BITI: Building Services for SAP Gateway

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INTRODUCTION

*Photo by Martin Gillet

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AGENDA

- Some Warnings
- Service Design
- Code patterns for reusability
- Code patterns for extensibility

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- Service Design
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- Code patterns for extensibility

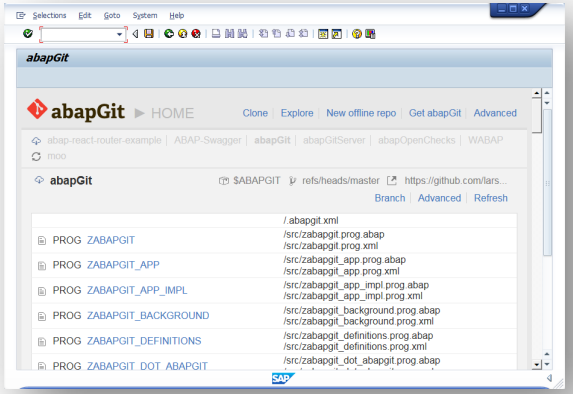
WARNING – THIS IS NOT FOR BEGINNERS

WARNING - HOMEWORK

https://grahamrobbo.github.io/teched16_example/

To install you will also need abapGit

https://abapGit.org



WARNING – FOCUS ON CONSUMPTION

These code patterns can apply to all actions – but I will focus on consumption

GET_ENTITYSET is more complex because it needs to supports oData query options

CDS views (NW 7.40 SP8) provide other consumption options

WARNING – I DO NOT HAVE ALL THE ANSWERS

¯_(ツ)_/¯

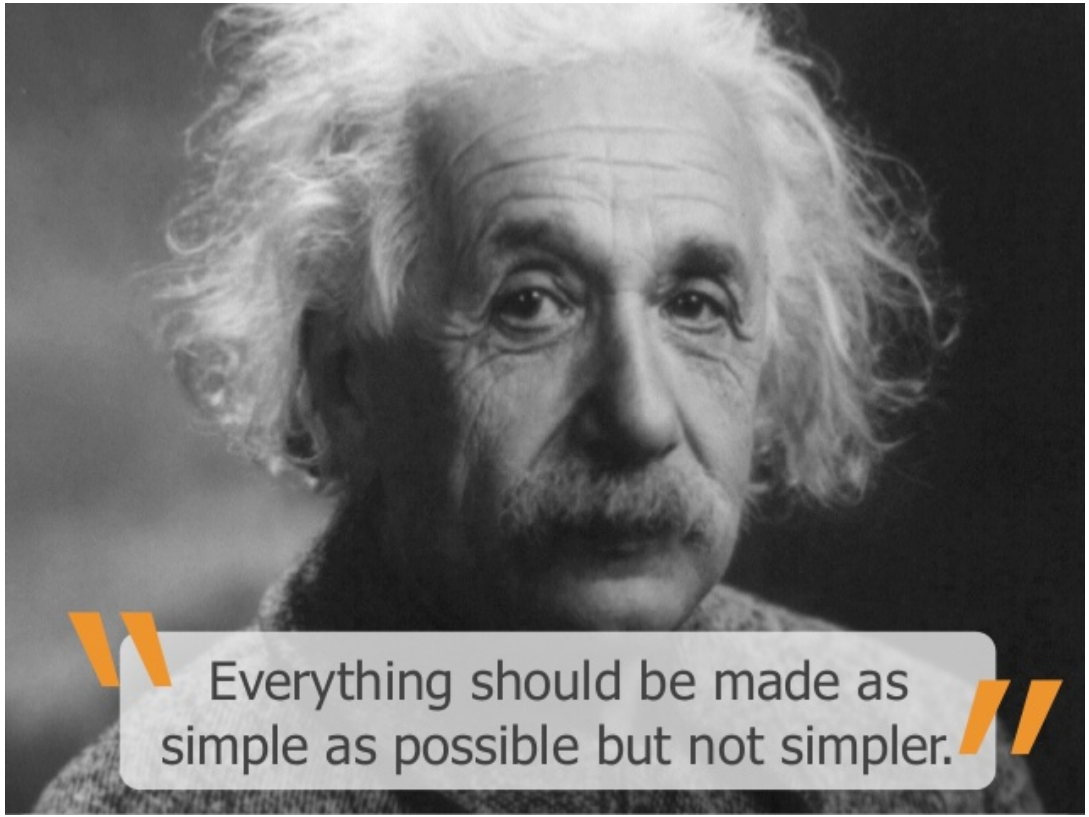
AGENDA

- Some Warnings
- Service Design
- Code patterns for reusability
- Code patterns for extensibility

SERVICE DESIGN PRINCIPLES

- Design for Consumers
- Think oData i.e. Entities, Associations, etc.
- Leave SAP domain knowledge at the door
- REST API's should be self-describing
- Function Imports should be for special cases

GENERAL THEORY OF API DESIGN

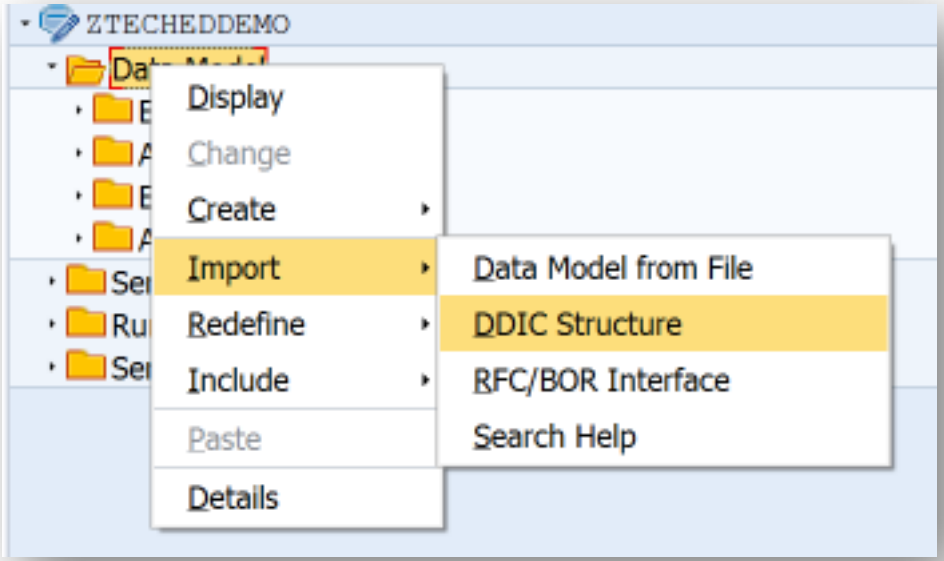


CONSUMER VIEW OF API

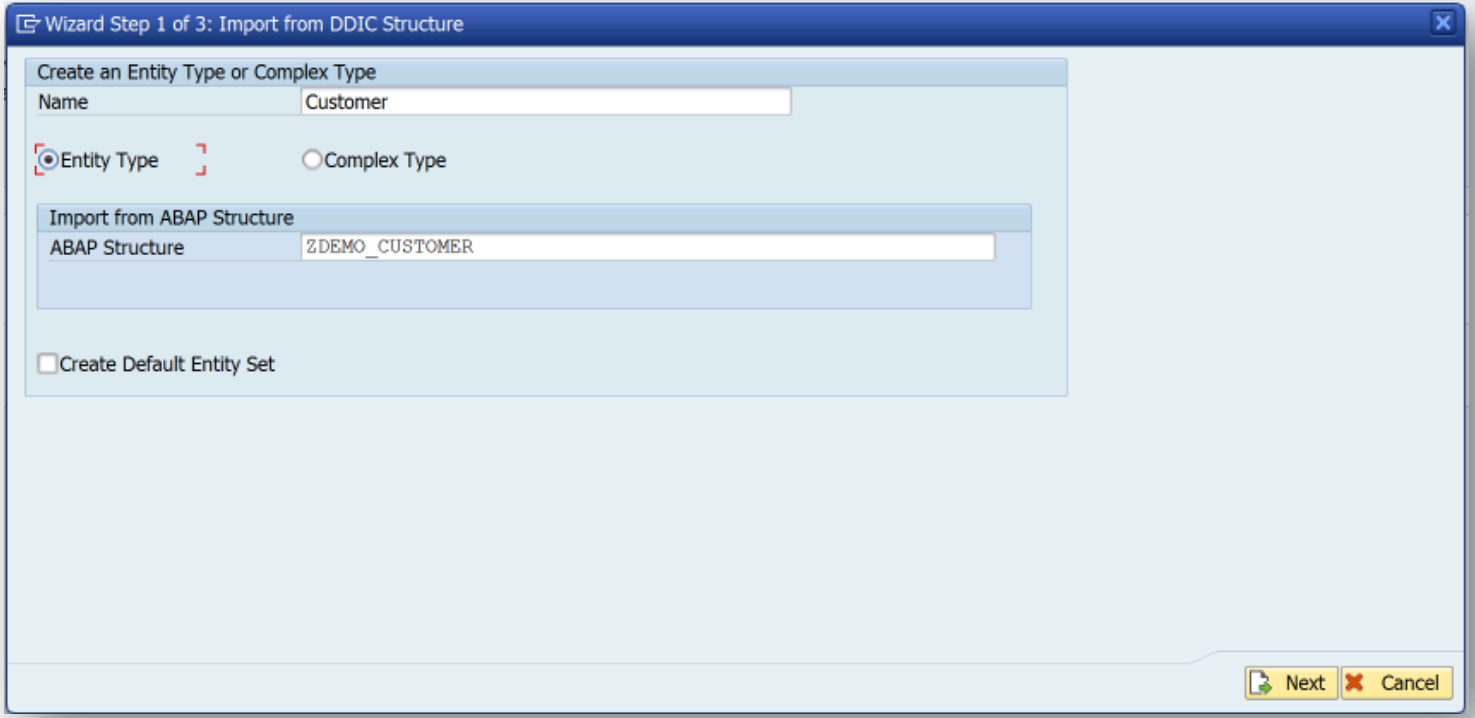
```
<EntityType Name="Order">
  <Key>
    <PropertyRef Name="OrderID"/>
  </Key>
  <Property Name="OrderID" Type="Edm.Int32" Nullable="false" p6:StoreGeneratedPattern="Identity"
  xmlns:p6="http://schemas.microsoft.com/ado/2009/02/edm/annotation"/>
  <Property Name="CustomerID" Type="Edm.String" MaxLength="5" FixedLength="true" Unicode="true"/>
  <Property Name="EmployeeID" Type="Edm.Int32"/>
  <Property Name="OrderDate" Type="Edm.DateTime"/>
  <Property Name="RequiredDate" Type="Edm.DateTime"/>
  <Property Name="ShippedDate" Type="Edm.DateTime"/>
  <Property Name="ShipVia" Type="Edm.Int32"/>
  <Property Name="Freight" Type="Edm.Decimal" Precision="19" Scale="4"/>
  <Property Name="ShipName" Type="Edm.String" MaxLength="40" FixedLength="false" Unicode="true"/>
  <Property Name="ShipAddress" Type="Edm.String" MaxLength="60" FixedLength="false" Unicode="true"/>
  <Property Name="ShipCity" Type="Edm.String" MaxLength="15" FixedLength="false" Unicode="true"/>
  <Property Name="ShipRegion" Type="Edm.String" MaxLength="15" FixedLength="false" Unicode="true"/>
  <Property Name="ShipPostalCode" Type="Edm.String" MaxLength="10" FixedLength="false" Unicode="true"/>
  <Property Name="ShipCountry" Type="Edm.String" MaxLength="15" FixedLength="false" Unicode="true"/>
  <NavigationProperty Name="Customer" Relationship="NorthwindModel.FK_Orders_Customers" ToRole="Customers" FromRole="Orders"/>
  <NavigationProperty Name="Employee" Relationship="NorthwindModel.FK_Orders_Employees" ToRole="Employees" FromRole="Orders"/>
  <NavigationProperty Name="Order_Details" Relationship="NorthwindModel.FK_Order_Details_Orders" ToRole="Order_Details" FromRole="Orders"/>
  <NavigationProperty Name="Shipper" Relationship="NorthwindModel.FK_Orders_Shippers" ToRole="Shippers" FromRole="Orders"/>
</EntityType>
```

Source: http://services.odata.org/northwind/northwind.svc/$metadata

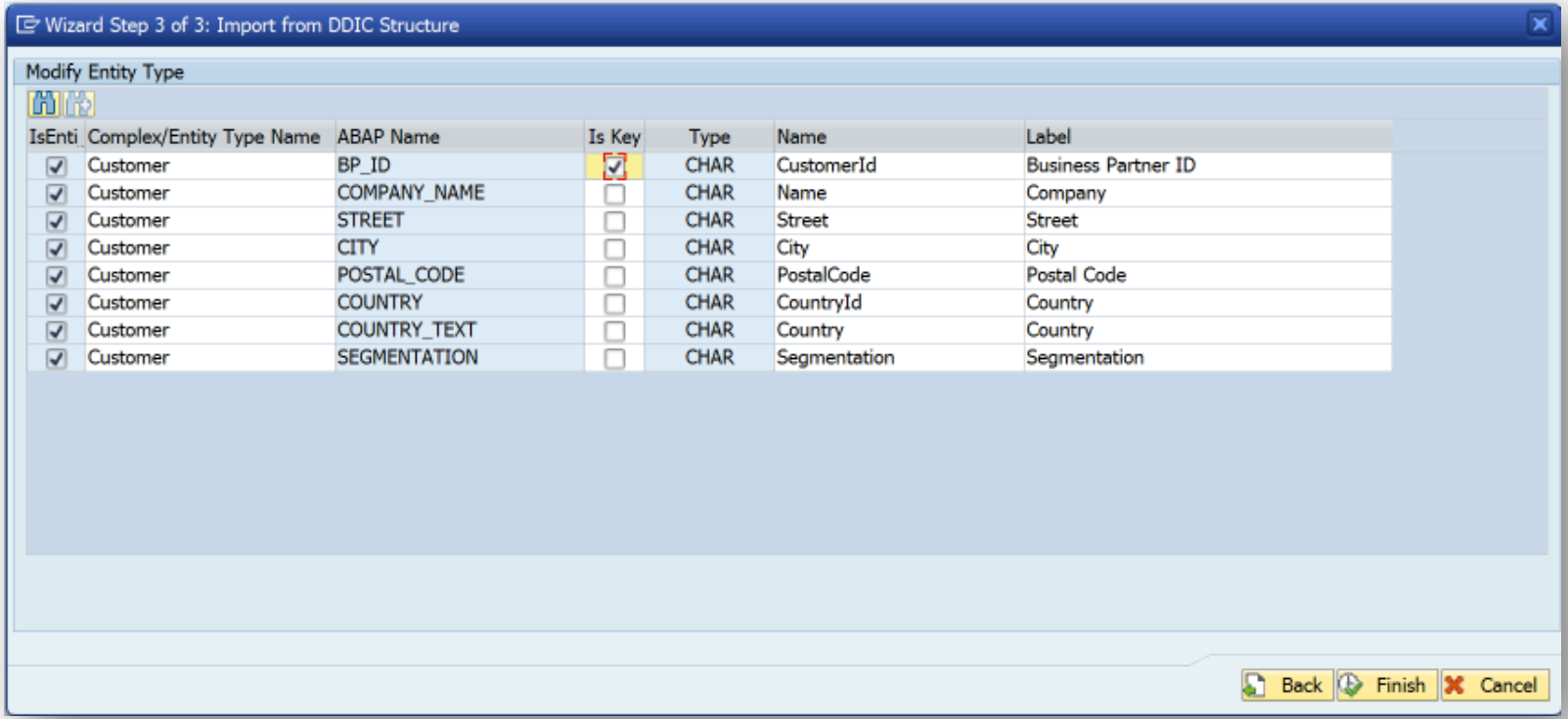
BIND ENTITY TO DDIC STRUCTURE



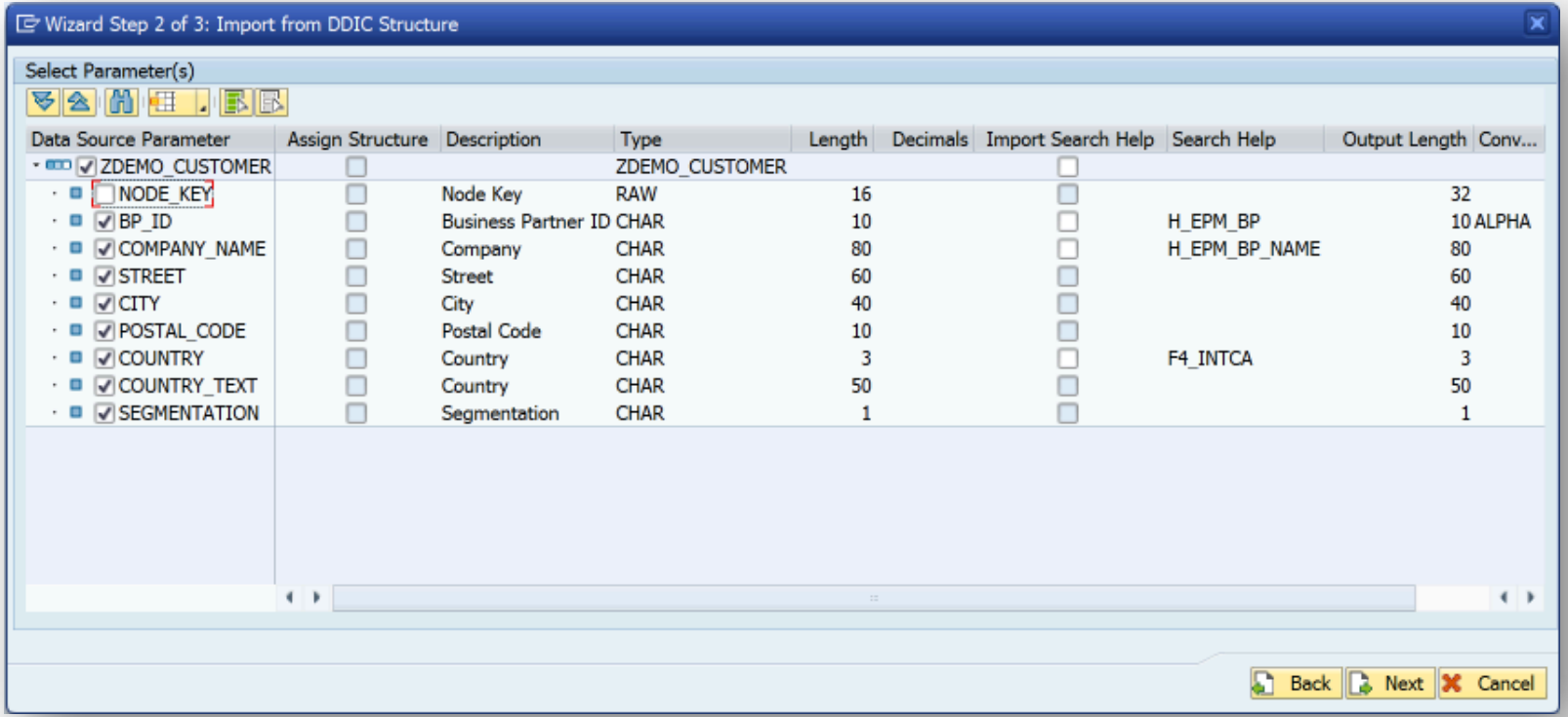
BIND ENTITY TO DDIC STRUCTURE



BIND ENTITY TO DDIC STRUCTURE

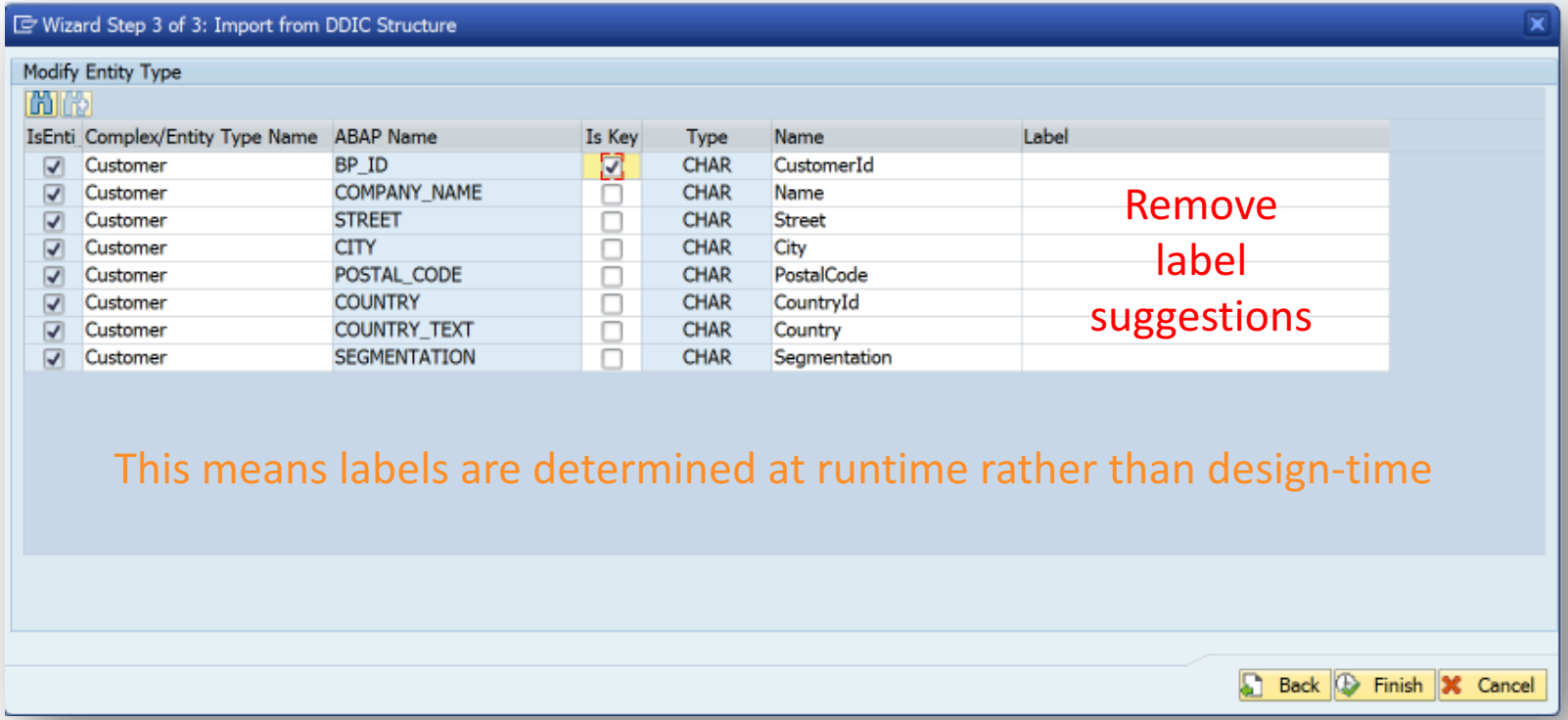


BIND ENTITY TO DDIC STRUCTURE



Data Source Parameter	Assign Structure	Description	Type	Length	Decimals	Import Search Help	Search Help	Output Length	Conv...
ZDEMO_CUSTOMER			ZDEMO_CUSTOMER						
NODE_KEY		Node Key	RAW	16				32	
BP_ID		Business Partner ID	CHAR	10			H_EPM_BP	10	ALPHA
COMPANY_NAME		Company	CHAR	80			H_EPM_BP_NAME	80	
STREET		Street	CHAR	60				60	
CITY		City	CHAR	40				40	
POSTAL_CODE		Postal Code	CHAR	10				10	
COUNTRY		Country	CHAR	3			F4_INTCA	3	
COUNTRY_TEXT		Country	CHAR	50				50	
SEGMENTATION		Segmentation	CHAR	1				1	

BIND ENTITY TO DDIC STRUCTURE



$METADATA

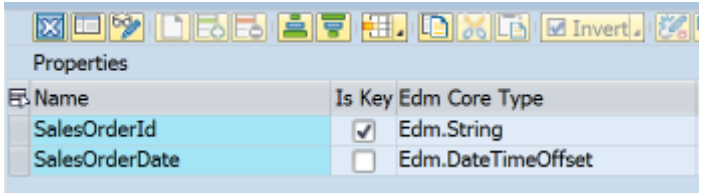
Invert | Identical

Properties

Name	Is Key	Edm Core Type	Prec.	Scale	Max L	Unit Property Name	Creatable	Updatable	Sortable	Nullable	Filt.	Label	La	Complex Type Name	ABAP Field Name
CustomerId	☑	Edm.String	0	0	10		☐	☐	☑	☐	☑		I		BP_ID
Name	☐	Edm.String	0	0	80		☐	☐	☑	☐	☑		I		COMPANY_NAME
Street	☐	Edm.String	0	0	60		☐	☐	☑	☐	☑		I		STREET
City	☐	Edm.String	0	0	40		☐	☐	☑	☐	☑		I		CITY
PostCode	☐	Edm.String	0	0	10		☐	☐	☑	☐	☑		I		POSTAL_CODE
CountryId	☐	Edm.String	0	0	3		☐	☐	☑	☐	☑		I		COUNTRY
Country	☐	Edm.String	0	0	50		☐	☐	☐	☐	☐		I		COUNTRY_TEXT
Segmentation	☐	Edm.String	0	0	1		☐	☐	☐	☐	☐		I		SEGMENTATION

```
<EntityType Name="Customer" sap:content-version="1">
  <Key>
    <PropertyRef Name="CustomerId"/>
  </Key>
  <Property Name="CustomerId" Type="Edm.String" Nullable="false" MaxLength="10" sap:label="Business Partner ID" sap:creatable="false" sap:updatable="false"/>
  <Property Name="Name" Type="Edm.String" Nullable="false" MaxLength="80" sap:label="Company" sap:creatable="false" sap:updatable="false"/>
  <Property Name="Street" Type="Edm.String" Nullable="false" MaxLength="60" sap:label="Street" sap:creatable="false" sap:updatable="false"/>
  <Property Name="City" Type="Edm.String" Nullable="false" MaxLength="40" sap:label="City" sap:creatable="false" sap:updatable="false"/>
  <Property Name="PostCode" Type="Edm.String" Nullable="false" MaxLength="10" sap:label="Postal Code" sap:creatable="false" sap:updatable="false"/>
  <Property Name="CountryId" Type="Edm.String" Nullable="false" MaxLength="3" sap:label="Country" sap:creatable="false" sap:updatable="false"/>
  <Property Name="Country" Type="Edm.String" Nullable="false" MaxLength="50" sap:label="Country" sap:creatable="false" sap:updatable="false" sap:sortable="false" sap:filterable="false"/>
  <Property Name="Segmentation" Type="Edm.String" Nullable="false" MaxLength="1" sap:label="Segmentation" sap:creatable="false" sap:updatable="false" sap:sortable="false" sap:filterable="false"/>
  <NavigationProperty Name="SalesOrders" Relationship="ZDEMO_SRV.Customer_SalesOrder" FromRole="FromRole_Customer_SalesOrder" ToRole="ToRole_Customer_SalesOrder"/>
</EntityType>
```

DATES & TIMES




```
- <content type="application/xml">
  - <m:properties xmlns:m="http://schemas.microsoft.com/ado/2007/08/da
      <d:SalesOrderId>60000008</d:SalesOrderId>
      <d:SalesOrderDate>2006-10-19T00:00:00Z</d:SalesOrderDate>
    </m:properties>
  </content>
```

```
<EntityType Name="SalesOrder" sap:content-version="1">
   <Key>
      <PropertyRef Name="SalesOrderId"/>
   </Key>
   <Property Name="SalesOrderId" Type="Edm.String" Nullable="false" MaxLength="10" sap:label="Sales Document" sap:creatable="false" sap:updatable="false"/>
   <Property Name="SalesOrderDate" Type="Edm.DateTimeOffset" Precision="7" sap:label="Document Date" sap:creatable="false" sap:updatable="false" sap:filterable="false"/>
   <NavigationProperty Name="Customer" Relationship="ZDEMO_SRV.Customer_SalesOrder" FromRole="ToRole_Customer_SalesOrder" ToRole="FromRole_Customer_SalesOrder"/>
   <NavigationProperty Name="SalesOrderItems" Relationship="ZDEMO_SRV.SalesOrder_Items" FromRole="FromRole_SalesOrder_Items" ToRole="ToRole_SalesOrder_Items"/>
</EntityType>
```

Use `Edm.DateTimeOffset` for date/time/timestamp properties

Don’t be tempted to use Edm.String “for convenience”
Edm.DateTime replaced in oData V4 specification

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- Some Warnings
- Service Design
- Code patterns for reusability
- Code patterns for extensibility

CODE PATTERNS FOR REUSABILITY

The first rule of reusability is encapsulate all business logic in concrete classes

WHAT A CLASS IS NOT

An ABAP class that only contains static methods is not really a class…..

… in all respects except object type it is a...

Function Group

The second rule of reusability

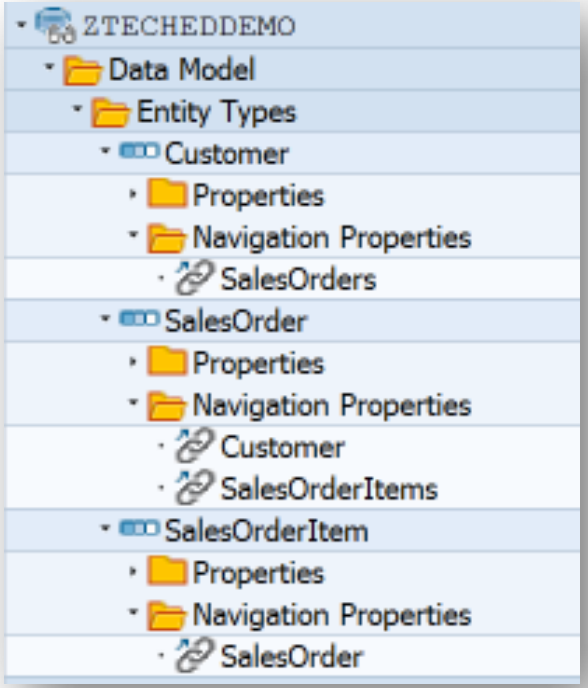
ENCAPSULATE ALL BUSINESS LOGIC IN CONCRETE CLASSES

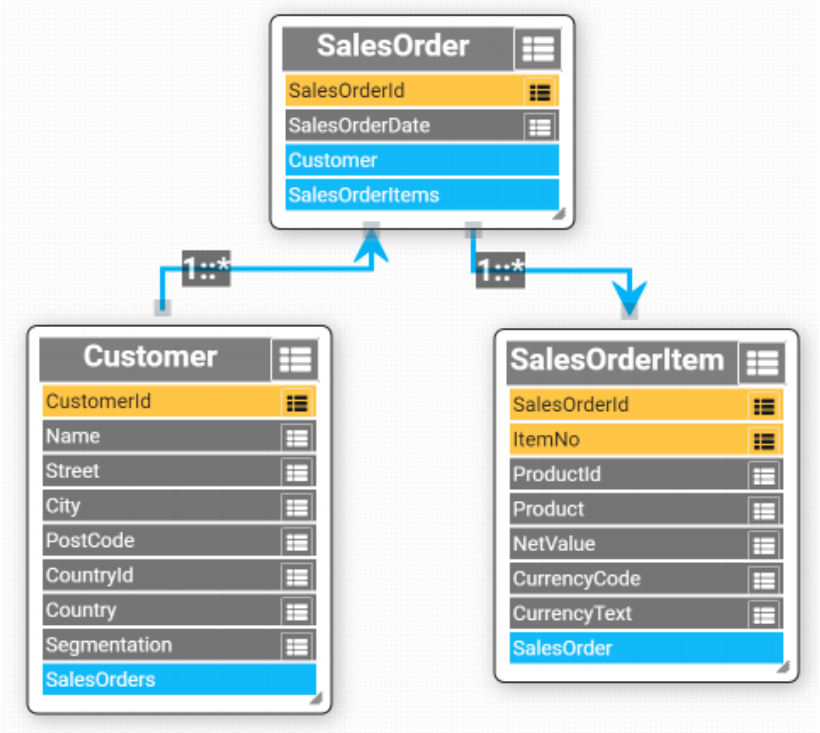
CODE PATTERNS FOR REUSABILITY

- I like the singleton design pattern in ABAP
  - Be aware that some people don't
  - I don't care – it works for me
- I like getters (& sometimes setters)
  - Be aware that some people don't
  - I don't care – it works for me

You can implement business logic however you like…
just remember the first & second rules of reusability

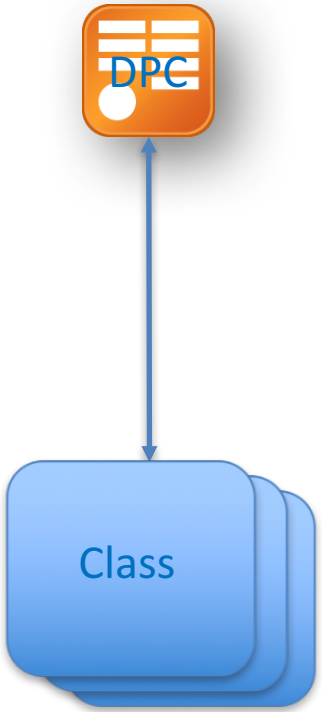
SAMPLE DATA MODEL



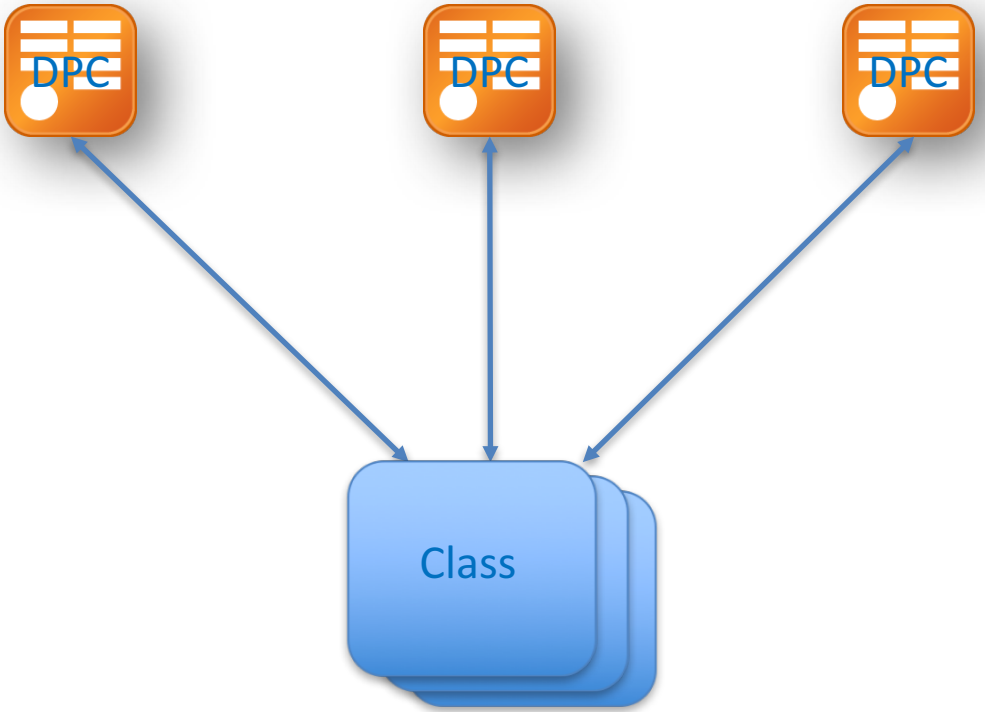


Based upon SAP Enterprise Procurement Model

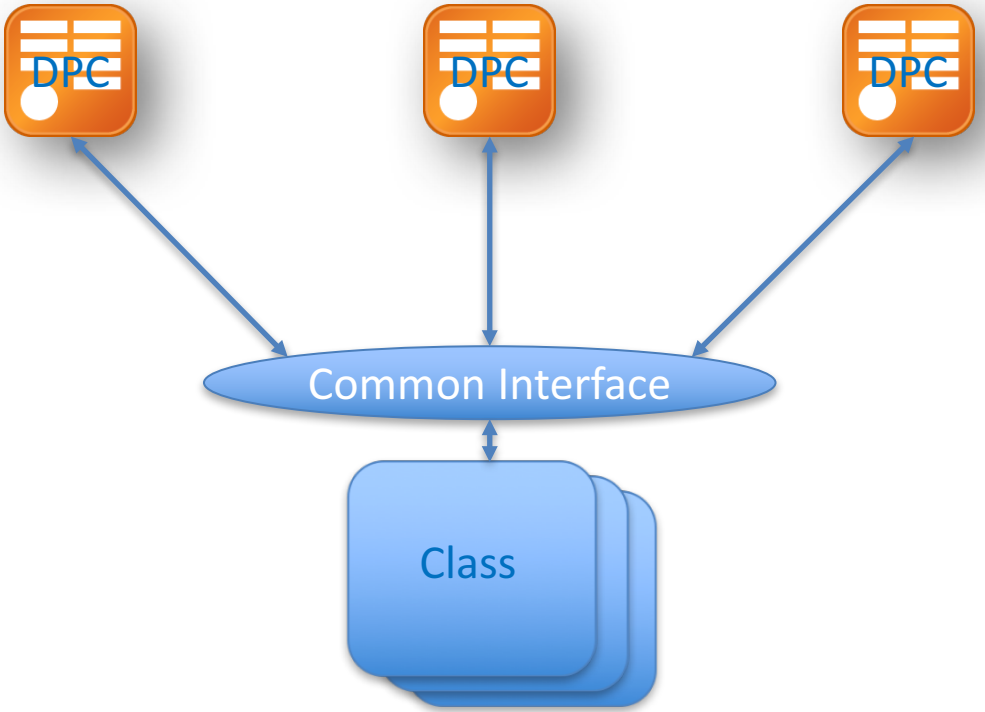
DATA PROVIDER CLASS



MULTIPLE CONSUMERS



MULTIPLE CONSUMERS



REPLICATE GW METHOD INTERFACE

Ty.	Parameter	Typing
	IV_ENTITY_NAME	TYPE STRING OPTIONAL
	IV_ENTITY_SET_NAME	TYPE STRING OPTIONAL
	IV_SOURCE_NAME	TYPE STRING OPTIONAL
	IT_FILTER_SELECT_OPTIONS	TYPE /IWBEP/T_MGW_SELECT_OPTION OPTIONAL
	IT_ORDER	TYPE /IWBEP/T_MGW_SORTING_ORDER OPTIONAL
	IS_PAGING	TYPE /IWBEP/S_MGW_PAGING OPTIONAL
	IT_NAVIGATION_PATH	TYPE /IWBEP/T_MGW_NAVIGATION_PATH OPTIONAL
	IT_KEY_TAB	TYPE /IWBEP/T_MGW_NAME_VALUE_PAIR OPTIONAL
	IV_FILTER_STRING	TYPE STRING OPTIONAL
	IV_SEARCH_STRING	TYPE STRING OPTIONAL
	IO_TECH_REQUEST_CONTEXT	TYPE REF TO /IWBEP/IF_MGW_REQ_ENTITYSET OPTIONAL
	ER_ENTITYSET	TYPE REF TO DATA
	ES_RESPONSE_CONTEXT	TYPE /IWBEP/IF_MGW_APPL_SRV_RUNTIME=>TY_S_MGW_RESPONSE_CONTEXT
	/IWBEP/CX_MGW_BUSI_EXCEPTION	
	/IWBEP/CX_MGW_TECH_EXCEPTION	

Method /IWBEP/IF_MGW_APPL_SRV_RUNTIME~GET_ENTITYSET Active

```
1  method /IWBEP/IF_MGW_APPL_SRV_RUNTIME~GET_ENTITYSET.
```

AVOID USING DEPRECATED PARAMETERS

Ty.	Parameter	Typing	Description
	IV_ENTITY_NAME	TYPE STRING OPTIONAL	Obsolete
	IV_ENTITY_SET_NAME	TYPE STRING OPTIONAL	Obsolete
	IV_SOURCE_NAME	TYPE STRING OPTIONAL	Obsolete
	IT_FILTER_SELECT_OPTIONS	TYPE /IWBEP/T_MGW_SELECT_OPTION OPTIONAL	table of select options - Obsolete
	IT_ORDER	TYPE /IWBEP/T_MGW_SORTING_ORDER OPTIONAL	the sorting order - Obsolete
	IS_PAGING	TYPE /IWBEP/S_MGW_PAGING OPTIONAL	paging structure - Obsolete
	IT_NAVIGATION_PATH	TYPE /IWBEP/T_MGW_NAVIGATION_PATH OPTIONAL	table of navigation paths - Obsolete
	IT_KEY_TAB	TYPE /IWBEP/T_MGW_NAME_VALUE_PAIR OPTIONAL	table for name value pairs - Obsolete
	IV_FILTER_STRING	TYPE STRING OPTIONAL	the filter as a string containing ANDs and ORs etc -Obsolete
	IV_SEARCH_STRING	TYPE STRING OPTIONAL	Obsolete
	IO_TECH_REQUEST_CONTEXT	TYPE REF TO /IWBEP/IF_MGW_REQ_ENTITYSET OPTIONAL	
	ER_ENTITYSET	TYPE REF TO DATA	
	ES_RESPONSE_CONTEXT	TYPE /IWBEP/IF_MGW_APPL_SRV_RUNTIME=>TY_S_MGW_RESPONSE_CONTEXT	
	/IWBEP/CX_MGW_BUSI_EXCEPTION		business exception in mgw
	/IWBEP/CX_MGW_TECH_EXCEPTION		mgw technical exception

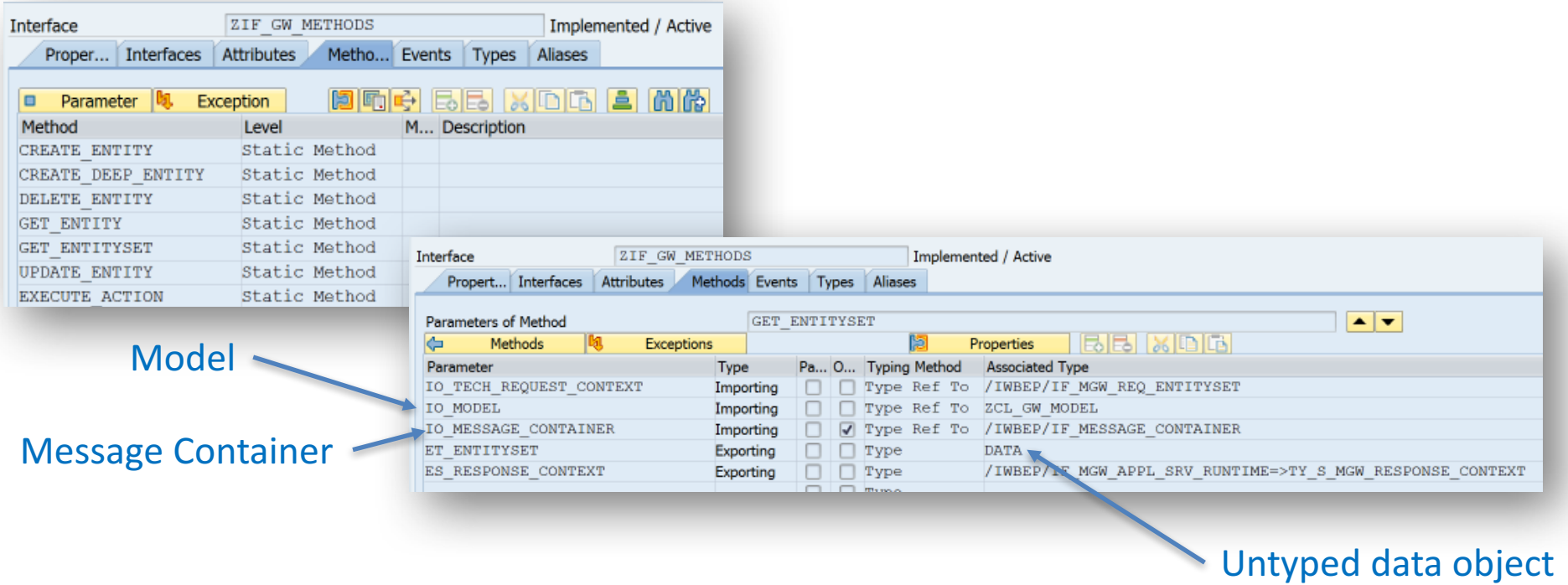
Method /IWBEP/IF_MGW_APPL_SRV_RUNTIME~GET_ENTITYSET Active

```
1  method /IWBEP/IF_MGW_APPL_SRV_RUNTIME~GET_ENTITYSET.
```

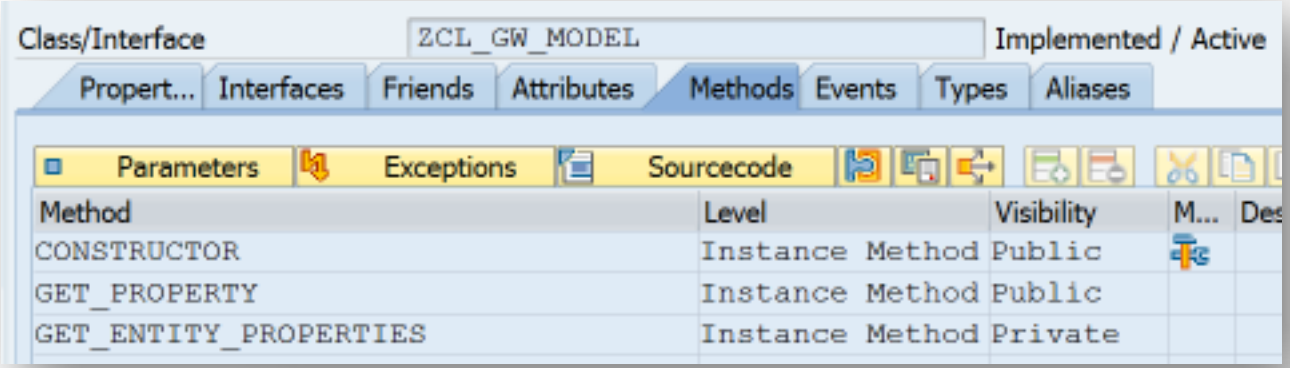
https://blogs.sap.com/2017/02/01/avoid-using-deprecated-sap-gateway-apis-in-your-odata-service-implementation/

Nabi Zamani

COMMON INTERFACE

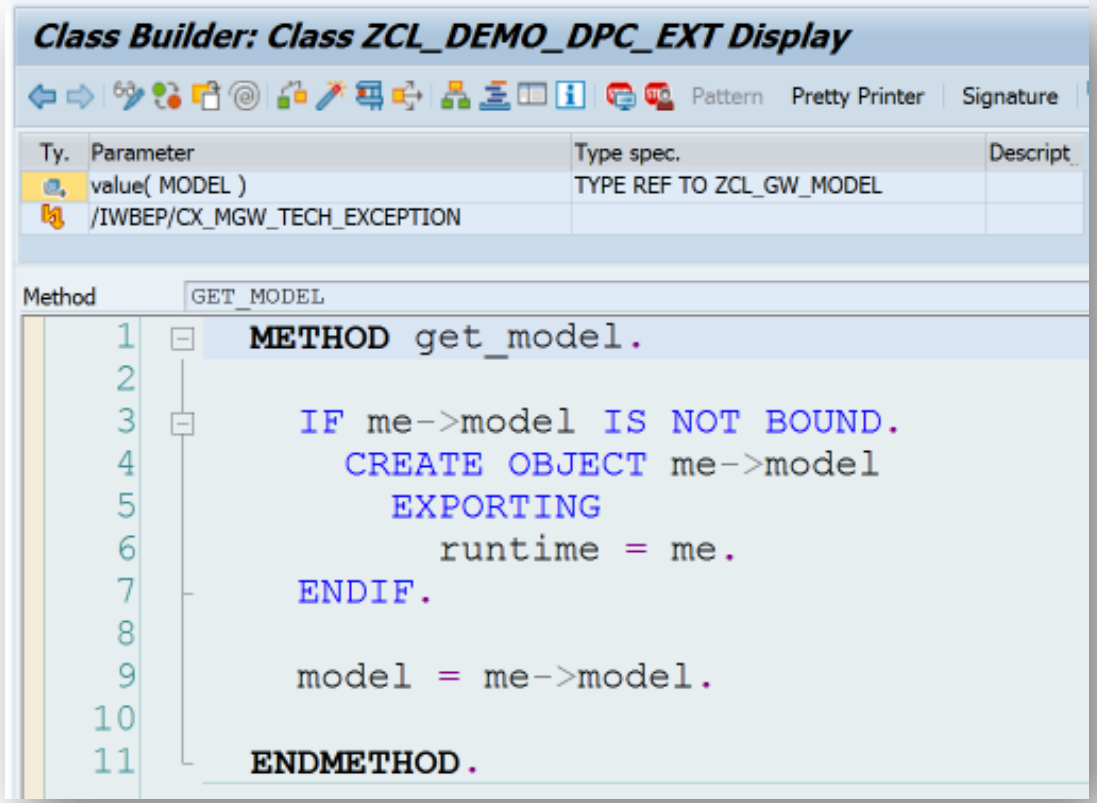


ZCL_GW_MODEL




```
METHOD constructor.

  DATA: lr_facade TYPE REF TO /iwbep/cl_mgw_dp_facade.
  lr_facade ?= runtime->get_dp_facade( ).

  mpc ?= lr_facade->/iwbep/if_mgw_dp_int_facade~get_model( ).

ENDMETHOD.
```

DPC->GET_MODEL



CALL BO CLASS FROM DPC

Method CUSTOMERS_GET_ENTITYSET Active

```
1  METHOD customers_get_entityset.
2    zcl_demo_customer=>zif_gw_methods~get_entityset(
3      EXPORTING
4        io_tech_request_context  = io_tech_request_context
5        io_model                 = get_model( )
6        io_message_container     = mo_context->get_message_container( )
7      IMPORTING
8        et_entityset             = et_entityset
9        es_response_context      = es_response_context ).
10 ENDMETHOD.
```

ODATA OPERATIONS

	Identify Primary Key(s)	Instantiate Class	Call class methods	Fill Entity
Create		✓	✓	✓
Read	✓	✓		✓
Update	✓	✓	✓	✓
Delete	✓	✓	✓	

GET_ENTITY

- Identify primary key(s)
- Instantiate BO class
- Fill entity

GET_ENTITY V1

```
DATA: lt_key_tab  TYPE /iwbep/t_mgw_tech_pairs,
      ls_key      LIKE LINE OF lt_key_tab,
      lv_bp_id    TYPE snwd_partner_id,
      lo_customer TYPE REF TO zif_demo_customer,
      lr_entity   TYPE REF TO data.

lt_key_tab = io_tech_request_context->get_keys( ).
READ TABLE lt_key_tab
  WITH KEY name = 'BP_ID'
  INTO ls_key.

lv_bp_id = ls_key-value.

lo_customer = zcl_demo_customer=>get_using_bp_id( lv_bp_id ).

GET REFERENCE OF er_entity INTO lr_entity.
lo_customer->zif_gw_methods~map_to_entity( lr_entity ).
```

GET_ENTITY V1 – IDENTIFY PRIMARY KEY

```
DATA: lt_key_tab  TYPE /iwbep/t_mgw_tech_pairs,
      ls_key      LIKE LINE OF lt_key_tab,
      lv_bp_id    TYPE snwd_partner_id,
      lo_customer TYPE REF TO zif_demo_customer,
      lr_entity   TYPE REF TO data.
```

```
lt_key_tab = io_tech_request_context->get_keys( ).
READ TABLE lt_key_tab
  WITH KEY name = 'BP_ID'
  INTO ls_key.

lv_bp_id = ls_key-value.
```

```
lo_customer = zcl_demo_customer=>get_using_bp_id( lv_bp_id ).

GET REFERENCE OF er_entity INTO lr_entity.
lo_customer->zif_gw_methods~map_to_entity( lr_entity ).
```

GET_ENTITY V1 – INSTANTIATE BO CLASS

```
DATA: lt_key_tab  TYPE /iwbep/t_mgw_tech_pairs,
      ls_key      LIKE LINE OF lt_key_tab,
      lv_bp_id    TYPE snwd_partner_id,
      lo_customer TYPE REF TO zif_demo_customer,
      lr_entity   TYPE REF TO data.

lt_key_tab = io_tech_request_context->get_keys( ).
READ TABLE lt_key_tab
  WITH KEY name = 'BP_ID'
  INTO ls_key.

lv_bp_id = ls_key-value.

lo_customer = zcl_demo_customer=>get_using_bp_id( lv_bp_id ).

GET REFERENCE OF er_entity INTO lr_entity.
lo_customer->zif_gw_methods~map_to_entity( lr_entity ).
```

GET_ENTITY V1 – FILL ENTITY

```
DATA: lt_key_tab  TYPE /iwbep/t_mgw_tech_pairs,
      ls_key      LIKE LINE OF lt_key_tab,
      lv_bp_id    TYPE snwd_partner_id,
      lo_customer TYPE REF TO zif_demo_customer,
      lr_entity   TYPE REF TO data.

lt_key_tab = io_tech_request_context->get_keys( ).
READ TABLE lt_key_tab
  WITH KEY name = 'BP_ID'
  INTO ls_key.

lv_bp_id = ls_key-value.

lo_customer = zcl_demo_customer=>get_using_bp_id( lv_bp_id ).
```

```
GET REFERENCE OF er_entity INTO lr_entity.
lo_customer->zif_gw_methods~map_to_entity( lr_entity ).
```

GET_ENTITY V2

```
DATA: lt_key_tab  TYPE /iwbep/t_mgw_tech_pairs,
      ls_key      LIKE LINE OF lt_key_tab,
      lv_bp_id    TYPE snwd_partner_id,
      lo_customer TYPE REF TO zif_demo_customer,
      lr_entity   TYPE REF TO data.

lt_key_tab = io_tech_request_context->get_keys( ).
READ TABLE lt_key_tab
  WITH KEY name = 'BP_ID'
  INTO ls_key.

lv_bp_id = ls_key-value.

lo_customer = zcl_demo_customer=>get_using_bp_id( lv_bp_id ).

GET REFERENCE OF er_entity INTO lr_entity.
lo_customer->zif_gw_methods~map_to_entity( lr_entity ).
```

GET_ENTITY V2

```
lt_key_tab = io_tech_request_context->get_keys( ).
READ TABLE lt_key_tab
  with KEY name = 'BP_ID'
  into ls_key.

lv_bp_id = ls_key-value.

lo_customer = zcl_demo_customer=>get_using_bp_id( lv_bp_id ).

GET REFERENCE OF er_entity INTO lr_entity.
lo_customer->zif_gw_methods~map_to_entity( lr_entity ).
```

GET_ENTITY V2 – TABLE EXPRESSION

```
lt_key_tab = io_tech_request_context->get_keys( ).

lv_bp_id = lt_key_tab[ name = 'BP_ID' ]-value.



lo_customer = zcl_demo_customer=>get_using_bp_id( lv_bp_id ).

GET REFERENCE OF er_entity INTO lr_entity.
lo_customer->zif_gw_methods~map_to_entity( lr_entity ).
```

GET_ENTITY V2 – CONVERSION OPERATOR

```
lt_key_tab = io_tech_request_context->get_keys( ).
```

```
lo_customer = zcl_demo_customer=>get_using_bp_id(
  CONV #( lt_key_tab[ name = 'BP_ID' ]-value ) ).

GET REFERENCE OF er_entity INTO lr_entity.
lo_customer->zif_gw_methods~map_to_entity( lr_entity ).
```

GET_ENTITY V2 – REFERENCE OPERATOR

```
lt_key_tab = io_tech_request_context->get_keys( ).
```

```
lo_customer = zcl_demo_customer=>get_using_bp_id(
  CONV #( lt_key_tab[ name = 'BP_ID' ]-value ) ).

lo_customer->zif_gw_methods~map_to_entity(
  REF #( er_entity ) ).
```

GET_ENTITY V2

```
lt_key_tab = io_tech_request_context->get_keys( ).

lo_customer = zcl_demo_customer=>get_using_bp_id(
  CONV #( lt_key_tab[ name = 'BP_ID' ]-value ) ).

*--------------------------------------------------------------------*
* For update operations we would call class methods here *
*--------------------------------------------------------------------*

lo_customer->zif_gw_methods~map_to_entity(
  REF #( er_entity ) ).
```

GET_ENTITY V2 – METHOD CHAINING

```
lt_key_tab = io_tech_request_context->get_keys( ).

zcl_demo_customer=>get_using_bp_id(
  CONV #( lt_key_tab[ name = 'BP_ID' ]-value )
  )->zif_gw_methods~map_to_entity( REF #( er_entity ) ).
```

ZIF_GW_METHODS~GET_ENTITY

```
METHOD zif_gw_methods~get_entity.

  TRY.
      CASE io_tech_request_context->get_source_entity_type_name( ).
        WHEN 'SalesOrder'.
          DATA(source_keys) = io_tech_request_context->get_source_keys( ).
          zcl_demo_salesorder=>get_using_so_id(
            CONV #( source_keys[ name = 'SO_ID' ]-value )
            )->get_customer( )->zif_gw_methods~map_to_entity( REF #( er_entity ) ).
        WHEN OTHERS.
          DATA(keys) = io_tech_request_context->get_keys( ).
          zcl_demo_customer=>get_using_bp_id(
            CONV #( keys[ name = 'BP_ID' ]-value )
            )->zif_gw_methods~map_to_entity( REF #( er_entity ) ).
      ENDCASE.

    CATCH zcx_demo_bo cx_sy_itab_line_not_found INTO DATA(exception).
      RAISE EXCEPTION TYPE /iwbep/cx_mgw_busi_exception
        EXPORTING
          textid   = /iwbep/cx_mgw_busi_exception=>business_error
          previous = exception
          message  = |{ exception->get_text( ) }|.
  ENDTRY.

ENDMETHOD.
```

ZIF_GW_METHODS~GET_ENTITY

```
METHOD zif_gw_methods~get_entity.

  TRY.
      CASE io_tech_request_context->get_source_entity_type_name( ).
        WHEN 'SalesOrder'.
          DATA(source_keys) = io_tech_request_context->get_source_keys( ).
          zcl_demo_salesorder=>get_using_so_id(
            CONV #( source_keys[ name = 'SO_ID' ]-value )
            )->get_customer( )->zif_gw_methods~map_to_entity( REF #( er_entity ) ).
        WHEN OTHERS.
          DATA(keys) = io_tech_request_context->get_keys( ).
          zcl_demo_customer=>get_using_bp_id(
            CONV #( keys[ name = 'BP_ID' ]-value )
            )->zif_gw_methods~map_to_entity( REF #( er_entity ) ).
      ENDCASE.

    CATCH zcx_demo_bo cx_sy_itab_line_not_found INTO DATA(exception).
      RAISE EXCEPTION TYPE /iwbep/cx_mgw_busi_exception
        EXPORTING
          textid   = /iwbep/cx_mgw_busi_exception=>business_error
          previous = exception
          message  = |{ exception->get_text( ) }|.
  ENDTRY.

ENDMETHOD.
```

Exception handling

ZIF_GW_METHODS~GET_ENTITY

```
METHOD zif_gw_methods~get_entity.

  TRY.
      CASE io_tech_request_context->get_source_entity_type_name( ).
        WHEN 'SalesOrder'.
          DATA(source_keys) = io_tech_request_context->get_source_keys( ).
          zcl_demo_salesorder=>get_using_so_id(
            CONV #( source_keys[ name = 'SO_ID' ]-value )
            )->get_customer( )->zif_gw_methods~map_to_entity( REF #( er_entity ) ).
        WHEN OTHERS.
          DATA(keys) = io_tech_request_context->get_keys( ).
          zcl_demo_customer=>get_using_bp_id(
            CONV #( keys[ name = 'BP_ID' ]-value )
            )->zif_gw_methods~map_to_entity( REF #( er_entity ) ).
      ENDCASE.

    CATCH zcx_demo_bo cx_sy_itab_line_not_found INTO DATA(exception).
      RAISE EXCEPTION TYPE /iwbep/cx_mgw_busi_exception
        EXPORTING
          textid   = /iwbep/cx_mgw_busi_exception=>business_error
          previous = exception
          message  = |{ exception->get_text( ) }|.
  ENDTRY.

ENDMETHOD.
```

Use salesorder key to get customer

MAP_TO_ENTITY

Ty.	Parameter	Typing	Descript
	ENTITY	TYPE REF TO DATA	
	ZCX_DEMO_BO		

Method ZIF_GW_METHODS~MAP_TO_ENTITY Active

```
1   METHOD zif_gw_methods~map_to_entity.
2
3   ENDMETHOD.
```

MAP_TO_ENTITY

Ty.	Parameter	Typing	Descript
	ENTITY	TYPE REF TO DATA	
	ZCX_DEMO_BO		

Method ZIF_GW_METHODS~MAP_TO_ENTITY Active

```
1  METHOD zif_gw_methods~map_to_entity.
2    call_all_getters( entity ).
3  ENDMETHOD.
```

CALL_ALL_GETTERS

```
DATA: struct_descr TYPE REF TO cl_abap_structdescr,
      parameter    TYPE abap_parmbind,
      parameters   TYPE abap_parmbind_tab.

ASSIGN entity->* TO FIELD-SYMBOL(<entity>).

TRY.
    struct_descr ?= cl_abap_structdescr=>describe_by_data_ref( entity ).
    LOOP AT struct_descr->components REFERENCE INTO DATA(component).
      CLEAR parameters.
      TRY.
          ASSIGN COMPONENT component->name OF STRUCTURE <entity> TO FIELD-SYMBOL(<comp>).
          IF sy-subrc = 0.
            parameter-name = component->name.
            parameter-kind = cl_abap_objectdescr=>returning.
            GET REFERENCE OF <comp> INTO parameter-value.
            INSERT parameter INTO TABLE parameters.
            DATA(method_name) = |GET_{ component->name }|.
            CALL METHOD me->(method_name)
              PARAMETER-TABLE parameters.
          ENDIF.
        CATCH cx_sy_dyn_call_error.
      ENDTRY.
    ENDLOOP.
  CATCH cx_root.
ENDTRY.
```

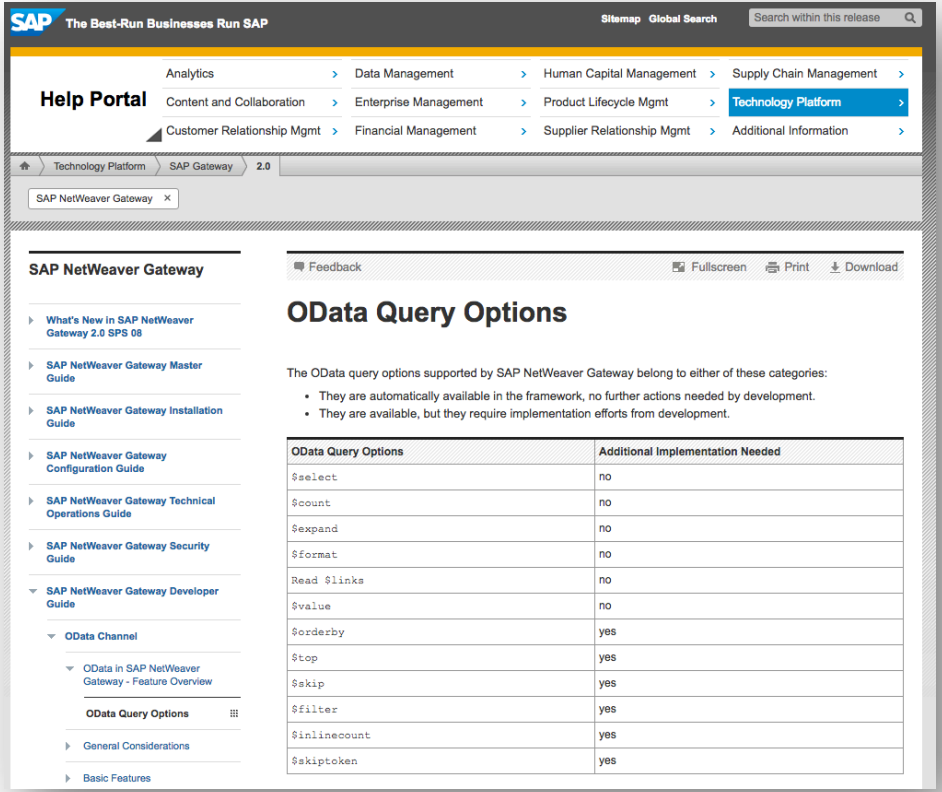
For each entity component we attempt to call matching getter functional method

e.g `<entity>-prop1 = me->get_prop1( ).`

GET_ENTITYSET

Just like GET_ENTITY in a loop…except…

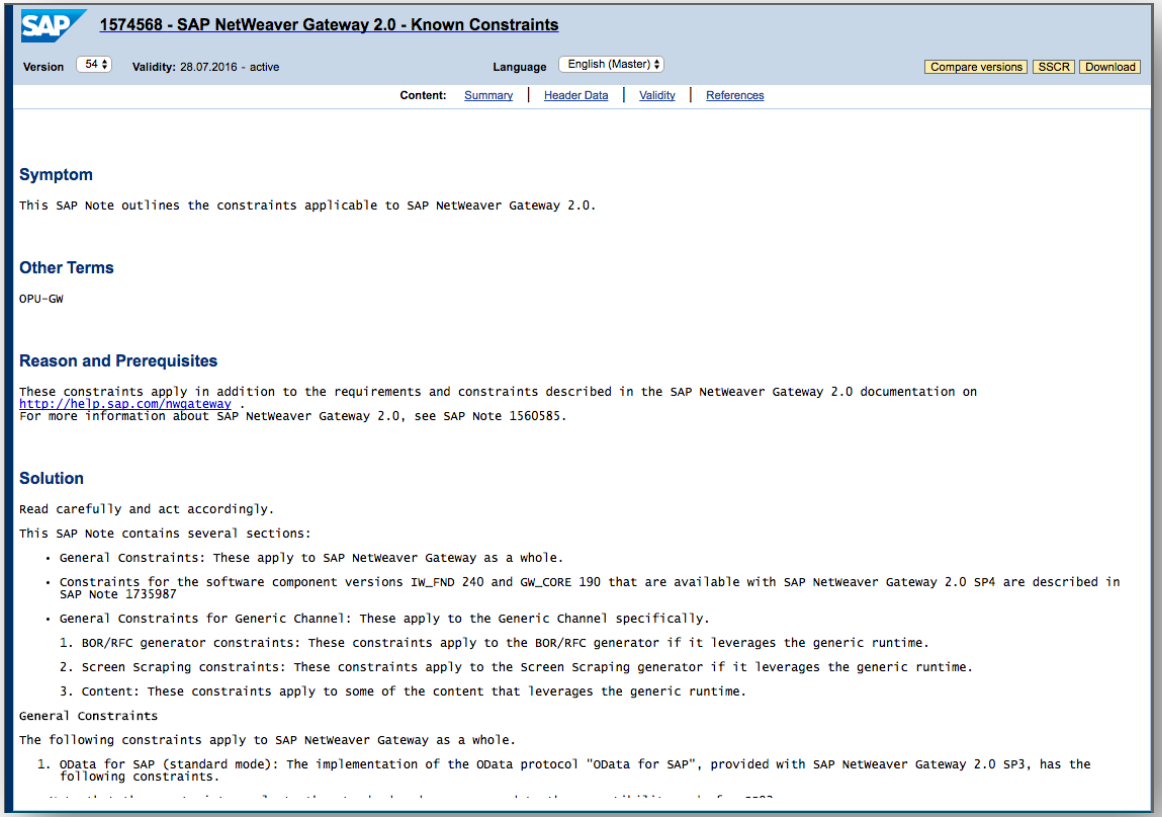
ODATA QUERY OPTIONS



ODATA QUERY OPTIONS

OData Query Options	Additional Implementation Needed
$select	no
$count	no
$expand	no
$format	no
Read $links	no
$value	no
$orderby	yes
$top	yes
$skip	yes
$filter	yes
$inlinecount	yes
$skiptoken	yes

KNOWN CONSTRAINTS



1574568 - SAP NetWeaver Gateway 2.0 - Known Constraints

Version 54 Validity: 28.07.2016 - active Language English (Master) Compare versions SSCR Download

Content: Summary | Header Data | Validity | References

Symptom

This SAP Note outlines the constraints applicable to SAP NetWeaver Gateway 2.0.

Other Terms

OPU-GW

Reason and Prerequisites

These constraints apply in addition to the requirements and constraints described in the SAP NetWeaver Gateway 2.0 documentation on http://help.sap.com/nwgateway .
For more information about SAP NetWeaver Gateway 2.0, see SAP Note 1560585.

Solution

Read carefully and act accordingly.

This SAP Note contains several sections:

- General Constraints: These apply to SAP NetWeaver Gateway as a whole.
- Constraints for the software component versions IW_FND 240 and GW_CORE 190 that are available with SAP NetWeaver Gateway 2.0 SP4 are described in SAP Note 1735987
- General Constraints for Generic Channel: These apply to the Generic Channel specifically.
  1. BOR/RFC generator constraints: These constraints apply to the BOR/RFC generator if it leverages the generic runtime.
  2. Screen Scraping constraints: These constraints apply to the Screen Scraping generator if it leverages the generic runtime.
  3. Content: These constraints apply to some of the content that leverages the generic runtime.

General Constraints

The following constraints apply to SAP NetWeaver Gateway as a whole.

1. OData for SAP (standard mode): The implementation of the OData protocol "OData for SAP", provided with SAP NetWeaver Gateway 2.0 SP3, has the following constraints.

SAP Note 1574568

ZIF_GW_METHODS~GET_ENTITYSET

Goal is to identify primary key(s) as quickly as possible and use them to fill entities.

ZIF_GW_METHODS~GET_ENTITYSET

- Create anonymous data object
- $orderby
- $filter
- $inlinecount
- $top & $skip
- $count
- $skiptoken
- Fill entities

CREATE ANONYMOUS DATA OBJECT

```
" Use RTTS/RTTC to create anonymous object like line of et_entityset
DATA: entity          TYPE REF TO data.
TRY.
    DATA(struct_descr) = get_struct_descr( et_entityset ).
    CREATE DATA entity TYPE HANDLE struct_descr.
    ASSIGN entity->* TO FIELD-SYMBOL(<entity>).
  CATCH cx_sy_create_data_error INTO DATA(cx_sy_create_data_error).
    RAISE EXCEPTION TYPE /iwbep/cx_mgw_tech_exception
      EXPORTING
        textid   = /iwbep/cx_mgw_tech_exception=>internal_error
        previous = cx_sy_create_data_error.
ENDTRY.
```

$ORDERBY

OData Query Options	Additional Implementation Needed
$select	no
$count	no
$expand	no
$format	no
Read $links	no
$value	no
$orderby	yes
$top	yes
$skip	yes
$filter	yes
$inlinecount	yes
$skiptoken	yes

$ORDERBY

```
" $orderby query options
DATA: orderby_clause TYPE string.
LOOP AT io_tech_request_context->get_orderby( ) REFERENCE INTO DATA(orderby).
  DATA(property) =
    io_model->get_property(
      iv_entity_name = io_tech_request_context->get_entity_type_name( )
      iv_property_name  = orderby->property ).
  IF property-sortable = abap_true.
    CASE orderby->property. " This is where we add table aliases for the SQL join
      WHEN 'BP_ID' OR 'COMPANY_NAME'.
        orderby_clause = orderby_clause &&
          |, BP~{ orderby->property } { orderby->order CASE = UPPER }ENDING |.
      WHEN OTHERS.
        orderby_clause = orderby_clause &&
          |, AD~{ orderby->property } { orderby->order CASE = UPPER }ENDING |.
    ENDCASE.
  ELSE.
    RAISE EXCEPTION TYPE /iwbep/cx_mgw_busi_exception
      EXPORTING
        textid  = /iwbep/cx_mgw_busi_exception=>business_error
        message = |Order property '{ property-external_name }' is not supported|.
  ENDIF.
ENDLOOP.
SHIFT orderby_clause LEFT DELETING LEADING ', '.
```

$FILTER

OData Query Options	Additional Implementation Needed
`$select`	no
`$count`	no
`$expand`	no
`$format`	no
`Read $links`	no
`$value`	no
`$orderby`	yes
`$top`	yes
`$skip`	yes
`$filter`	yes
`$inlinecount`	yes
`$skiptoken`	yes

$FILTER

```
" $filterby query options
DATA: where_clause   TYPE string.
LOOP AT io_tech_request_context->get_filter( )->get_filter_select_options( )
  REFERENCE INTO DATA(filterby).
  property =
    io_model->get_property(
      iv_entity_name = io_tech_request_context->get_entity_type_name( )
      iv_property_name  = CONV #( filterby->property ) ).
  IF property-filterable = abap_true.
    CASE filterby->property.
      WHEN 'BP_ID'.
        DATA(bp_range) = filterby->select_options.
        where_clause = |{ where_clause } & BP~BP_ID IN @BP_RANGE|.
        ...
    ENDCASE.
  ELSE.
    RAISE EXCEPTION TYPE /iwbep/cx_mgw_busi_exception
      EXPORTING
        textid       = /iwbep/cx_mgw_busi_exception=>filter_not_supported
        filter_param = CONV #( property-external_name ).
  ENDIF.
ENDLOOP.
```

COMPLEX $FILTER QUERIES

$filter=substringof('Gold',Name) or substringof('Johan',City)

```
IF sy-subrc NE 0. " Catch complex $filter queries
  where_clause = io_tech_request_context->get_filter( )->get_filter_string( ).
ENDIF.
```

Field	WHERE_CLAUSE
Data Type	CString(61)
Absolute Type	\TYPE=STRING
Read-Only	
View	VAR_TEXT Text in Browser

```
( ( COMPANY_NAME like '%Gold%' ) or ( CITY like '%Johan%' ) )
```

*Note `where_clause` may require modification e.g. Table aliases, etc.

$INLINECOUNT

OData Query Options	Additional Implementation Needed
`$select`	no
`$count`	no
`$expand`	no
`$format`	no
`Read $links`	no
`$value`	no
`$orderby`	yes
`$top`	yes
`$skip`	yes
`$filter`	yes
`$inlinecount`	yes
`$skiptoken`	yes

$INLINECOUNT

```
IF io_tech_request_context->has_inlinecount( ) = abap_true.
  DATA dbcount TYPE int4 .
  SELECT COUNT(*)
    INTO @dbcount
    FROM snwd_bpa AS bp
      INNER JOIN snwd_ad AS ad
      ON bp~address_guid = ad~node_key
    WHERE (where_clause).
  es_response_context-inlinecount = dbcount.
ENDIF.
```

$INLINECOUNT

```
IF io_tech_request_context->has_inlinecount( ) = abap_true.
  DATA dbcount TYPE int4 .
  SELECT COUNT(*)
    INTO @dbcount
    FROM snwd_bpa
      INNER JOIN
      ON bp~addre
    WHERE (where_
  es_response_cor
ENDIF.
```

```
<feed xml:base="http://korora.yelcho.com.au:8000/sap/opu/odata/sap/ZDEMO_SRV/" xmlns="http://www.w3.
  <id>http://korora.yelcho.com.au:8000/sap/opu/odata/sap/ZDEMO_SRV/Customers</id>
  <title type="text">Customers</title>
  <updated>2017-04-06T07:31:33Z</updated>
  <author>
    <name/>
  </author>
  <link href="Customers" rel="self" title="Customers"/>
  <m:count>47</m:count>
  <entry>
    <id>http://korora.yelcho.com.au:8000/sap/opu/odata/sap/ZDEMO_SRV/Customers('100000000')</id>
    <title type="text">Customers('100000000')</title>
    <updated>2017-04-06T07:31:33Z</updated>
```

$TOP & $SKIP

OData Query Options	Additional Implementation Needed
$select	no
$count	no
$expand	no
$format	no
Read $links	no
$value	no
$orderby	yes
$top	yes
$skip	yes
$filter	yes
$inlinecount	yes
$skiptoken	yes

$TOP & $SKIP

```
DATA: top  TYPE i,
      skip TYPE i.
top = io_tech_request_context->get_top( ).
skip = io_tech_request_context->get_skip( ).

" Get primary keys
SELECT bp~node_key
  FROM snwd_bpa AS bp
    INNER JOIN snwd_ad AS ad
    ON bp~address_guid = ad~node_key
      WHERE (where_clause)
      ORDER BY (orderby_clause)
      INTO CORRESPONDING FIELDS OF @<entity>.

  CHECK sy-dbcnt > skip.
  APPEND <entity> TO <entityset>.
  IF top > 0 AND lines( <entityset> ) GE top.
    EXIT.
  ENDIF.
ENDSELECT.
```

$COUNT

OData Query Options	Additional Implementation Needed
$select	no
$count	no
$expand	no
$format	no
Read $links	no
$value	no
$orderby	yes
$top	yes
$skip	yes
$filter	yes
$inlinecount	yes
$skiptoken	yes

$COUNT

```
CHECK io_tech_request_context->has_count( ) NE abap_true.
```

$SKIPTOKEN

OData Query Options	Additional Implementation Needed
`$select`	no
`$count`	no
`$expand`	no
`$format`	no
`Read $links`	no
`$value`	no
`$orderby`	yes
`$top`	yes
`$skip`	yes
`$filter`	yes
`$inlinecount`	yes
`$skiptoken`	yes

$SKIPTOKEN

```
" $skiptoken
CONSTANTS: max_page_size TYPE i VALUE 50.
DATA: index_start TYPE i,
      index_end   TYPE i.

IF lines( <entityset> ) > max_page_size.
  index_start = io_tech_request_context->get_skiptoken( ).
  IF index_start = 0. index_start = 1. ENDIF.
  index_end = index_start + max_page_size - 1.
  LOOP AT <entityset> REFERENCE INTO entity.
    IF index_start > 1.
      DELETE <entityset>.
      SUBTRACT 1 FROM index_start.
    ELSE.
      CHECK sy-tabix > max_page_size.
      DELETE <entityset>.
    ENDIF.
  ENDLOOP.
  IF lines( <entityset> ) = max_page_size.
    es_response_context-skiptoken = index_end + 1.
  ENDIF.
ENDIF.
```

$SKIPTOKEN

```
" $skiptoken
CONSTANTS: max_page_size TYPE i VALUE 50.
DATA: index_start TYPE i,
      index_end   TYPE i.

IF lines( <entityset> ) > max_pa
  index_start = io_tech_request_
  IF index_start = 0. index_star
  index_end = index_start + max_
  LOOP AT <entityset> REFERENCE
    IF index_start > 1.
      DELETE <entityset>.
      SUBTRACT 1 FROM index_star
    ELSE.
      CHECK sy-tabix > max_page_
      DELETE <entityset>.
    ENDIF.
  ENDLOOP.
  IF lines( <entityset> ) = max_
    es_response_context-skiptoken = index_end + 1.
  ENDIF.
ENDIF.
```

```
<entry>
  <id>http://mwsapdev2k8.mayfairs.local:8010/sap/opu/odata/sap/ZDEMO_SRV/Customers('9147')</id>
  <title type="text">Customers('9147')</title>
  <updated>2016-09-21T15:58:12Z</updated>
  <category term="ZDEMO_SRV.Customer" scheme="http://schemas.microsoft.com/ado/2007/08/dataservices/sch
  <link href="Customers('9147')" rel="self" title="Customer"/>
  <link href="Customers('9147')/SalesOrders" rel="http://schemas.microsoft.com/ado/2007/08/dataservices
  <content type="application/xml">
    <m:properties xmlns:m="http://schemas.microsoft.com/ado/2007/08/dataservices/metadata" xmlns:d="ht
      <d:CustomerId>9147</d:CustomerId>
      <d:Name>SOUTHWEST AUTOMOTIVE GROUP PTY LTD</d:Name>
      <d:Street>CNR MT LINDESAY HWY &amp;amp; CORP PLACE</d:Street>
      <d:City>HILLCREST</d:City>
      <d:RegionId>QLD</d:RegionId>
      <d:Region>Queensland</d:Region>
      <d:PostCode>4118</d:PostCode>
      <d:CountryId>AU</d:CountryId>
      <d:Country>Australia</d:Country>
      <d:Segmentation>A</d:Segmentation>
    </m:properties>
  </content>
</entry>
<link rel="next" href="Customers?$skiptoken=51%20"/>
</feed>
```

FILL ENTITIES

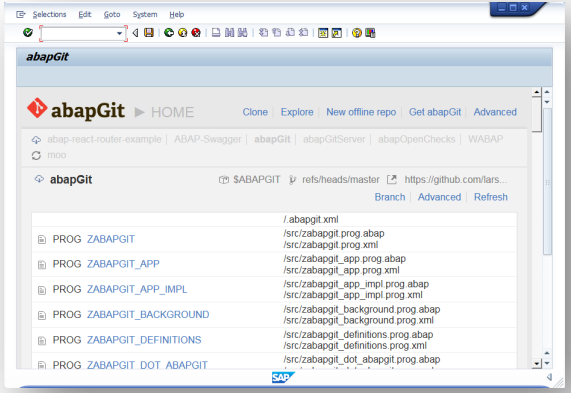
```
" Fill entities
LOOP AT <entityset> REFERENCE INTO entity.
  ASSIGN entity->* TO <entity>.
  ASSIGN COMPONENT 'NODE_KEY' OF STRUCTURE <entity> TO FIELD-SYMBOL(<node_key>).
  CHECK <node_key> IS ASSIGNED.
  TRY.
      zcl_demo_customer=>get( <node_key> )->zif_gw_methods~map_to_entity( entity ).
    CATCH zcx_demo_bo.
  ENDTRY.
ENDLOOP.
```

WHERE IS THE CODE?

https://grahamrobbo.github.io/teched16_example/

To install you will also need abapGit

https://abapGit.org



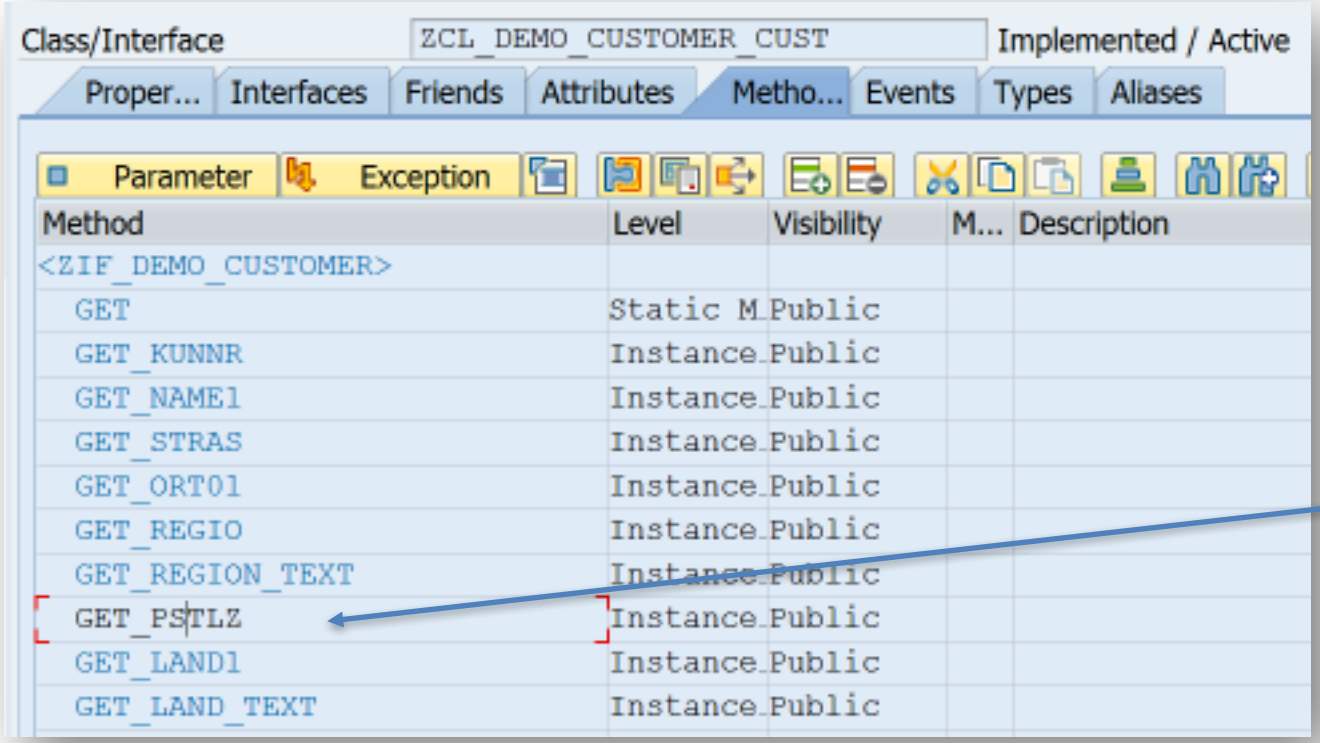
AGENDA

- Some Warnings
- Service Design
- Code patterns for reusability
- Code patterns for extensibility

CODE PATTERNS FOR EXTENSIBILITY

- Mainline code built on central development server
- Mainline code deployed to customer system via abapGit 
- Need to be able to add customer-specific code without changing mainline code

BO CLASS SUBCLASS



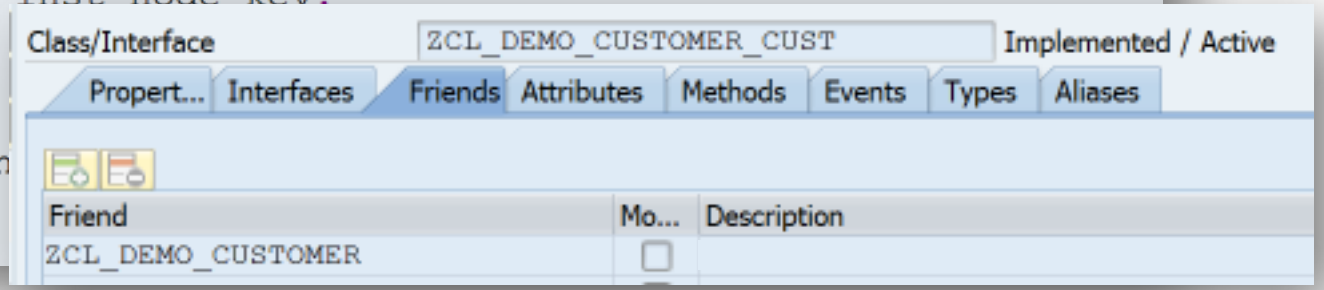
New methods or redefine existing methods

BO CLASS INSTANTIATION

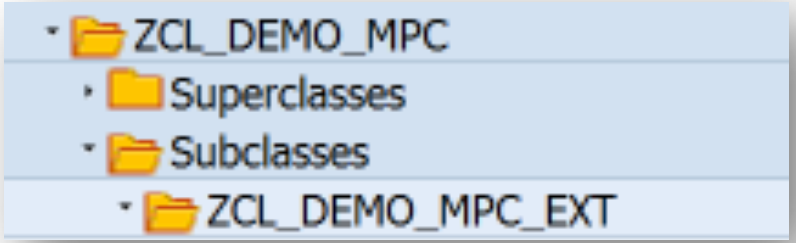
```
METHOD zif_demo_customer~get.

  TRY.
      DATA(inst) = zif_demo_customer~instances[ node_key = node_key ].
    CATCH cx_sy_itab_line_not_found.
      inst-node_key = node_key.
      DATA(class_name) = get_subclass( 'ZCL_DEMO_CUSTOMER' ).
      CREATE OBJECT inst-instance
        TYPE (class_name)
        EXPORTING
          node_key = inst-node_key.
      APPEND inst TO zif_demo_customer~instances.
  ENDTRY.

  instance ?= inst-instance.

ENDMETHOD.
```

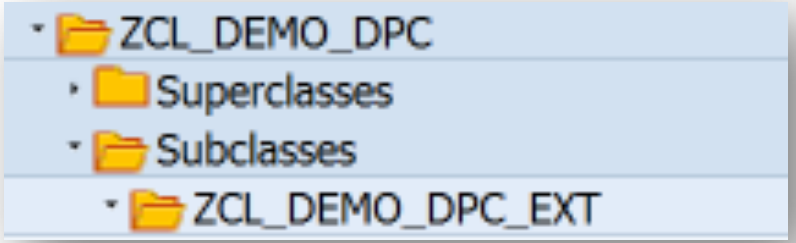
BO CLASS INSTANTIATION

```
METHOD zif_demo_customer~get.

  TRY.
      DATA(inst) = zif_demo_customer~instances[ node_key = node_key ].
    CATCH cx_sy_itab_line_not_found.
      inst-node_key = node_key.
      DATA(class_name) = get_subclass( 'ZCL_DEMO_CUSTOMER' ).
      CREATE OBJECT inst-instance
        TYPE (class_name)
        EXPORTING
          node_key = inst-node_key.
      APPEND inst TO
  ENDTRY.

  instance ?= inst-in

ENDMETHOD.
```

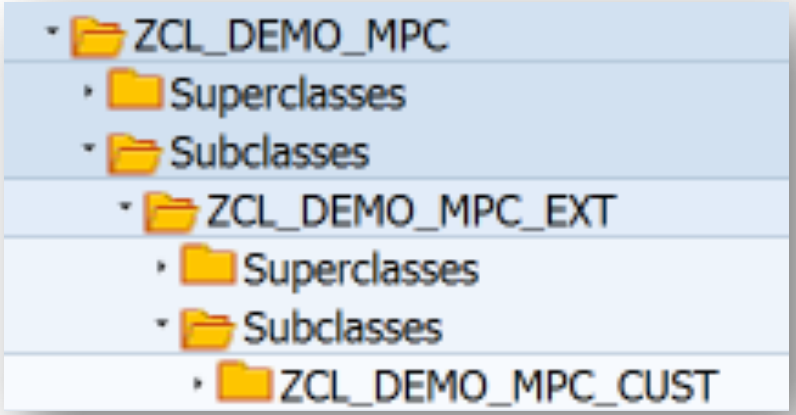


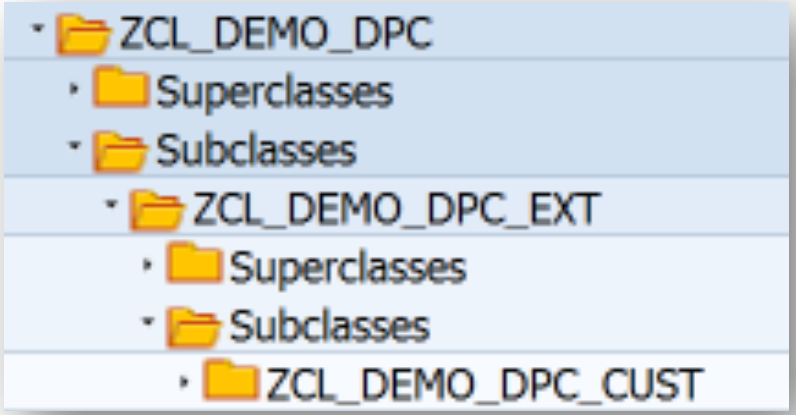
DPC & MPC CLASSES



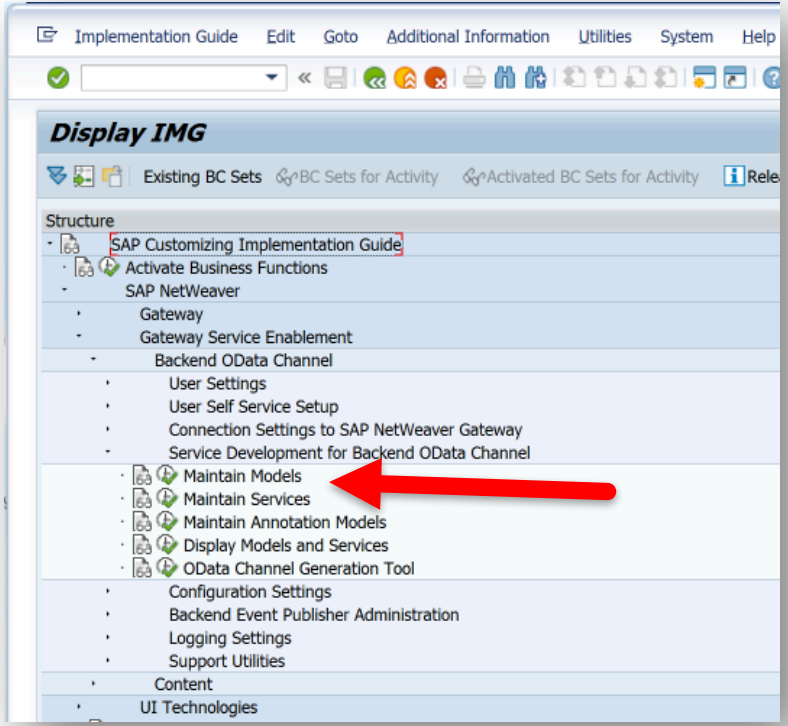


DPC & MPC SUBCLASSES

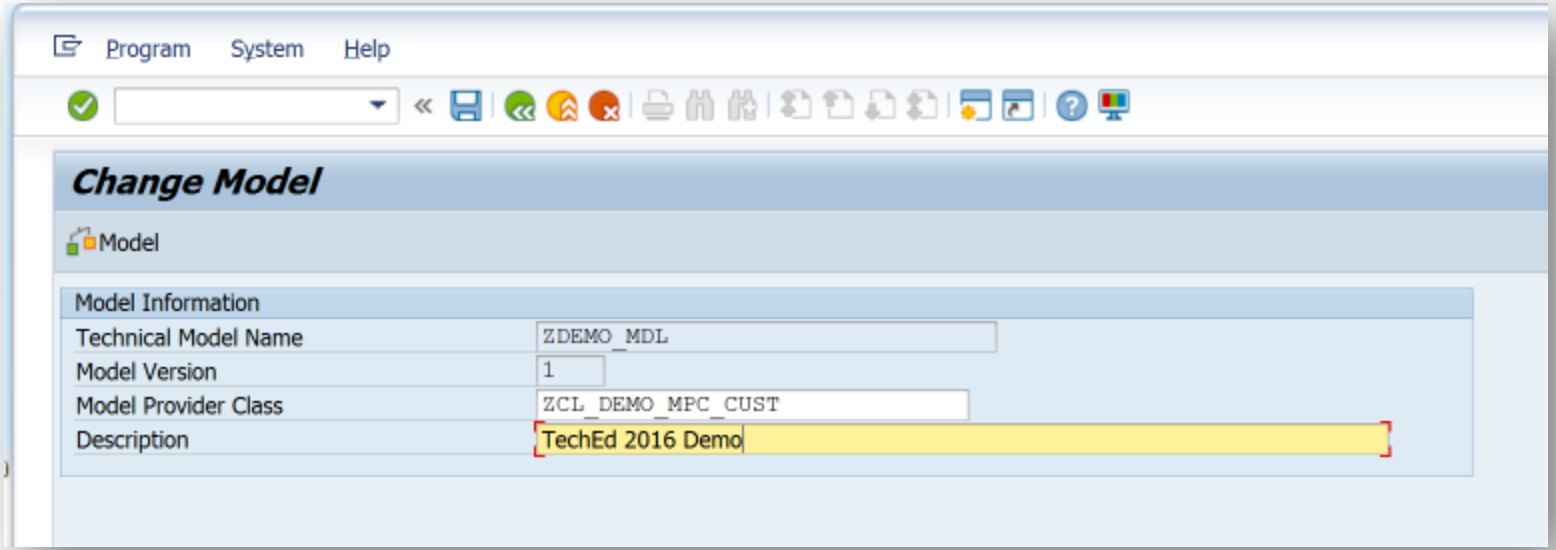




MAINTAIN GW MODELS & SERVICES



/IWBEP/R_DST_MODEL_BUILDER



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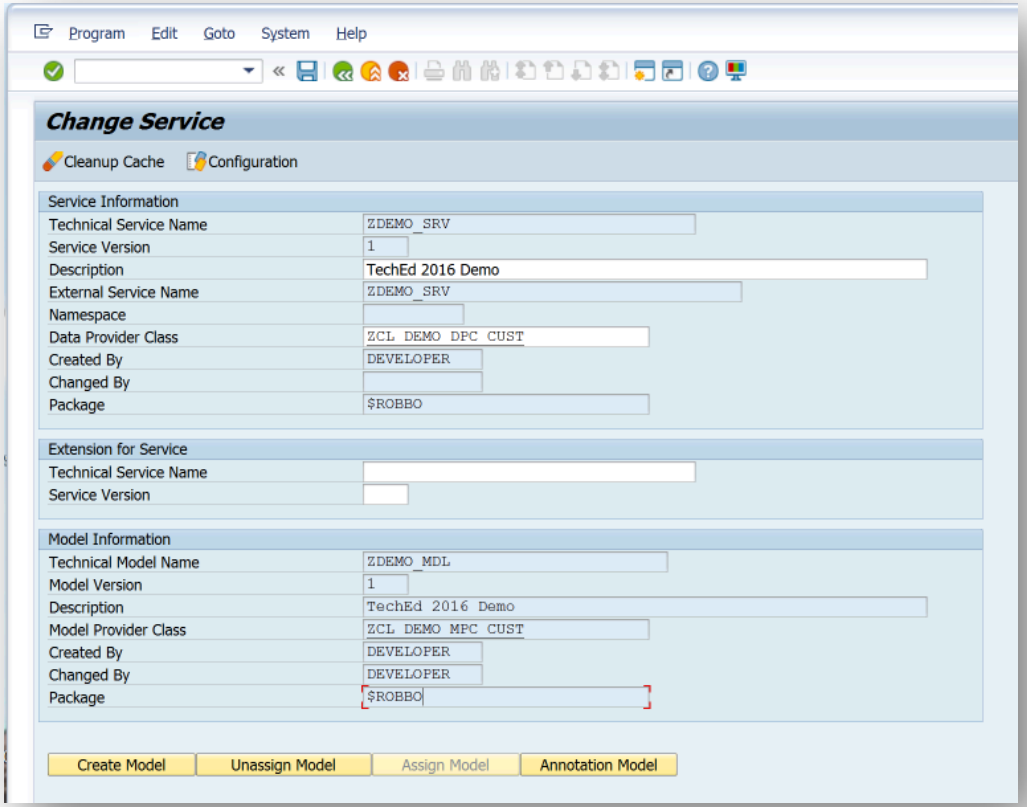
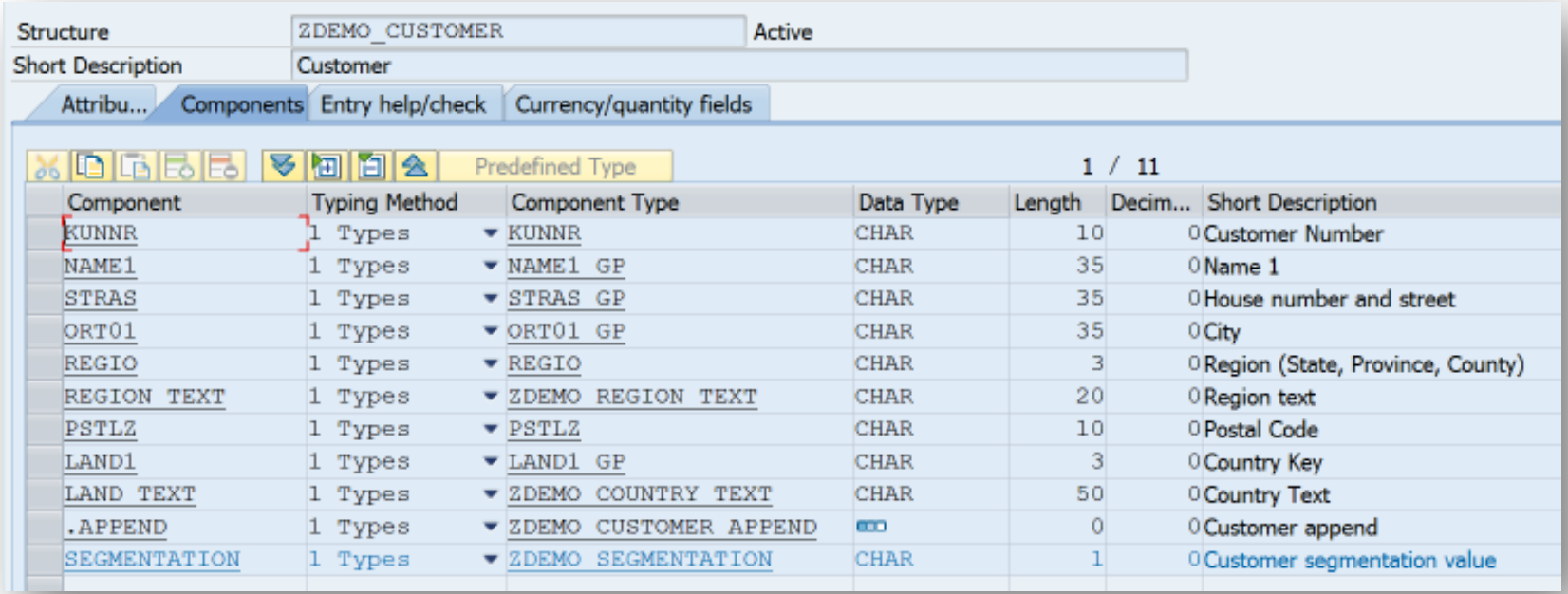


EXTEND GW SERVICE

- Create or Enhance DDIC structure
- Enhance model definition in MPC
- Add code to fill new entities/properties

ENHANCE DDIC STRUCTURE



Structure	ZDEMO_CUSTOMER	Active
Short Description	Customer	

Attribu... | Components | Entry help/check | Currency/quantity fields

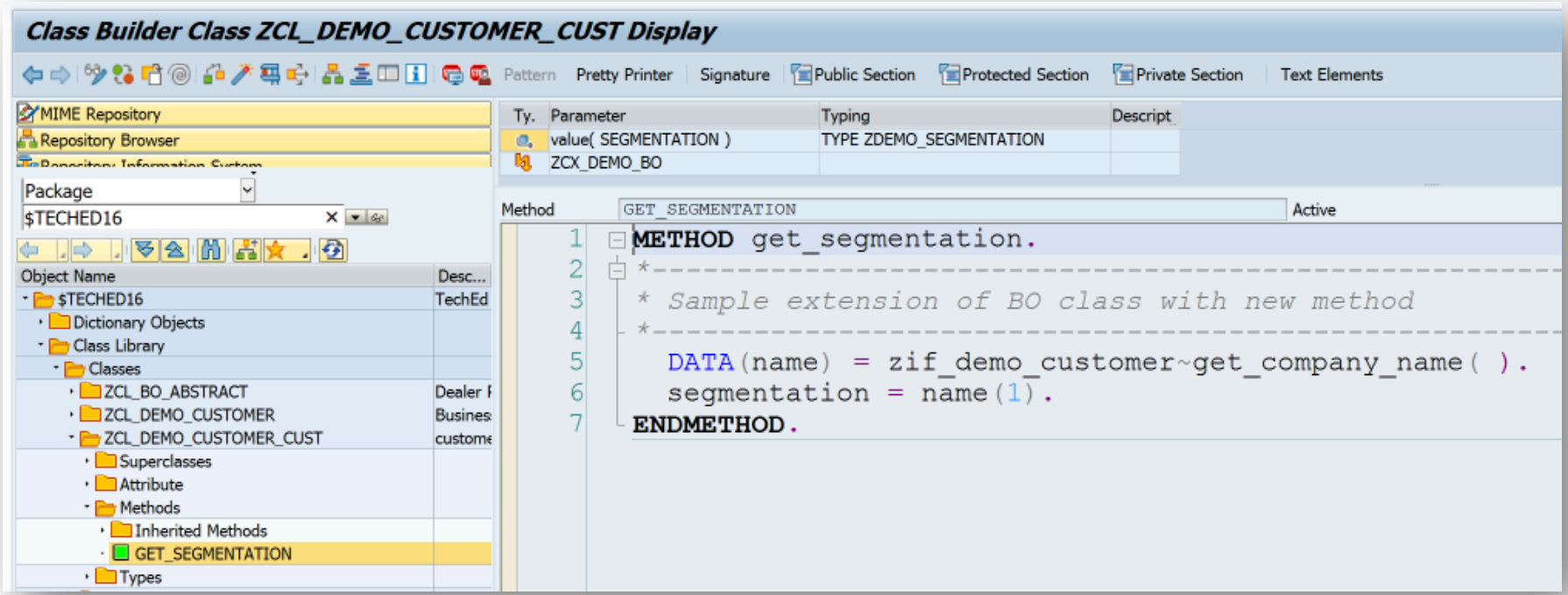
Predefined Type — 1 / 11

Component	Typing Method	Component Type	Data Type	Length	Decim...	Short Description
KUNNR	1 Types	KUNNR	CHAR	10	0	Customer Number
NAME1	1 Types	NAME1_GP	CHAR	35	0	Name 1
STRAS	1 Types	STRAS_GP	CHAR	35	0	House number and street
ORT01	1 Types	ORT01_GP	CHAR	35	0	City
REGIO	1 Types	REGIO	CHAR	3	0	Region (State, Province, County)
REGION_TEXT	1 Types	ZDEMO_REGION_TEXT	CHAR	20	0	Region text
PSTLZ	1 Types	PSTLZ	CHAR	10	0	Postal Code
LAND1	1 Types	LAND1_GP	CHAR	3	0	Country Key
LAND_TEXT	1 Types	ZDEMO_COUNTRY_TEXT	CHAR	50	0	Country Text
.APPEND	1 Types	ZDEMO_CUSTOMER_APPEND		0	0	Customer append
SEGMENTATION	1 Types	ZDEMO_SEGMENTATION	CHAR	1	0	Customer segmentation value

ENHANCE MODEL

```
METHOD extend_customer.

    DATA:
      lo_entity_type TYPE REF TO /iwbep/if_mgw_odata_entity_typ, "#EC NEEDED
      lo_property    TYPE REF TO /iwbep/if_mgw_odata_property. "#EC NEEDED

**********************************************************************
*   ENTITY - Customer
**********************************************************************

    lo_entity_type = model->get_entity_type( 'Customer' ).   "#EC NOTEXT

**********************************************************************
*Properties
**********************************************************************

    lo_property = lo_entity_type->create_property(
      iv_property_name = 'Segmentation'
      iv_abap_fieldname = 'SEGMENTATION' ).                  "#EC NOTEXT
    lo_property->set_type_edm_string( ).
    lo_property->set_maxlength( iv_max_length = 1 ).         "#EC NOTEXT
    lo_property->set_creatable( abap_false ).
    lo_property->set_updatable( abap_false ).
    lo_property->set_sortable( abap_false ).
    lo_property->set_nullable( abap_false ).
    lo_property->set_filterable( abap_false ).

ENDMETHOD.
```

FILL NEW PROPERTY



SUMMARY

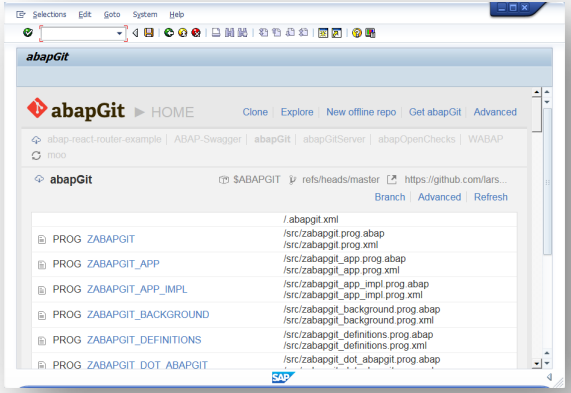
- Service Design
  - Design for consumers
- Code patterns for reusability
  - The first & second rule
- Code patterns for extensibility

WHERE IS THE CODE?

https://grahamrobbo.github.io/teched16_example/

To install you will also need abapGit

https://abapGit.org



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THANK YOU

Thank you for your time

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