(null)	(null)
6	RULE_CRITERIA_006	TRANSACTION	5	STRING	ADMIN	ADMINISTRATION	(null)	(null)	(null)
7	RULE_CRITERIA_007	ACCOUNT	5	STRING	CUSTOMER	FINANCIAL_TRANSACTION	(null)	(null)	(null)
8	RULE_CRITERIA_008	ACCOUNT	5	STRING	CUSTOMER	NONFINANCIAL_TRANSACTION	(null)	(null)	(null)
9	RULE_CRITERIA_009	ACCOUNT	5	STRING	ADMIN	FINANCIAL_TRANSACTION	(null)	(null)	(null)
10	RULE_CRITERIA_010	ACCOUNT	5	STRING	ADMIN	NONFINANCIAL_TRANSACTION	(null)	(null)	(null)
11	RULE_CRITERIA_011	AMOUNT	5	BIGDECIMAL	CUSTOMER	FINANCIAL_TRANSACTION	(null)	(null)	(null)
12	RULE_CRITERIA_012	AMOUNT	5	BIGDECIMAL	ADMIN	FINANCIAL_TRANSACTION	(null)	(null)	(null)
13	RULE_CRITERIA_013	TRANSACTION	5	STRING	CUSTOMER	ADMINISTRATION	(null)	(null)	(null)
14	RULE_CRITERIA_014	CURRENCY	15	STRING	CUSTOMER	FINANCIAL_TRANSACTION	(null)	(null)	(null)
15	RULE_CRITERIA_015	CURRENCY	15	STRING	ADMIN	FINANCIAL_TRANSACTION	(null)	(null)	(null)
16	RULE_CRITERIA_016	AMOUNT	5	BIGDECIMAL	CUSTOMER	AMOUNT_FIN_TRANSACTION	(null)	(null)	(null)
17	RULE_CRITERIA_017	CURRENCY	15	STRING	CUSTOMER	AMOUNT_FIN_TRANSACTION	(null)	(null)	(null)
18	RULE_CRITERIA_018	TRANSACTION	5	STRING	CUSTOMER	AMOUNT_FIN_TRANSACTION	(null)	(null)	(null)

5.1.2 Implementing a Rule Criteria Handler

For the newly created RuleCriteria mentioned in step above , create a RuleCriteriaHandler implementation. This class implements the interface named com.offss.digx.app.approval.service.rulecriteria.handler.IRuleCriteriaHandler

Override the methods

- addRuleCriteriaRelationships** : This method returns the list of RuleRuleCriteriaRelationshipDTO to be added as a part of the newly created RuleCriteria to the rule being created for the TaskType to which the customized task belongs.
- getRuleCriteriaMultiplierForRule**: returns a multiplier (datatype :double) which gives precedence to a rule over other rule in case both the rules are applicable for a particular instance of a transaction.

Note: While implementing Rule Criteria Handler make sure that it is implemented in a way that it does not impact existing Tasks in the system belonging to the TaskType against which it is added.

5.1.3 **Registering a Rule Criteria Handler**

The Rule Criteria Handler implemented in the step above needs to be registered in the system. To register make an entry in the table DIGX_FW_CONFIG_ALL_B as shown in the example query below.

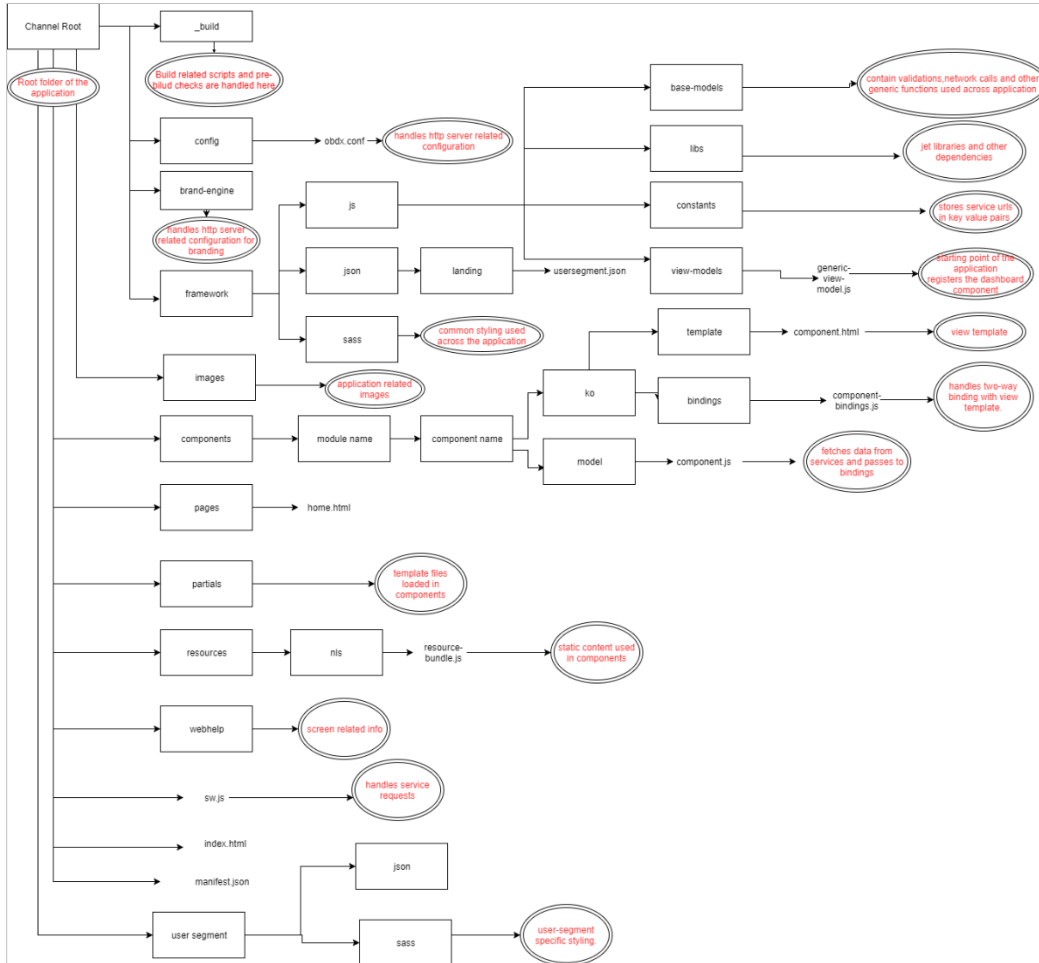
```
insert into DIGX_FW_CONFIG_ALL_B (PROP_ID, CATEGORY_ID, PROP_VALUE,
FACTORY_SHIPPED_FLAG, PROP_COMMENTS, SUMMARY_TEXT, CREATED_BY,
CREATION_DATE, LAST_UPDATED_BY, LAST_UPDATED_DATE, OBJECT_STATUS,
OBJECT_VERSION_NUMBER)
```

values ('<<Rule Criteria Name>>', 'RuleCriteriaHandlerConfig', '<<Fully qualified name of the Handler implementation class created in the step above>>', 'N', 'Specifies the class name of the Handler for rule criteria type <<Rule Criteria Name>>.', 'Specifies the class name of the Handler for rule criteria type <<Rule Criteria Name>>.', 'ofssuser', sysdate, 'ofssuser', sysdate, 'A', 1);

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6. Architecture of GUI Tier

Below diagram shows structure of the UI artifacts and some of the important artifacts are explained subsequently.



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7. Extensible Points in GUI Tier

This article provide the guidelines for UI Extensibility.

7.1 Theme and Brand

- CSS Custom Properties are available for modifications. You can change the variables by creating a new CSS file which has updated value of CSS custom properties. Make sure that file is imported after the main.css file. Same functionality you can achieve by Branding. It is recommended that implementer should use Branding functionality.
- We are not allowing adding new styles in the core UI.
- For the Images you are free to do modifications.

7.2 Component Extensibility

- Framework Elements like (header,dashboard, menu etc) are not available for the modification and customization.
- All components available under component folder are available for the extension.

7.2.1 Adding New and Overriding Existing Components

If you want to add new component place that component in `<CHANNEL_ROOT_PATH>/extensions/components`. It follow the same structure which is present in components folder. Same thing is applicable for the existing components. If you want to change anything then copy that component and place it extensions/components folder with the same structure.

If resource bundle needs to change for that component place related resource bundle in `<CHANNEL_ROOT_PATH>/extensions/resources` location. Structure remain same for `<CHANNEL_ROOT_PATH>/resources` and `<CHANNEL_ROOT_PATH>/extensions/resources` folder. Make sure that you updated the resource bundle path in your component.

If any component is present in `<CHANNEL_ROOT_PATH>/extensions/components` will take precedence over the `<CHANNEL_ROOT_PATH>/components`. For it we maintaining the list of components available in extensions in `<CHANNEL_ROOT_PATH>/extensions/extension.json` which is to be entered manually. For example:

Sample JSON for **extension.json**

```

{
"components": [<component1>,<component2>].
"partials" : ["partial1.html","partial2.html"]
}

```

In the Same manner you can override the partial templates.

Note: Out of the box we are providing extension for Internal Account Input Component (inernal-account-input). This extension need to be implemented in scenario where the bank account number do not have branch code prefixed in the account.

7.2.2 Add / Modify Validations

All the validation available in the application are maintained in `<CHANNEL_ROOT_PATH>/framework/js/base-models/validations/obdx-locale.js`. Implementer can override and add new validations in the application without changing this file. An extension hook is given at :

For OBDX 18.1 at `<CHANNEL_ROOT_PATH>/extensions/validations/obdx-locale.js`

From OBDX 18.2 onwards `<CHANNEL_ROOT_PATH>extensions\override\obdx-locale.js`

In this file Implementer can add or override validations.

For Example: If you need to change the pattern which validate Mobile Number. Add updated pattern in this file as below.

```

define([
  "ojL10n!resources/nls/obdx-locale"
], function(locale) {
  "use strict";
  var Locale = {
    validations: {
      MOBILE_NO: [{
        type: "regExp",
        options: {
          pattern: "^((\\+\\d{1,3}[- ]?)?\\d{10})$",
          messageDetail: locale.messages.MOBILE_NO
        }
      }
    ]
  }
  return Locale;
});

```

7.3 Calling custom REST service

In implementation if any new services are written by implementer it has been directed to change the context root for new REST to `digx/cz/v1`. For supporting it from the UI, implementer has to pass `cz/v1` in the version field of the AJAX setting from his model.

For example see the snippet below:

```
fetchDetails = function(urlParams, deferred) {
  var options = {
    url: urlParams,
    version: "cz/v1",
    success: function(data) {
      deferred.resolve(data);
    },
    error: function(data) {
      deferred.reject(data);
    }
  };
  baseService.fetch(options);
},
```

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8. Libraries

OBDX has bundled its platform features and capabilities in various libraries based on logical separation of features. This section provides a list of such libraries along with their purpose

8.1 OBDX Libraries

This section provides information about various OBDX libraries that are provided out of the box.

8.1.1 Core/Framework Libraries

Provide infrastructure features of OBDX platform. These libraries are packaged in the digx-shared-libs.war

Library	Description
com.ofss.digx.infra	Provides basic infrastructure classes.
com.ofss.digx.infra.audit	Provides basic infrastructure classes for audit.
com.ofss.digx.infra.crypto com.ofss.digx.infra.crypto.asymmetric.impl.db com.ofss.digx.infra.crypto.asymmetric.impl.keystore com.ofss.digx.infra.crypto.asymmetric.impl.remote	Provides cryptography functions such as hash generation, public private key generation and symmetric cryptography provider.
com.ofss.digx.infra.crypto.impl.jar	Provides default implementations of cryptography functions such as hash generation, public private key generation and symmetric cryptography provider.
com.ofss.digx.framework.domain	Provides base classes for entities, assemblers, repositories etc.
com.ofss.digx.framework.rest	Provides classes for calling host REST services.
com.ofss.digx.framework.adapter	Provides adapter interfaces for cross-domain invocation required for the framework.
com.ofss.digx.appx.core.rest	Provides infrastructure classes for OBDX REST services

Library	Description
com.ofss.digx.datatype	Provides complex data types used in OBDX application
com.ofss.digx.core.enumeration	Provides enumerations required for the core framework of the application.
com.ofss.digx.appcore	Provides base classes for application services, Interaction classes etc.
com.ofss.digx.security.core	Provides two factor authentication related core classes.
com.ofss.digx.appcore.dto	Provides DTOs used in infrastructure services
com.ofss.digx.annotations	Provides various annotations used in OBDX application
com.ofss.digx.appx.core.soap	Provides infrastructure classes for OBDX REST services
com.ofss.digx.core.enumeration.converters	Provides infrastructure classes for defining converter logic for enumeration
com.ofss.digx.framework.scheduler	Provides infrastructure classes for OBDX scheduler
com.ofss.digx.infra.orms	Contains ORM mapping files for framework domains
com.ofss.digx.infra.token.security	Contains infrastructure classes for provide user/subject information using token.

8.1.2 Common Library

Provide common libraries used across all modules of the application. These libraries are packaged in digx-shared-libs.war

Library	Description
com.ofss.digx.accountrelationship.core	Provides classes for account relationship evaluators.
com.ofss.digx.adapter	Provides interfaces for cross-domain adapters.

Library	Description
com.ofss.digx.common	Provides all constants and utilities to be used across the application.
com.ofss.digx.enumeration	Provides all enumerations.
com.ofss.digx.extxface	Provides adapters for interaction with external applications.
com.ofss.digx.finlimit.core	Provides core classes for financial limits processing
com.ofss.digx.access.core	Provides core classes for account access processing

8.1.3 Modules

Provide functional module available in the application.

- digx-access.war
- digx-account.war
- digx-accountaggregation.war
- digx-accountrelationship.war
- digx-alerts.war
- digx-analytics.war
- digx-approval.war
- digx-associatedparty.war
- digx-audit.war
- digx-berlinaisp.war
- digx-berlinpiisp.war
- digx-berlinpisp.war
- digx-brand.war
- digx-budget.war
- digx-bulkadmin.war
- digx-bulkcms.war
- digx-bulkinvoice.war
- digx-bulkpayment.war
- digx-bulkscf.war
- digx-bulktradefinance.war
- digx-bulkvam.war

- digx-card.war
- digx-chatbot.war
- digx-cms.war
- digx-collaboration.war
- digx-common.war
- digx-config.war
- digx-content.war
- digx-creditfacility.war
- digx-cutoff.war
- digx-dda.war
- digx-ebpp.war
- digx-feedback.war
- digx-finlimit.war
- digx-forexdeal.war
- digx-goal.war
- digx-insight.war
- digx-invoice.war
- digx-liquiditymanagement.war
- digx-loan.war
- digx-loanapplication.war
- digx-location.war
- digx-login.war
- digx-me.war
- digx-mobile.war
- digx-nlp.war
- digx-oauth.war
- digx-obc.war
- digx-origination.war
- digx-party.war
- digx-payment.war
- digx-pm.war
- digx-processmanagement.war
- digx-report.war
- digx-rewards.war
- digx-scf.war

- digx-security.war
- digx-sms.war
- digx-smsbanking.war
- digx-social.war
- digx-spendanalysis.war
- digx-sr.war
- digx-td.war
- digx-tradefinance.war
- digx-ukaisp.war
- digx-ukcbpii.war
- digx-ukpisp.war
- digx-user.war
- digx-vam.war
- digx-wallet.war
- digx-wm.war

8.1.4 **External System Adapters**

These are packaged into module specific wars.

Library	Description
com.ofss.digx.<module_name>.extxface	Provides all external interfaces
com.ofss.digx.extxface.<Host Name>.impl	Provides adapter implementations of the external interfaces for particular host
com.ofss.<Host Name>.soap.client	Provides stubs used for communicating with host

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9. Digx Scheduler Application

This section describes how to create custom schedulers in OBDX.

9.1 Create New Scheduler Class

Follow the steps given below while creating new scheduler

- a. **Implement the class with org.quartz.Job, java.io.Serializable.**

Example :

```
public class ReportSchedulerImpl implements Serializable, Job {
}

```

- b. **Define the required business logic in the overridden method execute(JobExecutionContext) required for scheduling.**

Example :

@Override

```
public void execute(JobExecutionContext paramJobExecutionContext) throws
JobExecutionException {
// business logic required for scheduling
}

```

- c. **Get the SessionContext and AccessPoint objects from the method parameter before calling the business logic (if any). Set both the objects in the thread attributes.**

Example:

```
SessionContext sessionContext = (SessionContext)
paramJobExecutionContext.getJobDetail().getJobDataMap().get("sessionContext");

AccessPointDTO accessPoint = (AccessPointDTO)
paramJobExecutionContext.getJobDetail().getJobDataMap().get("accessPoint");

com.ofss.digx.infra.thread.ThreadAttribute.set(com.ofss.digx.infra.thread.ThreadAttribute.
ACCESS_POINT, accessPoint);

ThreadAttribute.set(ThreadAttribute.SESSION_CONTEXT, sessionContext);

```

d. Call the respective service class (if any) for business logic.

Example:

```
try {

ReportRequest service = new ReportRequest();

service.executeScheduled(sessionContext);

} catch (Exception e) {

logger.log(Level.SEVERE, "Error occurred while executing ReportSchedulerImpl class at
: " + new java.util.Date(), e);

} catch (java.lang.Exception e) {

logger.log(Level.SEVERE, "Error occurred while executing ReportSchedulerImpl class at
: " + new java.util.Date(), e);

}
```

9.2 Configure Scheduler Class

Configure the newly created scheduler class in “DIGX_CM_TIMER” table as per the following script.

Example:

```
Insert into digx_cm_timer
(TIMER_ID,TIMER_CLASS,SECONDS,MINUTE,HOUR,DAY_OF_WEEK,DAY_OF_MONTH,MO
NTH,YEAR,IS_ENABLED,IS_PERSISTENT,JVM_ID,CREATED_BY,CREATION_DATE,LAST_UP
DATED_BY,LAST_UPDATED_DATE,OBJECT_VERSION_NUMBER) values
('ReportSchedulerTimer','com.ofss.digx.scheduler.report.ReportSchedulerImpl','0','*/15','*','null,null
,null,null,'Y','N','1','ofssuser',sysdate,'ofssuser',sysdate,1);
```

10. Consistent UI Download

10.1 Implement IPaginable and add XmlRootElement annotation on Response Object

To enable UI Download on a service, you should implement the IPaginable Interface and add the XmlRootElement annotation as shown below. The XmlRootElement's name property should be 'root', and you need to implement all the methods in the IPaginable Interface.

```
package com.ofss.digx.app.brand.dto;

import com.ofss.digx.app.dto.IPaginable;
import com.ofss.digx.service.response.BaseResponseObject;

import javax.xml.bind.annotation.XmlRootElement;
import java.util.List;

@XmlRootElement(name = "root")
public class BrandManagementListResponseDTO extends BaseResponseObject implements IPaginable<BrandDTO> {

    /**
     * serialVersionUID
     */
    private static final long serialVersionUID = 212372340387896408L;

    /**
     * Represents object of type {@link BrandDTO}
     */
    private List<BrandDTO> brandDTOs;

    /**
     * Represents object of type {@link BrandDTO}
     */
    private List<BrandDTO> items;

    /**
     * Represents object of type {@link Boolean}
     */
    private Boolean more;

    /**
     * Represents object of type {@link Integer}
     */
    private Integer totalRecords;

    /**
     * Represents object of type {@link Integer}
     */
    private Integer startSequence;

    /**
     * Returns brandDTOs.
     *
     * @return brandDTOs in the form of {@link BrandDTO}.
     */
}
```

```

}

/**
 *
 * @return items in the form of {@link List<BrandDTO>}
 */
@Override
public List<BrandDTO> getItems() {
    return items;
}

/**
 *
 * @param items in the form of {@link List<BrandDTO>}
 */
@Override
public void setItems(List<BrandDTO> items) {
    this.items = items;
}

/**
 *
 * @return more in the form of {@link Boolean}
 */
@Override
public Boolean hasMore() {
    return more;
}

/**
 *
 * @param more in the form of {@link Boolean}
 */
@Override
public void setMore(Boolean more) {
    this.more = more;
}

/**
 *
 * @return totalRecords in the form of {@link Integer}
 */

```

10.2 Add configurations in the Metadata Tables

The report generation system relies on the following metadata tables

1. DIGX_CM_TABLE_METADATA
Stores information about each table.

Property	Description
TABLE_CODE	Unique identifier for each table.
SUPPORTED_DOWNLOAD_TYPES	Media types supported for download. Supported values are 'pdf' and 'csv'.
PAGINATION_TYPE	The type of pagination supported. Supported values are 'S' and 'V'. Static ('S') refers to a one time fetching of all records. Virtual ('V') refers to virtual fetching of records.

ACTION_COMPONENT	The path of the UI component present in channel folder for which gets loaded on click of a row.
TABLE_HEADER	<p>Comma Separated Values for Report and UI Screen Headers. Please note headings are NLS supported. The file name should be <TABLE_CODE>.properties and maintain at location "config/resources/nls/tablemetadata" with the keys and values.</p> <p>Example: BrandManagement, ManageBrand</p> <p>Here the BrandMangement header key will be used for reports and ManageBrand will be used for UI screen.</p> <p>Incase the second value is missing. The UI screen won't show the header.</p> <p>Example: BrandManagement</p>
ROW_ID	Unique identifier for each record in a table.
SERIAL_NUMBER_REQUIRED	Flag to enable serial numbers on the user interface. Supported values are 'Y' to enable and 'N' to disable.
MAX_COLUMNS	Property to limit the number of columns a PDF can show. Default is 6 which can be changed by updating this property.

Example

Insert into DIGX_CM_TABLE_METADATA
 (TABLE_CODE,SUPPORTED_DOWNLOAD_TYPES,PAGINATION_TYPE,ACTION_COMPONENT,TABLE_HEADER,ROW_ID,SERIAL_NUMBER_REQUIRED,MAX_COLUMNS) values
 ('ManageBrandBrand','csv,pdf','S','theme-config/review-theme','brand,brand','brandId',null,4);

TABLE_CODE	SUPPORTED_DOWNLOAD_TYPES	PAGINATION_TYPE	ACTION_COMPONENT	TABLE_HEADER	ROW_ID	SERIAL_NUMBER_REQUIRED	MAX_COLUMNS
1 ManageBrandBrand	csv,pdf	S	theme-config/review-theme	brand,brand	brandId (null)		4

2. DIGX_CM_COLUMN_METADATA
 Stores information about columns available for a given table.

Property	Description
ID	Unique Identifier for an entry in this table.
TABLE_METADATA_ID	Unique identifier for each table. Many to one relationship to DIGX_CM_TABLE_METADATA table and TABLE_CODE column.
NAME	The name of the column with NLS support. Maintain the file with the name "<TABLE_CODE>.properties" at the location "config/resources/nls/tablemetadata" along with the corresponding keys and values. Avoid creating duplicate files, as this file already contains the TABLE_HEADER for the DIGX_CM_TABLE_METADATA table.

COMPONENT_ID	Custom component created for user interface. Used to add custom formatting for specific columns. Default value is 'null'.
DATATYPE	The supported datatypes are String, Number, Date, Currency and Complex. Similar to COMPONENT_ID, which is purely use for UI rendering; Datatypes is for report generation.
PATH	For value fetching, use the data path. The root path of a record is represented by the dot operator ('.'). Use the root path if the entire data object is required. Alternatively, use specific JSON paths when only specific values are required, example "Person.name", here we read name from the Person object.
FIXED	To view column on some condition, Supported values are 'Y' to enable and 'N' to disable.
SORTABLE	Flag to enable serial numbers on the user interface. Supported values are 'Y' to enable and 'N' to disable.
DOWNLOADABLE	The column support for download. Supported values are 'Y' to enable and 'N' to disable.
SEQUENCE_NO	The position of the column in the table.
LENGTH	The width of the column. The sum of all column lengths for a table code should be 100 to avoid overflow and underflow of table content. If not mentioned framework will auto size the widths.

Example

```

Insert into DIGX_CM_TABLE_METADATA
(ID, TABLE_METADATA_ID, NAME, COMPONENT_ID, DATATYPE, PATH, FIXED, SORTABLE
, DOWNLOADABLE, SEQUENCE_NO, LENGTH) values
('ManageBrandBrandthemeName', 'ManageBrandBrand', 'themeName', null, 'String', 'brandName', 'Y', 'Y', 'Y', 1, null);
Insert into DIGX_CM_TABLE_METADATA
(ID, TABLE_METADATA_ID, NAME, COMPONENT_ID, DATATYPE, PATH, FIXED, SORTABLE
, DOWNLOADABLE, SEQUENCE_NO, LENGTH) values
('ManageBrandBrandthemeDesc', 'ManageBrandBrand', 'themeDesc', null, 'String', 'brandDescription', 'N', 'Y', 'Y', 2, null);
Insert into DIGX_CM_TABLE_METADATA
(ID, TABLE_METADATA_ID, NAME, COMPONENT_ID, DATATYPE, PATH, FIXED, SORTABLE
, DOWNLOADABLE, SEQUENCE_NO, LENGTH) values
('ManageBrandBranddateCreated', 'ManageBrandBrand', 'dateCreated', 'formattedDate', 'Date', 'creationDate', 'Y', 'Y', 'Y', 3, 40);
Insert into DIGX_CM_TABLE_METADATA
(ID, TABLE_METADATA_ID, NAME, COMPONENT_ID, DATATYPE, PATH, FIXED, SORTABLE
, DOWNLOADABLE, SEQUENCE_NO, LENGTH) values
('ManageBrandBrandactions', 'ManageBrandBrand', 'actions', 'theme-config/theme-actions', 'String', 'brandId', 'N', 'Y', 'Y', 4, null);

```

ID	TABLE_METADATA_ID	NAME	COMPONENT_ID	DATATYPE	PATH	FI...	S...	DO...	MIN...	MAX...	SEQUENCE_NO
1	ManageBrandBrandthemeName	themeName	(null)	String	brandName	Y	Y	Y	(null)	(null)	1
2	ManageBrandBrandthemeDesc	themeDesc	(null)	String	brandDescription	N	Y	Y	(null)	(null)	2
3	ManageBrandBranddateCreated	dateCreated	formattedDate	Date	creationDate	Y	Y	Y	(null)	(null)	3
4	ManageBrandBrandactions	actions	theme-config/theme-actions	String	brandId	N	Y	Y	(null)	(null)	4

10.3 Custom Datatypes for Report Download

The framework supports various data types, including String, Number, Date, and Complex. For any unsupported data type, the framework looks for corresponding XSL templates to handle report generation.

To create your own custom data types, follow these steps:

1. Identify the data type string to for using in the DIGX_CM_COLUMN_METADATA table. For example, 'CustomDateType' can be a string used to create special handling for dates. Alphanumeric combinations like 'CustomDateType#1' for additional variations, where each type corresponds to its own set of templates.
2. Create a custom template at the following location:
config/resources/com/ofss/digx/framework/list/universal/templates

```
<?xml version="1.0" encoding="UTF-8"?>
<xsl:stylesheet xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
  xmlns:fo="http://www.w3.org/1999/XSL/Format" version="1.0">
  <xsl:template name="CustomDateType">
    <xsl:param name = "data" />
    <fo:block>
      <!-- Add handling here -->
      <!-- <xsl:value-of select="$data/calendarDayOfWeek" /> -->
    </fo:block>
  </xsl:template>
</xsl:stylesheet>
```

The above is a sample template for your reference. We save it as CustomDateType.xsl at the given location. Each template has a data parameter as input, which contains the data provided based on the path specified in the maintenance. The above template selects the 'calendarDayOfWeek' value and displays it in the PDF from the available data.

3. Import the template in config\resources\com\ofss\digx\framework\list\universal\loader.xml and add the selection criteria.

```
<?xml version="1.0" encoding="UTF-8"?>
  <xsl:stylesheet xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
    xmlns:fo="http://www.w3.org/1999/XSL/Format" version="1.0">

    <!-- Import template -->
    <xsl:include
href="resources/com/ofss/digx/framework/list/universal/templates/CustomDateType.xml"/>
    <xsl:template name="loader">
      <xsl:param name = "dataType" />
      <xsl:param name = "data" />
      <xsl:choose>
        <!-- Add selection critria here and call template -->
        <xsl:when test="$dataType = 'CustomDateType'">
          <xsl:call-template name="CustomDateType" select="$data"/>
        </xsl:when>
        <!-- default handling -->
        <xsl:otherwise>
          <fo:block>
            <xsl:value-of select="$data" />
          </fo:block>
        </xsl:otherwise>
      </xsl:choose>
    </xsl:template>
  </xsl:stylesheet>
```

4. Steps for CSV templates:

The steps remain the same as mentioned above, with the difference being the storage location of templates and the loader file. The templates are at 'config\resources\com\ofss\digx\framework\list\universal\csv\templates', and the loader file should be 'config\resources\com\ofss\digx\framework\list\universal\csv\loader.xml'.

10.4 Adding content before and after table in PDF Reports

1. Create a template with slots at location "config\resources\uidownload\templates\pdf"

The file should be named with tableCode example ManageBrandBrand.xml where ManageBrandBrand is tablecode.

Use the below starter template,

```
<?xml version="1.0" encoding="UTF-8"?>

<xsl:stylesheet

  xmlns:xsl="http://www.w3.org/1999/XSL/Transform"

  xmlns:fo="http://www.w3.org/1999/XSL/Format" version="1.0" >

  <xsl:include href="resources/com/ofss/digx/framework/list/universal/utills/ui-download.xml" />

  <xsl:template match="/">

    <xsl:call-template name="ui-download">

      <xsl:with-param name="data" select="." />

    </xsl:call-template>

  </xsl:template>

  <xsl:template name="top-slot"></xsl:template>

  <xsl:template name="bottom-slot"></xsl:template>

</xsl:stylesheet>
```

2. Now new content can be added to the top-slot and bottom-slot templates, example

```
<?xml version="1.0" encoding="UTF-8"?>

<xsl:stylesheet

  xmlns:xsl="http://www.w3.org/1999/XSL/Transform"

  xmlns:fo="http://www.w3.org/1999/XSL/Format" version="1.0" >
```

```

<xsl:include href="resources/com/ofss/digx/framework/list/universal/utils/ui-download.xsl" />
<xsl:template match="/">
  <xsl:call-template name="ui-download">
    <xsl:with-param name="data" select="." />
  </xsl:call-template>
</xsl:template>
<xsl:template name="top-slot">
  <xsl:param name="data" />
  <fo:block>
    <xsl:value-of select="$data/status/apiType" />
  </fo:block>
</xsl:template>
<xsl:template name="bottom-slot">
  <xsl:param name="data" />
  <fo:block>
    <xsl:value-of select="$data/status/apiType" />
  </fo:block>
</xsl:template>
</xsl:stylesheet>

```

3. The complete response object can be accessed using the \$data param, excluding the items.

```

{
  "status": {
    "result": "SUCCESSFUL",
    "contextID": "0063eZOykwSAHReEtbToWH00E9EP000CXx",
    "message": {
      "type": "INFO"
    }
  },

```

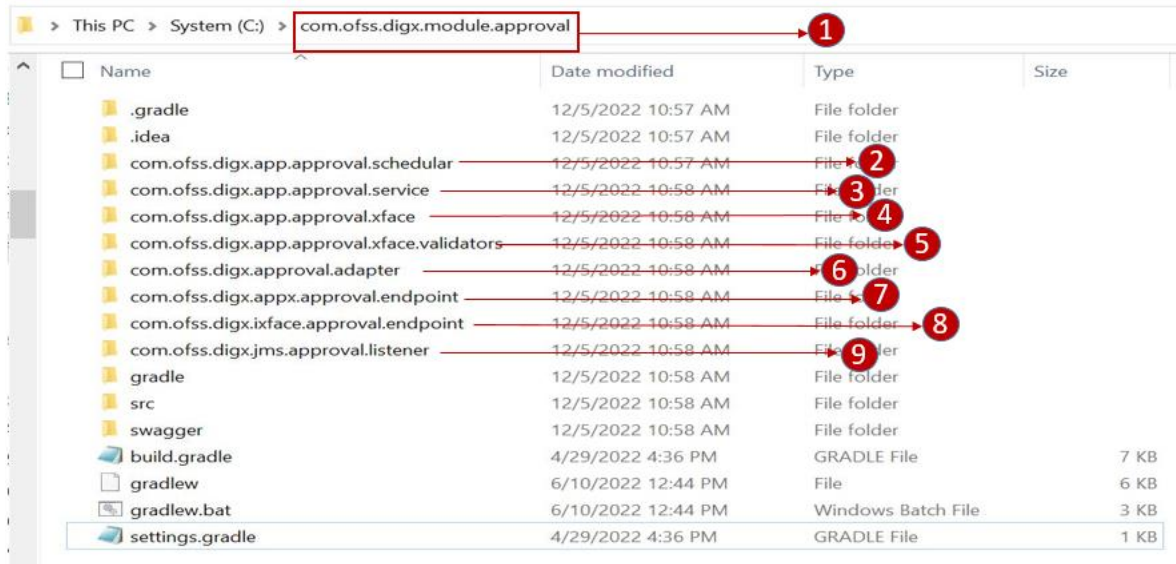
```
"apiType": "brand"  
},  
"brandDTOs": []  
}
```

11. Package and Deploy Customisations

11.1 Base product packaging

Before we look at how to package service extensions we need to understand the packaging of the base product.

Below we showcase project structure of an OBDX base module. We take approvals as an example.



1. Main-module-project.
2. Sub-project containing all the schedulers required by the module.
3. Sub-project containing all the services comprising the module. (Majority extensions fall under this subproject).
4. Sub-project containing all the Data Transfer Objects used in other sub-projects
5. Sub-project containing validators used to validate Data Transfer Objects facilitating input to OBDX.
6. Sub-project containing classes used to make cross module calls.
7. Sub-project exposing endpoints to UI for end user to interact with OBDX.
8. Subproject exposing endpoints used by other module's services to consume the services of this module via REST.
9. Sub-project containing JMS listeners required for the functioning of this module.

Each of the above listed subprojects are gradle projects which are then built into their respective jars. In case of the example shown above the jars artifacts resulting from the build are as given below.

1. com.ofss.digx.app.<<moduleName>>.scheduler.jar eg. com.ofss.digx.app.approval.scheduler.jar
2. com.ofss.digx.app.<<moduleName>>.service.jar eg. com.ofss.digx.app.approval.service.jar
3. com.ofss.digx.app.<<moduleName>>.xface.jar eg. com.ofss.digx.app.approval.xface.jar
4. com.ofss.digx.app.<<moduleName>>.xface.validators.jar eg. com.ofss.digx.app.approval.xface.validators.jar
5. com.ofss.digx.app.<<moduleName>>.adapter.jar eg. com.ofss.digx.app.approval.adapter.jar

6. com.ofss.digx.appx.<<moduleName>>.endpoint.jar eg. com.ofss.digx.appx.approval.endpoint.jar
7. com.ofss.digx.ixface.<<moduleName>>.endpoint.jar eg. com.ofss.digx.ixface.approval.endpoint.jar
8. com.ofss.digx.jms.<<moduleName>>.listener.jar eg. com.ofss.digx.jms.approval.listener.jar

11.2 Customisation packaging

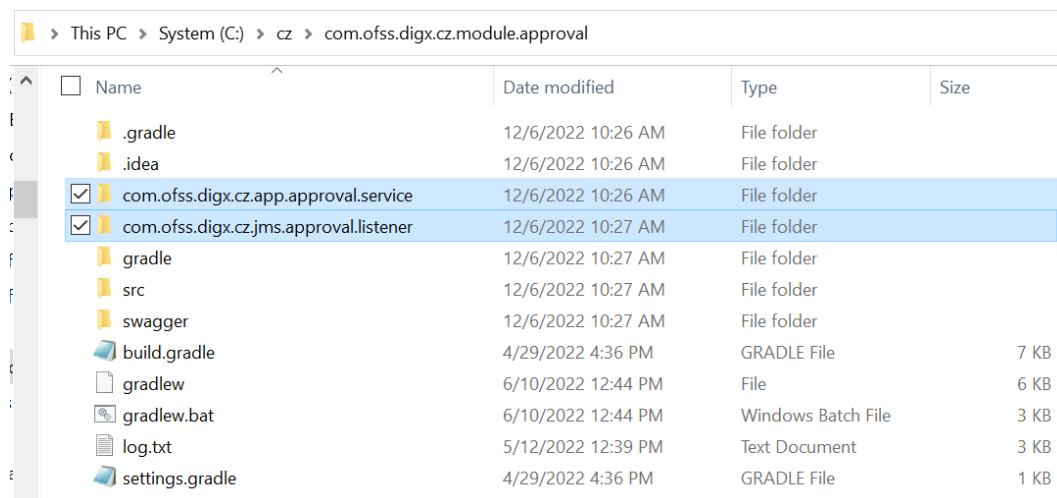
Customizations or extensions can be broadly classified into 2 as mentioned below

11.2.1 Customizations in existing service layer without the need to expose a new customized REST endpoint.

1. Building custom classes into customised jars:-

The majority customizations that fall into this category for example Pre-Post hooks, domain and adapter extensions are done on artifacts present in the service jar mentioned in the previous section namely com.ofss.digx.app.<<moduleName>>.service.jar. So the corresponding extensions should be packaged in a jar named com.ofss.digx.cz.app.<<moduleName>>.service.jar

Note: Similarly in case required artifacts related to extension classes get packaged into corresponding cz jars as mentioned above. For example if for a requirement we need to add a custom listener to a module say approval, the artifacts related to these listeners are packaged in a jar named com.ofss.digx.cz.jms.approval.listener.jar. This is depicted in the image below



2. Adding customised jars as dependencies in build scripts:-

These custom jars can then be added to the war of the domain using the gradle scripts provided in the installer as demonstrated below:

The patch set installer has the following folder structure

OBDX_Patch_Installer\installables\dist\Domainwise\wars

Taking ahead the current customization example we will refer module approval packaged within domain digx-admin. Please refer the below mentioned file for module approval. (As module approval is packaged in the domain named digx-admin)

OBDX_Patch_Installer\installables\dist\Domainwise\wars\digx-admin\module.gradle

Name	Date modified	Type	Size
src	5/25/2022 1:52 AM	File folder	
build.gradle	5/25/2022 1:52 AM	GRADLE File	2 KB
<input checked="" type="checkbox"/> module.gradle	5/25/2022 1:52 AM	GRADLE File	11 KB
settings.gradle	5/25/2022 1:52 AM	GRADLE File	1 KB

There is a line in the above file as shown below:

apply from: ".././cz/wars/digx-approval/module-cz.gradle"

```

1 apply from: ".././dependencies/vam-dep.gradle"
2 apply from: ".././dependencies/forexdeal-adapter-dep.gradle"
3 apply from: ".././cz/wars/digx-alerts/module-cz.gradle"
4 apply from: ".././dependencies/tradefinance-dep.gradle"
5 apply from: ".././cz/wars/digx-cutoff/module-cz.gradle"
6 apply from: ".././cz/wars/digx-approval/module-cz.gradle"
7 apply from: ".././dependencies/user-dep.gradle"
8 apply from: ".././dependencies/edx-dep.gradle"
9 apply from: ".././dependencies/me-dep.gradle"
10 apply from: ".././dependencies/me-adapter-dep.gradle"
11 apply from: ".././cz/wars/digx-oauth/module-cz.gradle"
12 apply from: ".././dependencies/common-adapter-dep.gradle"
13 apply from: ".././cz/wars/digx-gcif/module-cz.gradle"
14 apply from: ".././dependencies/pm-dep.gradle"
15 apply from: ".././dependencies/party-adapter-dep.gradle"
16 apply from: ".././dependencies/access-adapter-dep.gradle"
17 apply from: ".././dependencies/location-dep.gradle"
18 apply from: ".././dependencies/liquiditymanagement-dep.gradle"
19 apply from: ".././cz/wars/digx-accountrelationship/module-cz.gradle"
20 apply from: ".././cz/wars/digx-brand/module-cz.gradle"
21 apply from: ".././cz/wars/digx-me/module-cz.gradle"
22 apply from: ".././dependencies/config-dep.gradle"
23 apply from: ".././dependencies/accountaccess-adapter-dep.gradle"
24 apply from: ".././cz/wars/digx-accountaccess/module-cz.gradle"
25 apply from: ".././cz/wars/digx-config/module-cz.gradle"
26 apply from: ".././dependencies/td-dep.gradle"
27 apply from: ".././dependencies/td-adapter-dep.gradle"
28 apply from: ".././dependencies/liquiditymanagement-dep.gradle"
29 apply from: ".././cz/wars/digx-accountrelationship/module-cz.gradle"
30 apply from: ".././cz/wars/digx-access/module-cz.gradle"
31 apply from: ".././cz/wars/digx-smc/module-cz.gradle"
32 apply from: ".././dependencies/wizard-dep.gradle"
33 apply from: ".././cz/wars/digx-wizard/module-cz.gradle"
34 apply from: ".././dependencies/dia-dep.gradle"
35 apply from: ".././dependencies/loan-dep.gradle"
36 apply from: ".././dependencies/feedback-dep.gradle"
37 apply from: ".././dependencies/payment-den.gradle"

```

The highlighted line above refers to the file present inside the installer at the location given below.

OBDX_Patch_Installer\installables\dist\Domainwise\cz\wars\digx-approval\module-cz.gradle

So after customizations are done in a new jar say com.ofss.digx.cz.app.approval.service.jar, this jar can be specified in this (module-cz.gradle) file above as a dependency. Since dependencies in gradle are specified in group:artifact:version format, we can specify the dependency of this customized jar as below:

warLibs

"com.ofss.digx.cz.module.approval:com.ofss.digx.cz.app.account.service:\$libs_digxVersion"

- Place custom jars in the folder such that it gets picked by the gradle script and is packaged within the domain war:-

So that the above specified dependency of the customized jar gets resolved we need to place it in the folder structure as per **group:artifact:version** format. The repository defined for our base and customized product jars is

OBDX_Patch_Installer\installables\gradle-repo

Since in the above example **group** is as mentioned below

com.ofss.digx.cz.module.approval

So we will create a folder structure **com\ofss\digx\cz\module\approval** inside

OBDX_Patch_Installer\installables\gradle-repo

Now coming to artefact

com.ofss.digx.cz.app.approval.service

For this we will create a folder named **/com.ofss.digx.cz.app.approval.service** inside the above mentioned folder.

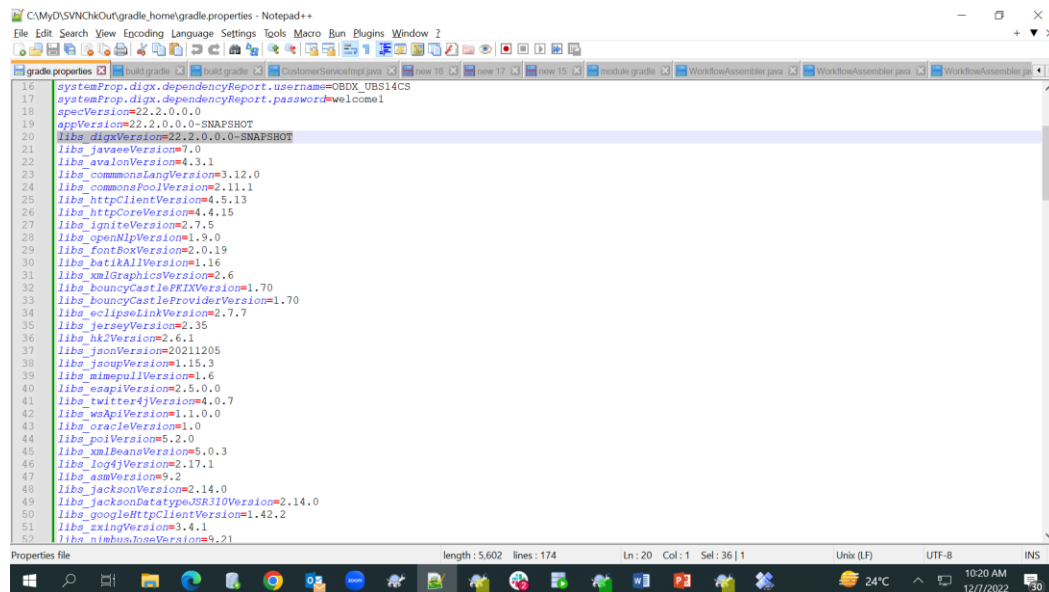
Finally the **version** is

\$libs_digxVersion

This version is a variable. The value of this variable is defined in a file

OBDX_Patch_Installer\core\config\gradle.properties.

If the value of the variable is as shown below



```

16 systemProp.digx.dependencyReport.useName=OBDX_UBS14CS
17 systemProp.digx.dependencyReport.password=welcome1
18 specVersion=22.2.0.0.0
19 appVersion=22.2.0.0.0-SNAPSHOT
20 libs_digxVersion=22.2.0.0.0-SNAPSHOT
21 libs_javaeeVersion=7.0
22 libs_avalonVersion=4.3.1
23 libs_commonsLangVersion=3.12.0
24 libs_commonsPoolVersion=2.11.1
25 libs_httpClientVersion=4.5.13
26 libs_httpCoreVersion=4.4.15
27 libs_igniteVersion=2.7.5
28 libs_openJlpVersion=1.9.0
29 libs_fontBoxVersion=2.0.19
30 libs_bt1kAllVersion=1.16
31 libs_xmlGraphicsVersion=2.6
32 libs_bouncyCastlePKIXVersion=1.70
33 libs_bouncyCastleProviderVersion=1.70
34 libs_eclipseLinkVersion=2.7.7
35 libs_jerseyVersion=2.35
36 libs_hk2Version=2.6.1
37 libs_jsonVersion=20211205
38 libs_jsoupVersion=1.15.3
39 libs_mimepullVersion=1.6
40 libs_eeapiVersion=2.5.0.0
41 libs_twitter4jVersion=4.0.7
42 libs_waApiVersion=1.1.0.0
43 libs_oracleVersion=1.0
44 libs_poIversion=5.2.0
45 libs_xmlBeansVersion=5.0.3
46 libs_log4jVersion=2.17.1
47 libs_asmVersion=9.2
48 libs_jacksonVersion=2.14.0
49 libs_jacksonDatatypeJSR310Version=2.14.0
50 libs_googleHttpClientVersion=1.42.2
51 libs_xxingVersion=3.4.1
52 libs_nimbusJoseVersion=9.21
  
```

Create a folder named **22.2.0.0-SNAPSHOT** inside the folder created for artefact above.

Consequently the final folder structure should be as below

**OBDX_Patch_Installer\installables\gradle-repo\com\ofss\digx\cz\module\approval\
com.ofss.digx.cz.app.approval.service\22.2.0.0-SNAPSHOT**

Place your customised jar inside the above folder such that it gets picked by the gradle script and packaged inside the digx-admin war

11.2.2 Customizations to add new war

1. Create module specific folder in dist\cz\wars (typically 'digx-cz-<<ModuleName>>')
2. Ensure all the artifacts like src, build.gradle, settings.gradle, module.gradle of modules are present.
3. Provide all the dependency, like other module jars and third party jars in module.gradle. The libraries which are part of digx-shared-lib should not be included here.
4. Once the dependencies are included, build the war using gradle build command. It will generate the module war in wars\digx-cz-<<ModuleName>>\build\libs folder.
5. Ensure the generated war has all the necessary components and deploy the same as an application on the server. Also make sure that the module name is correctly present in application.properties with following property name.
6. spring.application.name=digx-cz-<ModuleName>

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