Examples on OOPS in ABAP

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PREFACE

This documentation contains examples on Object Oriented Programming in ABAP. It covers the individual sections in detail and contains examples illustrating the important concepts. Examples are positive or nagative – the positive examples demonstrates implementation of concepts in program , the negative examples create compilation errors which shows the do's and don't's while coding for a class/object in ABAP.

Care has been taken to use simple examples which spawns not more than one page. Discussion on an example is categorised under four major heads:-

- **Theme :-** This section explains what the example is going to demonstrate.
- **Program Description :-** This section introduces to the program – briefly detailing the components of the programand what it is trying to achieve.
- **Dump:-** Contains code dump.
- **Output :-** Shows the output of the program when executed or shows the compilation errors for negative examples.

The best way to learn anything is learning by examples. The entire content has been designed and documented in such a way that the reader can easily grasp the matter and implement it in his course of learning.

The author will remain grateful to the responsible readers if they can point out mistakes in the documentation and suggest further improvements on this effort.

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1 Class

1.1 Accessibility of different sections of a class	
Theme	From this program, one will learn:- 1. How to define, implement and instantiate a class. 2. What are the different sections of visibility in a class. 3. How to define instance attributes and get them accessed by external users. The following program will also show that :- ❖ Data declared in public section can be accessed by the class itself, by its subclasses as well as by other users outside the class. ❖ Data declared in the protected section can be accessed by the class itself, and also by its subclasses but not by external users outside the class. ❖ Data declared in the private section can be accessed by the class only, but not by its subclasses and by external users outside the class.
Brief Description	This program contains a class : **parentclass** with following attributes in different sections:- **Commondata** in public section **Protectdata** in private section **Privatedata** in private section The method **showval** in class : **parentclass** displays values of all the attributes. **This demonstrates that class can access all its attributes.** Class **childclass** is a subclass of class **parentclass**, which has a method : **subval**. It displays the value for the data : commondata and protectdata . Then, it changes the values for both and displays them again. **This demonstrates that subclass can access/change public/ protected attributes of superclass.** In the **START-OF-SELECTION** event, object : **parent** is instantiated from class : **parentclass** and object : **child** is instantiated from class : **childclass**. Then , the method **showval** of **parent**(object of parentclass) and method **subval** of **child**(object of childclass) is called , which displays the values of different attributes.

	Then, the public attribute of object parent is changed and the changed value is displayed. **This demonstrates that external users can change/display public attributes of a class.**

Dump of the program:-

```
REPORT  YSUBDEL LINE-SIZE 120.

 CLASS parentclass DEFINITION .
 PUBLIC SECTION.
  DATA : commondata(30) type c value 'Accessible to all'.
  METHODS : SHOWVAL.
 PROTECTED SECTION.
  DATA : protectdata(40) type c value 'Protected data'.
 private section.
 data : privatedata(30) type c value 'Private data'.
 ENDCLASS.

 CLASS parentclass IMPLEMENTATION.
 METHOD : SHOWVAL.
  write:/5 'All data from parentclass shown:-'.
  write:/ sy-uline.
  WRITE:/5 COMMONDATA,
        /5 PROTECTDATA,
        /5 PRIVATEDATA.
 endmethod.
endclass.

CLASS childclass DEFINITION INHERITING FROM parentclass.
 PUBLIC SECTION .
 METHODS : subval.
 ENDCLASS.

 CLASS childclass IMPLEMENTATION.
 method : subval.
  skip 1.
  write:/5 'Data of parent shown from child-'.
  write:/5 sy-uline.
  WRITE:/5 COMMONDATA,
        /5 PROTECTDATA.
  Commondata = 'Public data changed in subclass'.
  Protectdata = 'Protected data changed in subclass'.
  write:/5 sy-uline.
  WRITE:/5 COMMONDATA,
        /5 PROTECTDATA.
 endmethod.
endclass.
```

```
START-OF-SELECTION.
   DATA : parent type ref to parentclass ,
          child  type ref to childclass  .
   create object : parent ,
                   child  .
   call method : parent->showval ,
                 child->subval.
      skip 2.
  parent->commondata = 'User changing public data'.
  write:/5 parent->commondata.
```

Output

All data from parentclass shown:-

Accessible to all
Protected data
Private data

Data of parent shown from child-

Accessible to all
Protected data

Public data changed in subclas
Protected data changed in subclass

User changing public data

1.2 Subclass cannot access the private component of superclass	
Theme	The program demonstrates that subclasses cannot access the private components of superclass.
Program description	The program used here is similar to above with change in the method : subval of class : childclass . This method is now attempting to access the attribute : privatedata , which is a private attribute of its superclass : parentclass. On compilation, the program will give a compilation error. **This demonstrates that private components of superclass cannot be accessed by subclasses**.
Program Dump	Take the first program. Only change the method : **subval** of class : **childclass** as follows:- method : subval. skip 1. write:/5 'All data from parent class shown by subclass'. write:/5 sy-uline. WRITE:/5 COMMONDATA, /5 PROTECTDATA, /5 privatedata. endmethod.
Output	The program will not compile. It will show an error message:- Program YSUBDEL The field "PRIVATEDATA" is unknown, but there is a field with the similar name "PROTECTDATA".

1.3 External users cannot access protected/private components of a class	
Theme	This program will demonstrate that external users cannot access the protected and private components of a class
Program Description	In this program , class **C1** has three attributes declared in different sections as follows:- ❖ **Commondata** in public section ❖ **Protectdata** in private section ❖ **Privatedata** in private section In the main program, an object , **OBJ1** is created from class **C1** and an incorrect attempt is made to display the protected and private attribute of class **C1** using its object **OBJ1**. Compilation of this program produces an error. **This demonstrates : protected and private components of a class cannot be accessed by external users.**

Dump	`REPORT YSUBDEL LINE-SIZE 120.`
	
	`CLASS c1 DEFINITION .`
	`PUBLIC SECTION.`
	`DATA : commondata(30) type c value 'Accessible to all'.`
	`PROTECTED SECTION.`
	`DATA : protectdata(40) type c value 'Protected data'.`
	`private section.`
	`data : privatedata(30) type c value 'Private data'.`
	`ENDCLASS.`
	
	`CLASS c1 IMPLEMENTATION.`
	`endclass.`
	
	`START-OF-SELECTION.`
	`DATA : obj1 type ref to c1.`
	`create object : obj1.`
	`write:/5 obj1->protectdata ,`
	`obj1->privatedata.`

Output	On compilation, an error will be generated which will prove that protected and private components of a class cannot be accessed by external users.

1.4 Local Class can understand data and types in the global area of the program.

Theme

This program will demonstrate the following:-

- ❖ Different attributes of a class can be constructed utilizing the data and types declared outside the class, in the global area of the program.
- ❖ Data declared in the global area of the program can be used directly in a class.

Program description

The global section of this program contains a type : **TYP_TAB** and an integer variable , **NUM1**.
These type and data are used while defining attributes **L_NUM1**(integer) and **IT_TAB** (internal table) for class **C1** . Also, the global data **L_NUM** is used directly inside the program.

This demonstrates the theme.

Dump

```
REPORT  YSUBDEL1 LINE-SIZE 120.

 TYPES : BEGIN OF TYP_TAB ,
          NAME(15) TYPE C ,
          AGE      TYPE I ,
         END OF TYP_TAB .

 DATA : num1 type i value 5 .

 CLASS c1 DEFINITION .
  public section.
    methods : meth1 .
    DATA : l_num like num1 ,
           it_tab type standard table of typ_tab ,
           w_tab like line of it_tab.
 ENDCLASS.

 CLASS c1 IMPLEMENTATION.
  method : meth1 .
     data : l_cnum(2) type c.
     l_num = 0.
     do 5 times.
      l_num = l_num + 1.
      l_cnum = l_num.
       concatenate 'Student-'
                   l_cnum
                   into w_tab-name.
      w_tab-age = num1 * l_num .
      append w_tab to it_tab.
      clear w_tab.
     enddo.
   loop at it_tab into w_tab.
    write:/5 w_tab-name ,
             w_tab-age.
   endloop.
  endmethod.
 endclass.


START-OF-SELECTION.
   DATA : obj1 type ref to c1.

     create object : obj1.
   call method obj1->meth1.
```

Output	Student-1	5
	Student-2	10
	Student-3	15
	Student-4	20
	Student-5	25

1.5 Class can be instantiated within implementation of another class	
Theme	This program will demonstrate that an object can be created from a class((which was created with no CREATE PRIVATE|PROTECTED option at the time of its definition) in the implementation section of another class.
Program Description	This program contains two classes – **CLASS1** and **CLASS2** . Class **CLASS1** contains method : **METHOD1** which displays value of some integer variable. Class **CLASS2** contains method : **METHOD2** . In the method implementation , an object is created from class : **CLASS1** and then that object is used to call method **METHOD1**. **This demonstrates that object can be created from a class(CLASS1) within implementation section of another class(CLASS2).**
	REPORT YSUBOOPS17 . class class1 definition. public section. methods : method1 . endclass. class class2 definition. public section. methods : method2 . endclass. class class1 implementation. method :method1. data : i_num type i value 2. write:/5 i_num. endmethod. endclass. class class2 implementation. method : method2. data : obj1 type ref to class1. create object obj1. call method obj1->method1. endmethod. endclass. start-of-selection. data : my_obj type ref to class2. create object : my_obj. call method my_obj->method2.
Output	2

1.6 Deferred Definition of a Class	
Theme	This program will demonstrate how one can refer to a class without defining the class before that point. But, the class has to be defined later on.
Program description	In this program , class **C1** has an interface reference **O2** declared with reference to class **C2**. But, before that, class **C2** is not defined. It is defined later with a single public attribute , **NUM** . **This demonstrates the theme.** In the main section of the program, object : **OBJ1** is created from class **C1**. Then, an object is created from the reference variable **O2** in class **C1**. Finally, the attribute num of that object is displayed.

Dump	`report ysubdel1.`
	
	`CLASS C2 DEFINITION DEFERRED.`
	
	`CLASS C1 DEFINITION.`
	`  PUBLIC SECTION.`
	`    DATA O2 TYPE REF TO C2.`
	`ENDCLASS.`
	
	`CLASS C2 DEFINITION.`
	`public section.`
	` data : num type i value 5.`
	`ENDCLASS.`
	
	`start-of-selection.`
	` data : obj1 type ref to C1.`
	`  CREATE OBJECT obj1.`
	`  create object obj1->o2.`
	`  write:/5 obj1->o2->num .`

Output	5

1.7 Place to put non-declarative statements

Theme	For a class, the IMPLEMENTATION section can immediately follow the class DEFINITION section. If this is so, then all the non-declarative statements (viz., processing statements outside any class definition/ implementation) should be placed under a processing block, such as START-OF-SELECTION.
Program description	This program contains a class C1 with a method M1. In version 1, the IMPLEMENTATION part of the class follows the class definition section. But, the non-declarative statements are not placed under any block. This creates a compilation error. In version 2, the non-declarative statements are not placed under the block START-OF-SELECTION. It gets correctly compiled. **This demonstrates the theme.**

Version 1: Incorrect

```
REPORT YSUBDEL .

class c1 definition.
public section.
 methods : m1 .
 endclass.

 class c1 implementation.
  method : m1 .
   write:/5 'I am method m1'.
  endmethod.
 endclass.


 data : obj1 type ref to c1 .
 create object obj1.
  call method obj1->m1.
```

Version 2 : Correct

```
REPORT YSUBDEL .

class c1 definition.
public section.
 methods : m1 .
 endclass.

 class c1 implementation.
  method : m1 .
   write:/5 'I am method m1'.
  endmethod.
 endclass.

START-OF-SELECTION.
 data : obj1 type ref to c1 .
 create object obj1.
  call method obj1->m1.
```

Output	Version 1 creates compilation error. Version 2 gets correctly compiled.

1.8 Use of Field Symbols in Class	
Theme	Field Symbols can be used to contain value of any variable in a class.
Program Description	The program uses a field symbol, <FS>. It handles the values of instance attribute, inum and static attribute , onum .
Dump	REPORT YSUB_ASSIGN_FS. FIELD-SYMBOLS : <FS> TYPE ANY . class c1 definition . public section . * Instance attribute : inum declared below data : inum type i value 5 . * static attribute onum declared below class-data : onum type i value 10 . endclass. class c1 implementation. endclass. start-of-selection. data : oref1 type ref to c1 . create object oref1. * Assigning instance attribute to field symbol <fs> assign oref1->inum to <fs> . write:/5 <fs> . * Assigning static attribute to field symbol assign oref1->onum to <fs> . write:/5 <fs> . assign c1=>onum to <fs> . write:/5 <fs> .
Output	5 10 10

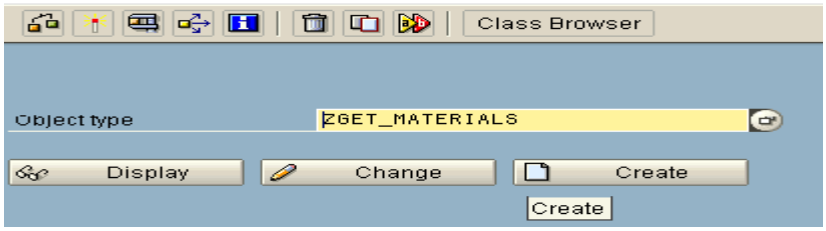
1.9 Use of Static Attributes	
Theme	This program will demonstrate that : Static sttributes of a class are retained throughout the entire runtime. All the objects within a class can access its static attributes.
Program Description	The program contains a class **C1** with static attribute : **NUM** . The method : **M1** increments the static attribute by 1 and displays the value each time it is called. In the main START-OF-SELECTION portion, two objects : **OBJ1** and **OBJ2** are created from class **C1**. First, static attribute : **NUM** is changed and accessed outside the class using the class component selector , '=>'. Then, both objects **OBJ1** and **OBJ2** are used to call method : **M1** which shows the new value of static attribute : **NUM** . That the value of the static attribute gets incremented each time when the method **M1** of different objects is called shows that this variable is able to retain its value through the entire runtime.

Dump	`report ysubdel.`
	
	`CLASS c1 DEFINITION .`
	`  PUBLIC SECTION.`
	`  CLASS-DATA : NUM TYPE I .`
	`  METHODS : M1.`
	`ENDCLASS.`
	
	`CLASS c1 IMPLEMENTATION.`
	`  METHOD m1 .`
	`  num = num + 1.`
	`  write:/5 num .`
	`  ENDMETHOD.`
	`ENDCLASS.`
	
	`  START-OF-SELECTION.`
	
	`  c1=>num = 3.`
	`  write:/5 c1=>num .`
	
	`  DATA : OREF1 TYPE REF TO C1 ,`
	`  OREF2 TYPE REF TO C1 .`
	
	`  CREATE OBJECT : OREF1 ,`
	`  OREF2 .`
	`  CALL METHOD OREF1->M1 .`
	`  CALL METHOD OREF2->M1.`

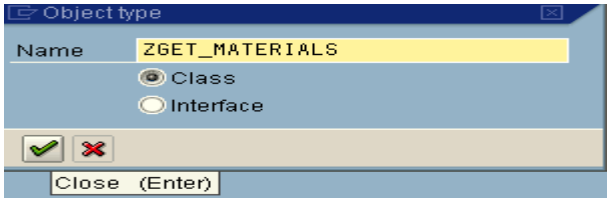
Output	3 4 5

1.10 Creation of Global class and using it in a local program	
Theme	This example will show you how to create a class globally and use it in your local program
Program Descr.	There is a demand to create a global class which will furnish a list of materials along with their descriptions based on the material type. Global class **ZGET_MATERIALS** will be created. Method **LIST_MATERIALS** will belong to this class which will take material type as an input and will furnish a list of material codes and their descriptions belonging to that material type.
Steps	Follow the steps outlined below to perform the task

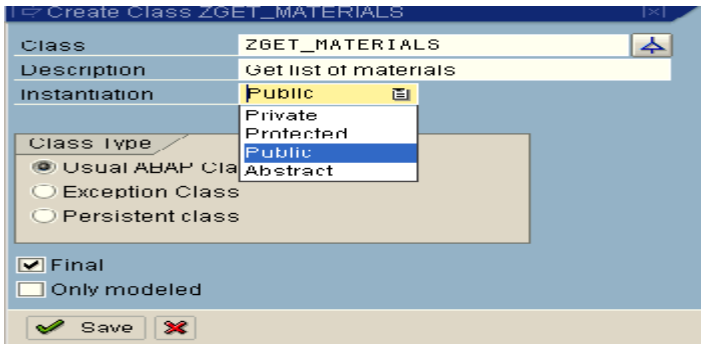
Step 1. Create the class from SE24:-



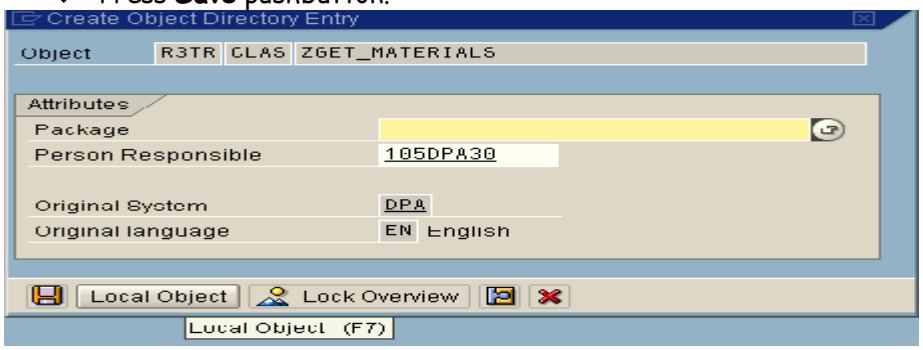
- Go to transaction SE24.
- Enter the name of the global class you want to create, with 'Y' or 'Z' at the beginning.
- Press Create pushbutton.



- A dialog window shown above will appear. Check the radiobutton : **Class**.
- Press Enter.



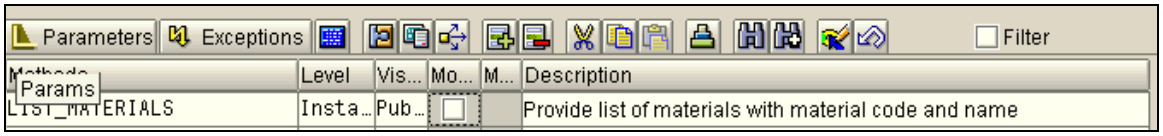
- Another dialog window shown above will appear. Enter the description for the class.
- Select from the **Instantiation** listbox whether you want to create the class as PUBLIC/PROTECTED/PRIVATE/ABSTRACT.
- Check the radiobutton for **Usual ABAP Class**.
- Check the checkbox for **Final**.
- Press **Save** pushbutton.



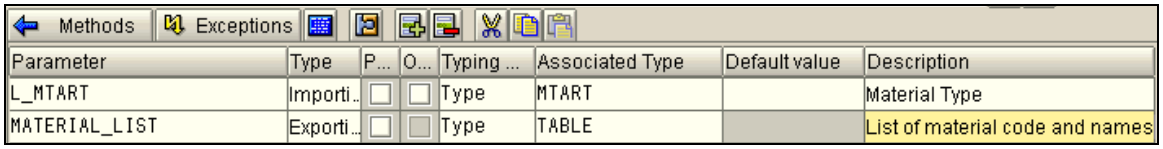
Enter the **package name** or **save** it as Local object.

Step 2 : Create the method : LIST_MATERIALS

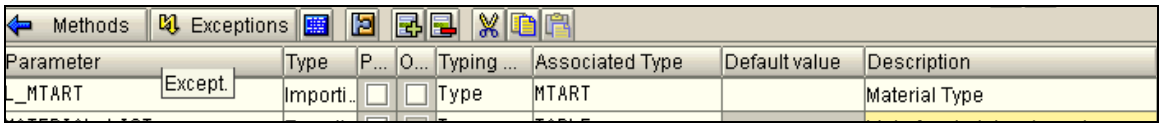
- Go to the tab-page : **Methods.**
- Enter the details for the method – mention name, type of method(instance/static), in which visibility section the method will reside and a short description of the method.
- Check –off/uncheck the checkbox to ensure that the method will be implemented.



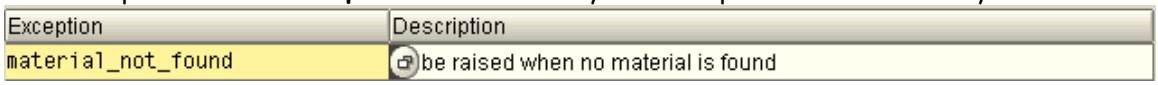
Click the pushbutton for **Parameters** to navigate to the screen to enter parameters for the method.



There will be one importing parameter : **L_MTART** and one exporting internal table : **MATERIAL_LIST**. Create entries for them as shown above.



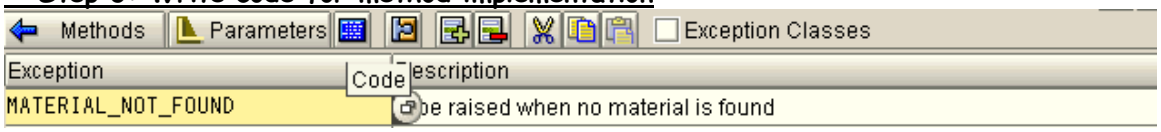
Click the pushbutton : **Exceptions** to make entry for Exceptions to be raised by the method.



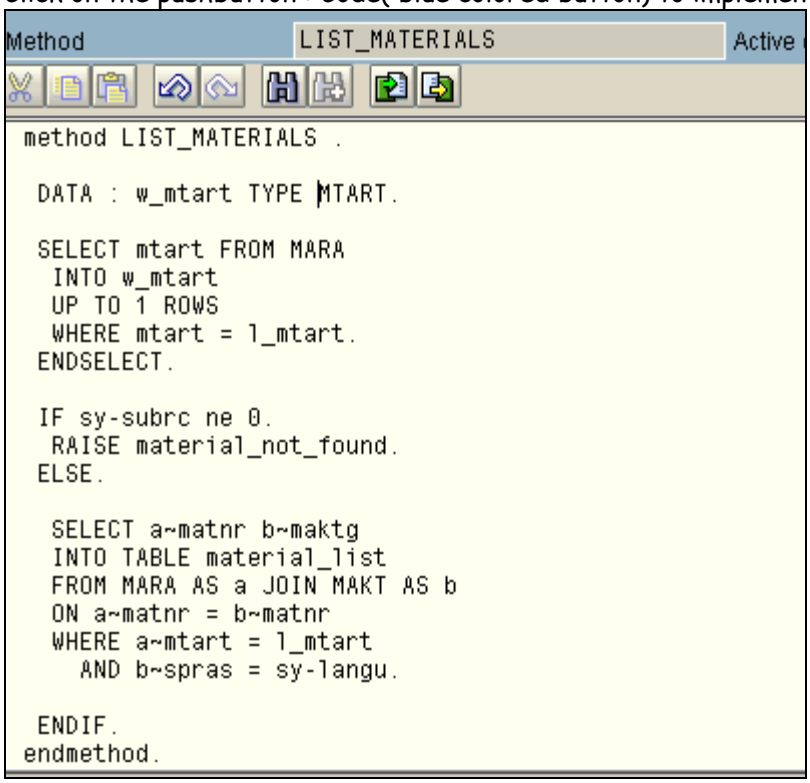
Enter the name and description for the exception .

Then, **check** and **activate** the class.

Step 3: Write code for method implementation



Click on the pushbutton : Code(blue colored button) to implement the method.



An ABAP Editor will open up. Write the logic for code implementation.
Then, check and activate the code.

Your job of creating a global class is complete!!!

Step 4 : Use the global class created by you in a local program

```
REPORT  YSUBDEL.

TYPES : BEGIN OF typ_mat ,
          matnr LIKE mara-matnr ,
          maktg LIKE makt-maktg ,
        END OF typ_mat .

DATA : it_mat TYPE STANDARD TABLE OF typ_mat ,
        x_mat LIKE LINE OF it_mat.

PARAMETERS : p_mtart LIKE mara-mtart OBLIGATORY.

  START-OF-SELECTION.
* Create object from the global class
   DATA : oref TYPE REF TO zget_materials.
   CREATE OBJECT oref.
* Call the method to get list of material code and name
   CALL METHOD oref->list_materials
        EXPORTING l_mtart       = p_mtart
        IMPORTING material_list = it_mat
      EXCEPTIONS
        material_not_found = 2.

    if sy-subrc ne 0.
     write:/5 'Material not found'.
    else.
* Display the list
     loop at it_mat into x_mat.
      write:/5 x_mat-matnr ,
               x_mat-maktg.
     endloop.
    endif.
```

Output	Compile and run the program. There will be a parameter for material type in the selection screen. Enter a valid value and get the list of material codes and descriptions.

2 Methods

2.1 Method with one import parameter/ only one non-optional parameter	
Theme	This program will demonstrate different ways of calling a method which has only one import parameter. This strategy is also valid for cases where a method has more than one import parameters, but only one of them being non-optional.
Program	This program has a class , **C1** with a method : **meth1**. This method has only one import parameter(**input1**). Look at the method implementation for details. The main purpose of this program is to demonstrate the different ways of calling a method with single import parameter.

Dump	`REPORT YSUBDEL .`
	
	`CLASS C1 DEFINITION.`
	`PUBLIC SECTION.`
	`DATA : NUM TYPE I VALUE 5.`
	`METHODS : METH1 IMPORTING INPUT1 TYPE I .`
	`ENDCLASS.`
	
	`CLASS C1 IMPLEMENTATION.`
	`METHOD : METH1.`
	`num = NUM * INPUT1 .`
	`WRITE:/5 NUM .`
	`num = 5.`
	`ENDMETHOD.`
	`ENDCLASS.`
	
	`START-OF-SELECTION.`
	`DATA : OREF1 TYPE REF TO C1.`
	`CREATE OBJECT : OREF1.`
	`* Different ways of calling the method with one import parameter`
	`CALL METHOD OREF1->METH1 EXPORTING INPUT1 = 4.`
	`CALL METHOD OREF1->METH1( INPUT1 = 5 ).`
	`CALL METHOD OREF1->METH1( 6 ).`

Output	20 25 30

<table>
<tr><th colspan="2">2.2 Import parameters passed by ref. can't be changed inside the method .</th></tr>
<tr><td>Theme</td><td>Parameters can be passed to a method as import parameters in two fashion:-
❖ By reference
❖ By value.
Parameters passed by value can be changed internally in a method. But, parameters passed by reference cannot be changed in the method.</td></tr>
<tr><td>Program description</td><td>This program contains a class C1 with a method METH1. This method contains two input parameters : -

INPUT1 : passed by reference
INPUT2 : passed by value.

The method METH1 attempts to change INPUT1. On compilation, an error is displayed. This establishes that input parameters passed by reference cannot be changed within the method.</td></tr>
<tr><td>Dump</td><td><pre>
REPORT YSUBDEL .
 DATA : num TYPE I.
 CLASS C1 DEFINITION.
  PUBLIC SECTION.
   METHODS : METH1 IMPORTING INPUT1 TYPE I
                             value(input2) type i.
 ENDCLASS.

 CLASS C1 IMPLEMENTATION.
  METHOD : METH1.
   Input1 = 4.
   write:/5 input1.
  ENDMETHOD.
 ENDCLASS.

 START-OF-SELECTION.
  DATA : OREF1 TYPE REF TO C1.
  CREATE OBJECT : OREF1.
   num = 3.
   CALL METHOD OREF1->METH1 EXPORTING INPUT1 = 4
                                      input2 = num.
</pre></td></tr>
<tr><td>Output</td><td>On compilation, an error message is generated.

Now, instead of changing input1, change the import parameter input2 (passed by value)within the method. The program will get successfully compiled and executed.</td></tr>
</table>

2.3 Use of PREFERRED PARAMETER in a method	
Theme	If there are more than one **OPTIONAL** import parameters in a method and no non-optional import parameters without values, one can type in the clause **PREFERRED PARAMETER** after the list of import parameters to specify which of the optional parameters will get more preference compared to others when the method will be called using syntax :- CALL METHOD objref->meth(<val>). In other words, it decides which of the optional parameters will be assigned the value 'VAL'.
Program Description	This program contains a class **C1** containing method **METH1** which has two optional parameters , **INPUT1** and **INPUT2**. Out of them, parameter **INPUT2** is declared as preferred parameter. The method simply displays the value of two import parameters . Notice the last line of the program and see the output. **The output will establish that the preferred parameter INPUT2 gets the value passed to the method when it is called using the syntax:-** **CALL METHOD objref->meth(<val>).**

Dump	`REPORT YSUBDEL .`
	` CLASS C1 DEFINITION.`
	`  PUBLIC SECTION.`
	`  METHODS : METH1 IMPORTING INPUT1 TYPE I optional`
	`  input2 TYPE I OPTIONAL`
	`  PREFERRED PARAMETER INPUT2.`
	` ENDCLASS.`
	
	` CLASS C1 IMPLEMENTATION.`
	`  METHOD : METH1.`
	`  write:/5 input1 ,`
	`  /5 input2 .`
	`  ENDMETHOD.`
	` ENDCLASS.`
	
	` START-OF-SELECTION.`
	`  DATA : OREF1 TYPE REF TO C1.`
	`  CREATE OBJECT : OREF1.`
	`  CALL METHOD : OREF1->METH1( input1 = 5  input2 = 3 ).`
	`  skip 2.`
	`  write:/5 'Next call'.`
	`  call method oref1->meth1( 10 ) .`

Output	5 3 Next call 0 10

2.4 Use of EXPORT and CHANGING parameters of a method

Theme	This program will demonstrate the use of EXPORTING and CHANGING parameters of a method.
Program description	The program contains a method **TAX_CALC** belonging to the class **CTAX**. It receives **GRADE** as **IMPORTING** parameter and **SALARY** as **CHANGING** parameter. Based on the grade, the **EXPORTING** parameter **ITAX** is calculated and the **CHANGING** parameter , **SALARY** is modified by deducting tax from it.

```
REPORT YSUBDEL .

DATA : w_tax    type p decimals 2 ,
       w_salary type p decimals 2 .

 CLASS CTAX DEFINITION.
  PUBLIC SECTION.
   METHODS : TAX_CALC IMPORTING grade  TYPE C
                      EXPORTING itax   TYPE P
                      CHANGING  salary TYPE P .
 ENDCLASS.

 CLASS CTAX IMPLEMENTATION.
  METHOD : TAX_CALC.
   CASE grade.
    WHEN 'A01'.
     itax = salary * '0.2'.
    WHEN 'A02'.
     itax = salary * '0.1'.
    WHEN OTHERS.
     itax = salary * '0.15'.
   ENDCASE.
    salary = salary - itax.
  ENDMETHOD.
 ENDCLASS.


 START-OF-SELECTION.
  DATA : OREF1 TYPE REF TO CTAX.
  CREATE OBJECT : OREF1.
  w_salary = 30000.
  w_tax    = 0    .
  write:/5 'Before method call, salary and tax are' ,
           w_salary ,
           w_tax .
   CALL METHOD OREF1->TAX_CALC EXPORTING grade = 'A01'
                               IMPORTING itax  = w_tax
                               CHANGING salary = w_salary.
    write:/5 'After method call, salary and tax are' ,
           w_salary ,
           w_tax .
```

Output

```
Before method call, salary and tax are      30,000.00        0.00
After method call, salary and tax are       24,000.00    6,000.00
```

2.5 Method using Internal Table as one of the parameters	
Theme	This program demonstrates how an internal table can be used as one of the interface parameters of a method.
Program Description	The program contains a method : **GETMARA** in class : **GET_MATERIALS**. It accepts material group, **MATGR** as import parameter and details out the details of the materials belonging to that material group into **I_TAB** , which is an internal table used as EXPORTING parameter for the method.
	REPORT YSUBOOPS5 . types : begin of typ_tab , matnr like mara-matnr , meins like mara-meins , end of typ_tab . data : itab type standard table of typ_tab , x_tab LIKE LINE OF ITAB. CLASS get_materials DEFINITION. PUBLIC SECTION. METHODS : getmara IMPORTING matgr TYPE C EXPORTING l_tab TYPE ANY TABLE. endclass. CLASS get_materials IMPLEMENTATION. METHOD : getmara . SELECT matnr meins INTO TABLE l_tab FROM MARA WHERE MATKL = matgr. ENDMETHOD. ENDCLASS. PARAMETERS : p_matkl like mara-matkl . START-OF-SELECTION. DATA : w_mat TYPE REF TO get_materials. CREATE OBJECT : w_mat. CALL METHOD w_mat->getmara EXPORTING matgr = p_matkl IMPORTING l_tab = itab . LOOP AT ITAB INTO X_TAB. WRITE:/5 X_TAB-MATNR , X_TAB-MEINS. ENDLOOP.
Output	One/more than one records with material number and basic unit, depending on the material group entered in the selection-screen.

2.6 Use of RETURNING parameters in method

Theme

To get some values from a method , one can use the EXPORTING, CHANGING or RETURNING parameters.
If one uses RETURNING parameters, the following restrictions apply:-
(1) No EXPORTING/CHANGING parameters can be used for the method.
(2) Only one RETURNING parameter can be used.
(3) RETURNING parameters are only passed by value.

This program demonstrates the use of RETURNING parameters and the various ways to call a method with RETURNING parameter to get the value into some variable.

Program Description

Method **M1** in class **C1** have two input parameters(**INPUT1** and **INPUT2**), which are used to derive value for RETURNING parameter , **RESULT**.

The program demonstrates various syntaxes that can be used to call a method of this kind.

```
report ysubdel1 message-id 00.

data : w_num type i.

class c1 definition .
 public section.
   methods : m1 importing input1        type i
                          input2        type i
                returning value(result) type i .
endclass.

class c1 implementation.
 method  : m1.
  result = input1 * 2 + input2.
 endmethod.
endclass.

 start-of-selection.
 data : obj1 type ref to c1 .
   create object obj1.
* Syntax 1
   call method obj1->m1 EXPORTING input1 = 5
                                  input2 = 4
                        RECEIVING result = w_num.
   write:/5 w_num .
* Syntax 2
   w_num = obj1->m1( input1 = 10 input2 = 20 ).
   write:/5 w_num .
* Syntax 3
   move obj1->m1( input1 = 2 input2 = 3 ) to w_num .
   write:/5 w_num .
```

Output

14
40
7

2.7 Demo on Static Method	
Theme	This program will show how to declare and define a static method and how it can be called using class component selector.
	In the following program, method : TESTMETHOD is defined as static method and is called later using class component selector, '=>'.
Dump	REPORT YSUBOOPS19 . data : num type i. class testclass definition. public section. class-methods : testmethod. endclass. class testclass implementation. method : testmethod. num = 5. write:/5 num. endmethod. endclass. start-of-selection. call method testclass=>testmethod.
Output	5

2.8 Static methods can only use static attributes, instance methods use both

Theme

Static methods of a class can only use static attributes of that class. It cannot use instance attributes. But, instance methods can use both.

Program Description

The following program contains a class **C1** which contains the following:-

Component	Type	Static/Instance
stnum	Data	static
Instnum	Data	Instance
Stmeth	Method	Static
Instmeth	Method	Instance

Both the static and instance methods are attempting to display values of the static and instance attributes: **STNUM** and **INSTNUM** .

On compilation, an error will be generated which will demonstrate that static method **STMETH** cannot work with instance attribute, **INSTNUM**.

Dump

```
REPORT YSUBDEL.

CLASS C1 DEFINITION.
PUBLIC SECTION.
 CLASS-DATA : STNUM TYPE I VALUE 5.
 DATA : INSTNUM TYPE I VALUE 6 .
 CLASS-METHODS : STMETH .
 METHODS : INSTMETH .
ENDCLASS.

CLASS C1 IMPLEMENTATION.
  METHOD : STMETH .
   WRITE:/5 STNUM .
   WRITE:/5 INSTNUM .
  ENDMETHOD.

  METHOD INSTMETH.
   WRITE:/5 STNUM .
   WRITE:/5 INSTNUM .
  ENDMETHOD.
 ENDCLASS.

 START-OF-SELECTION.
  DATA : OREF1 TYPE REF TO C1.
  CALL METHOD c1=>stmeth .
  CREATE OBJECT OREF1.
  CALL METHOD oref1->instmeth.
```

Output

On compilation,you get the following error:-

```
Program YSUBDEL
Within a static method, you can only access class attributes without
further specifications.
```

Remove the line in bold in the program and compile. It will get successfully compiled and executed.

2.9 Method Raising Exceptions

Theme	Methods can raise exceptions like function modules which can be handled after calling the method, depending on various sy-subrc values. This program will demonstrate that.
Program description	The program provides the user a selection-screen where the user enters a numeric value. If the user entry is <5, he gets an information message 'Should be >=5'. Else, five times of the value entered is displayed by the program on execution. The class **C1** in this program contains method **M1** which imports value for **NUM1** , and returns five times of it through the export parameter, **NUM2**. However, if the value passed to **NUM1** is lesser than 5, it raises an exception **E1** with some error message. The method **M1** is called after creating an object from the class. User-entered value in the parameter field : **P_NO** is passed to importing parameter **NUM1**.

Dump	`report ysubdel1 message-id 00.`
	
	`class c1 definition .`
	` public section.`
	`  methods : m1 importing num1 type i`
	`  exporting num2 type i`
	`  exceptions e1.`
	`endclass.`
	
	`class c1 implementation.`
	` method  : m1.`
	`  if num1 lt 5 .`
	`  message i398(00) with 'Should be >=5' raising e1.`
	`  else .`
	`  num2 = num1 * 5 .`
	`  endif.`
	` endmethod.`
	`endclass.`
	
	`  parameters : p_no type i .`
	
	`  start-of-selection.`
	`  data : obj1 type ref to c1 .`
	`  create object obj1.`
	`  call method obj1->m1 exporting num1 = p_no`
	`  importing num2 = p_no`
	`  exceptions e1 = 1.`
	
	`  IF sy-subrc <> 0.`
	`  MESSAGE ID SY-MSGID TYPE SY-MSGTY NUMBER SY-MSGNO`
	`  WITH SY-MSGV1 SY-MSGV2 SY-MSGV3 SY-MSGV4.`
	`  ELSE.`
	`  write:/5 p_no .`
	`  ENDIF.`

Output	The program provides the user a selection-screen where the user enters a numeric value. If the user entry is <5, he gets an information message 'Should be >=5'. Else, five times of the value entered is displayed by the program on execution.

2.10 Method can call itself	
Theme	Method of a class can call itself .But, please do not forget to specify some exit point to the method. Else, it will create an infinite loop.
Program Descr.	The program following contains a method **M1** in a class **C1**. It increases the value of static variable, **STATNUM** by 10 and displays it.Then, if the value of STATNUM is <=100 , it calls itself again.

Dump	`report ysubdel1 message-id 00.`
	
	`class c1 definition .`
	` public section.`
	` class-data : statnum type i .`
	`  methods : m1 .`
	`endclass.`
	
	`class c1 implementation.`
	` method  : m1.`
	`  statnum = statnum + 10.`
	`  if statnum gt 100.`
	`  exit.`
	`  endif.`
	`  write:/5 statnum .`
	`  call method m1.`
	` endmethod.`
	`endclass.`
	
	`  start-of-selection.`
	`  data : obj1 type ref to c1 .`
	`  create object obj1.`
	`  call method obj1->m1 .`

Output	10 20 …. 100

2.11 Use of ME in methods	
Theme	A method can have a variable defined within it having the same name as one of the attributes of the class to which the method belongs to. To clearly identify the class level attribute, the selector ME is used.
Program Description	Class **TESTCLAS**S contains method **TESTMETHOD**. There is a variable **I_NUM** declared as public attribute in the class as well as in the implementation part of the method. To access the variable **I_NUM** at the class level within the method, the selector ME is used. Please see the ouputs of this program for better understanding.

Dump	`REPORT YSUBOOPS17 .`
	
	`class testclass definition.`
	` public section.`
	`  data : i_num type i value 5.`
	`  methods : testmethod .`
	`endclass.`
	
	`class testclass implementation.`
	` method :testmethod.`
	`  data : i_num type i value 2.`
	`  write:/5 me->i_num , " access variable of the class`
	`  /5 i_num . " access variable of the method`
	` endmethod.`
	
	` endclass.`
	
	` start-of-selection.`
	` data : i_num type i.`
	`  data : my_obj type ref to testclass.`
	`  create object : my_obj.`
	`  call method my_obj->testmethod.`

Output	5 2

2.12 Pointer Tables	
Theme	This program will demonstrate the use of pointer tables
Program Description	The program below uses pointer table : **MYOBJ_TAB**.

	`REPORT YSUBOOPS19 .`
	
	`class testclass definition.`
	` public section.`
	`  methods : testmethod .`
	`  class-data : num type i.`
	`endclass.`
	
	`class testclass implementation.`
	` method : testmethod.`
	`  num = num + 5.`
	`  write:/5 num.`
	` endmethod.`
	`endclass.`
	
	`start-of-selection.`
	`data : myobj type ref to testclass ,`
	`  myobj_tab type table of ref to testclass.`
	
	`do 5 times.`
	` create object myobj .`
	` append myobj to myobj_tab.`
	`enddo.`
	
	` loop at myobj_tab into myobj.`
	`  call method : myobj->testmethod.`
	` endloop.`

Output	5 10 15 20 25

2.13 Dynamic Method Calls

Theme

One can call methods dynamically. Following restrictions apply:-

- Name of the method can be dynamic for static/instance method.
- Name of the class while calling static method can be dynamic.
- Both the name of the static method and the class containing it can be dynamic.

While doing so, it is better to use uppercase to assign the name of the class/methods to the variables(which will be used for dynamic assignment)

Program Description

The following program contains class **C1** with static method(**STATM**) and dynamic method(**INSTM**). The program utilizes all the syntaxes to call these static/instance methods dynamically.

Dump

```
REPORT  YSUBOOPS19          .

 data : f(6)   type c      ,
        g(10)  type c      .

class c1 definition.
public section.
  class-methods : statm .
  methods : instm .
endclass.

class c1 implementation.
 method : statm .
  write:/5 'I am static method'.
 endmethod.

 method : instm.
  write:/5 'I am instant method'.
 endmethod.
endclass.


start-of-selection.
 data : oref type ref to c1.
  create object oref.
* Name of instance method can be dynamic
  f = 'INSTM'.   call method oref->(f).
* Name of static method can be dynamic
   f = 'STATM'.  call method oref->(f).
* Name of the class can be dynamic for static method call
  f = 'C1'.      call method (f)=>statm.
* Name of the method can be dynamic for static method call
  f = 'STATM'.   call method c1=>(f).
* Both can be dynamic for static method call
   g = 'C1'.     call method (g)=>(f).
```

Output

```
I am instant method
 I am static method
 I am static method
 I am static method
 I am static method
```

2.14 Use of parameter table	
Theme	For dynamic method call, one can use the concept of PARAMETER TABLE to include references of all interface parameters of the method(instead of mentioning them separately).
Prog. Descr.	The program contains class **C1** with a method **M1**. This method has one IMPORTING parameter , '**P1**' and one EXPORTING parameter '**P3**'. **P3** is calculated within the method . Here, parameter table **PTAB** is used to dynamically call the method **M1** . Please note that, parameter tables work only when a method is called dynamically(i.e. to day, the name of the method/class is determined at runtime).

Dump	`REPORT YSUBOOPS24 .`
	
	`DATA : i_result type i,`
	`i_num type i value 5 .`
	`DATA f(2) TYPE c VALUE 'M1'.`
	
	`CLASS cl_abap_objectdescr DEFINITION LOAD .`
	
	`DEFINE : poptable.`
	`ptab_line-name = &1.`
	`ptab_line-kind = CL_ABAP_OBJECTDESCR=>&2.`
	`GET REFERENCE OF &3 INTO ptab_line-value.`
	`INSERT ptab_line INTO TABLE ptab.`
	`IF sy-subrc ne 0.`
	`EXIT.`
	`ENDIF.`
	`END-OF-DEFINITION.`
	
	`CLASS c1 DEFINITION.`
	`PUBLIC SECTION.`
	`METHODS m1 IMPORTING p1 TYPE i`
	`exporting p3 type i .`
	`ENDCLASS.`
	
	`CLASS c1 IMPLEMENTATION.`
	`METHOD m1.`
	`p3 = p1 + 200.`
	`ENDMETHOD.`
	`ENDCLASS.`
	
	`DATA r TYPE REF TO c1.`
	`DATA: ptab TYPE abap_parmbind_tab,`
	`ptab_line LIKE LINE OF ptab.`
	
	`START-OF-SELECTION.`
	
	`poptable : 'P1' EXPORTING i_num ,`
	`'P3' IMPORTING i_result .`
	
	`CREATE OBJECT r TYPE c1.`
	`CALL METHOD r->(f) PARAMETER-TABLE ptab.`
	`write:/5 i_result .`

Output	205

2.15 Use of Exception Table	
Theme	Instead of dealing with each and every exception and assigning it to different sy-subrc values, one can use exception table to handle the exceptions when a method is called dynamically.
	The class **C1** contains method **M1** which raises an exception. Exception table **ETAB** is used to handle the exception.
	REPORT YSUBOOPS25 . CLASS cl_abap_objectdescr DEFINITION LOAD. CLASS c1 DEFINITION. PUBLIC SECTION. METHODS m1 EXCEPTIONS exc. ENDCLASS. CLASS c1 IMPLEMENTATION. METHOD m1. RAISE exc. ENDMETHOD. ENDCLASS. DATA r TYPE REF TO object. DATA f(3) TYPE c VALUE 'M1'. DATA: etab TYPE abap_excpbind_tab, etab_line LIKE LINE OF etab. START-OF-SELECTION. etab_line-name = 'EXC'. etab_line-value = 4. INSERT etab_line INTO TABLE etab. IF sy-subrc ne 0. EXIT. ENDIF. CREATE OBJECT r TYPE c1. CALL METHOD r->(f) EXCEPTION-TABLE etab. WRITE sy-subrc.
Output	4

3 Constructors

3.1 Instance Constructors get fired at the time of class instantiation	
Theme	This simple program will show you that instance constructor methods of a class get triggered when an object is created from the class.
Program Description	This program contains a class **C1** with a constructor method which writes out something to indicate that it is triggered. In the START-OF-SELECTION block, the class **C1** is instantiated, which triggers the instance constructor method(as is evident by the output as report). **This establishes the theme.**

Dump	`REPORT YSUBOOPS1.`
	
	`CLASS C1 DEFINITION.`
	`PUBLIC SECTION.`
	`METHODS : CONSTRUCTOR .`
	`ENDCLASS.`
	
	`CLASS C1 IMPLEMENTATION.`
	`METHOD constructor.`
	`WRITE:/5 'I am constructor'.`
	`skip 2.`
	`ENDMETHOD.`
	`ENDCLASS.`
	`*************** main program **************`
	`START-OF-SELECTION.`
	`DATA: obj1 TYPE REF TO c1.`
	`CREATE OBJECT: obj1.`

Output	I am constructor

3.2 Instance Constructors can have import parameters	
Theme	Instance constructors can have import parameters. Values to them are passed at the time of CREATE OBJECT statement to create object from the class containing the constructor.
Program Description	The program contains a class **C1** which has one instance constructor with one import parameter. The constructor gets fired at the time of CREATE OBJECT statement.

Dump	`REPORT YSUBOOPS2.`
	
	`CLASS c1 DEFINITION.`
	`PUBLIC SECTION.`
	`METHODS : CONSTRUCTOR importing today type d.`
	`ENDCLASS.`
	
	`CLASS C1 IMPLEMENTATION.`
	`METHOD constructor.`
	`Write:/5 'Today is : ' , today dd/mm/yyyy.`
	`ENDMETHOD.`
	`ENDCLASS.`
	`*************** main program **************`
	`START-OF-SELECTION.`
	`DATA: obj1 TYPE REF TO c1.`
	`CREATE OBJECT: obj1 exporting today = sy-datum.`

Output	Today is 08.04.2004

3.3 Constructors cannot have any export parameters	
Theme	This program will demonstrate that constructor methods cannot have any export parameters
Program Description	This program attempts to create a constructor with export parameter, which is trapped and resisted at the time of compilation. **This establishes the theme.**

Dump	`REPORT YSUBOOPS2.`
	
	`CLASS c1 DEFINITION.`
	`PUBLIC SECTION.`
	`METHODS : CONSTRUCTOR exporting name type c.`
	`ENDCLASS.`

Output	Compilation errror is reported.

3.4 Instance Constructors can raise exceptions	
Theme	Instance Constructor methods can raise exceptions
Program Descriptions	This program contains a class **C1** which contains an instance constructor method. It accepts an import parameter, **NUM**. If it is lesser than 7, an exception is raised, which is properly handled by specifying some sy-subrc value at the time of CREATE OBJECT statement and later handled properly.
Dump	
Output	Exceptions Raised

```
REPORT  YSUBOOPS2.

CLASS c1 DEFINITION.
 PUBLIC SECTION.
 METHODS : CONSTRUCTOR importing num type i
                       exceptions e1 .
ENDCLASS.

 CLASS C1 IMPLEMENTATION.
  METHOD constructor.
    if num lt 7.
     raise  e1.
    endif.
  ENDMETHOD.
ENDCLASS.
*************** main program **************
START-OF-SELECTION.
DATA: obj1 TYPE REF TO c1.
CREATE OBJECT: obj1 exporting num = 5
 exceptions e1 = 2.
 if sy-subrc = 2.
  write:/5 'Exceptions raised'.
 endif.
```

3.5 Use of static constructor.

Theme

There are two programs over here which will show you simple example on a static constructor. You will learn how to declare a static constructor. Static/class constructors get triggered before any of the following events:-

- Generating an instance of a class using CREATE OBJECT obj, where obj has the data type REF TO class.
- Calling a static method using [CALL METHOD] class=>meth.
- Registering a static event handler method using SET HANDLER class=>meth for obj.
- Registering an event handler method for a static event of the class class.
- Addressing a static attribute with class=>a.

These two programs will show you that a class constructor gets fired before any of its static components are accessed, or an object is created from the class.

Dump

```
REPORT  YSUBOOPS2.
 CLASS c1 DEFINITION .
  PUBLIC SECTION.
   CLASS-DATA : NUM TYPE I VALUE 5.
   CLASS-METHODS :CLASS_CONSTRUCTOR.
 ENDCLASS.

 CLASS c1 IMPLEMENTATION.
  METHOD CLASS_CONSTRUCTOR.
   WRITE:/5 'I am class constructor'.
  ENDMETHOD.
 ENDCLASS.

 START-OF-SELECTION.
   WRITE:/5 C1=>NUM.
```

Constructor is triggered when a static attribute is accessed

```
REPORT  YSUBOOPS2.
 CLASS c1 DEFINITION .
  PUBLIC SECTION.
   CLASS-DATA : NUM TYPE I VALUE 5.
   CLASS-METHODS :CLASS_CONSTRUCTOR.
 ENDCLASS.

 CLASS c1 IMPLEMENTATION.
  METHOD CLASS_CONSTRUCTOR.
   WRITE:/5 'I am class constructor'.
  ENDMETHOD.
 ENDCLASS.

 START-OF-SELECTION.
   DATA : OREF TYPE REF TO C1.
   CREATE OBJECT OREF.
```

Constructor is fired when an object is created from the class

Output

For the first program(on the LHS):-
I am class constructor
5
For the second program(on the RHS):-
I am class constructor

3.6 Static constructor can be triggered at the beginning of a processing block(form /event/block/procedure)	
Theme	In the START-OF-SELECTION block of this program, static attribute of a class containing class constructor will be accessed. This will demonstrate that the the first thing which will get executed in the START-OF-SELECTION block is the class constructor method, irrespective of the point at which the static attribute is accessed.
Program Description	The program contains a class C1 with a static constructor, which prints the statement:- " I am class constructor". This class also contains a static attribute , num of value = 5. The START-OF-SELECTION block in this program contains the following statements:- A write statement which will print :-"Hello" A call to access the static attribute(NUM) of class C1. On execution of this program, we will get the following output in the list:- I am class constructor Hello 5 instead of the expected output:- Hello I am class constructor 5 **This demonstrates the theme.**

Dump	`REPORT YSUBOOPS2.`
	`CLASS c1 DEFINITION .`
	`PUBLIC SECTION.`
	`CLASS-DATA : NUM TYPE I VALUE 5.`
	`CLASS-METHODS :CLASS_CONSTRUCTOR.`
	`ENDCLASS.`
	
	`CLASS c1 IMPLEMENTATION.`
	`METHOD CLASS_CONSTRUCTOR.`
	`WRITE:/5 'I am class constructor'.`
	`ENDMETHOD.`
	`ENDCLASS.`
	
	`START-OF-SELECTION.`
	`write:/5 'Hello'.`
	`write:/5 c1=>num.`

Output	I am class constructor Hello 5

3.7 Static/Class constructors cannot have any interface	
Theme	This program will show you that static constructors of a class cannot have any interface parameters and exceptions
Program Description	In this program, the class **C1** contains a class constructor which is having an import parameter , **NUM**. The program could not be successfully compiled due to such attempt.

Dump	`REPORT YSUBOOPS2.`
	`CLASS c1 DEFINITION .`
	`PUBLIC SECTION.`
	`CLASS-METHODS :CLASS_CONSTRUCTOR IMPORTING NUM TYPE C.`
	`ENDCLASS.`

Output	Compilation of the progran will fail with an error message:- **"The method CLASS_CONSTRUCTOR may not have parameters or EXCEPTIONS"**.

4 Inheritance

4.1 Subclass can access public/protected components of superclass

Theme

This program will demonstrate:-

- How to create a subclass from a superclass.
- Subclass can access public/protected components(methods, attributes etc) of superclass.

Prog. Descr.

This program contains superclass **C1** and its subclass **C2**. Class **C1** has the following components:-

Component	Nature	Section of Existence	Significance/action
NUM	Attribute	public	Value = 6
METH1	Method	Public	Displays value of NUM
METH2	Method	Protected	Displays:- "I am meth2"
NUM2	Attribute	Protected	Value = 7

Subclass of **C1** is **C2** which contains the following new components:-

Component	Nature	Section of Existence	Significance/action
M1	Method	public	➢ Calls method meth1. ➢ Calls method meth2 ➢ Displays value of variable num2.

In the START-OF-SELECTION block, an object **OREF** is created from **C2** and the method **M1** is called.The output of the program shows that method **M1** of class **C2** calls method **METH1**, then **METH2** and finally displays variable **NUM2**.

This demonstrates that subclass C2 has access to the public and protected methods and attributes of superclass C1 and truly establishes the theme.

Dump

```
REPORT YSUBDEL.
CLASS C1 DEFINITION.
 PUBLIC SECTION.
  METHODS : METH1.
  DATA : NUM TYPE I VALUE 6.
 PROTECTED SECTION.
  DATA : num2 type i value 7.
  METHODS METH2.
 ENDCLASS.

CLASS C1 IMPLEMENTATION .
 METHOD : METH1.
  WRITE:/5 num.
 endmethod.

 METHOD : METH2.
  WRITE:/5 ' I am meth2 '.
 ENDMETHOD.
ENDCLASS.

CLASS C2 DEFINITION INHERITING FROM C1.
 PUBLIC SECTION.
  METHODS : M1.
ENDCLASS.

CLASS C2 IMPLEMENTATION.
 METHOD M1.
  CALL METHOD : meth1, meth2.
  write:/5 num2.
 endmethod.
endclass.

 START-OF-SELECTION.
  DATA : OREF TYPE REF TO C2.
  CREATE OBJECT OREF.
```

	CALL METHOD : OREF->M1.
Output	6 I am meth2 7

4.2 Subclass can re-implement inherited methods from superclass	
Theme	Subclass can re-implement the inherited public and protected methods from superclass.
Program Descr.	Class **C1** contains method **METH1**(public) and **METH2**(protected), both of which are modified and re-implemented in its subclass **C2**.Objects are created out of both classes and the method **METH1** for both objects are called. Output of the program demonstrates different behaviour for method **METH1** of class **C1** and **C2**. **This demonstrates the theme.**

Dump	`REPORT YSUBDEL.`
	` CLASS C1 DEFINITION.`
	`  PUBLIC SECTION.`
	`  METHODS : METH1.`
	`  PROTECTED SECTION.`
	`  METHODS METH2.`
	`  ENDCLASS.`
	
	` CLASS C1 IMPLEMENTATION .`
	`  METHOD : METH1.`
	`  WRITE:/5 'I am meth1 in class C1'.`
	`  CALL METHOD METH2.`
	`  ENDMETHOD.`
	
	`  METHOD : METH2.`
	`  WRITE:/5 ' I am meth2 in class C1 '.`
	`  ENDMETHOD.`
	`ENDCLASS.`
	
	`CLASS C2 DEFINITION INHERITING FROM C1.`
	` PUBLIC SECTION.`
	`  METHODS : METH1 redefinition .`
	` PROTECTED SECTION.`
	`  METHODS : METH2 redefinition.`
	`ENDCLASS.`
	
	`CLASS C2 IMPLEMENTATION.`
	` METHOD METH1.`
	`  WRITE:/5 'I am meth1 in class C2'.`
	`  call method meth2.`
	` endmethod.`
	
	`  METHOD : METH2.`
	`  WRITE:/5 ' I am meth2 in class C2 '.`
	` ENDMETHOD.`
	
	`endclass.`
	
	` START-OF-SELECTION.`
	`  DATA : OREF1 TYPE REF TO C1 ,`
	`  OREF2 TYPE REF TO C2.`
	`  CREATE OBJECT :  OREF1 , OREF2.`
	`  CALL METHOD : OREF1->METH1 ,`
	`  OREF2->METH1.`

Output	I am meth1 in class C1 I am meth2 in class C1 I am meth1 in class C2 I am meth2 in class C2

4.3 Objects cannot be created from an abstract class.

Theme	Objects cannot be created from an abstract class. Only the subclasses of such class can be instantiated.
Program Description	This program contains an abstract class **C1** and its subclass **C2**. Object cannot be created from class **C1**, but possible from class **C2**.

Dump

```
REPORT YSUBDEL.

 CLASS C1 DEFINITION ABSTRACT.
  PUBLIC SECTION.
 ENDCLASS.

 CLASS C1 IMPLEMENTATION .
  METHOD : METH1.
 ENDCLASS.

CLASS C2 DEFINITION INHERITING
FROM C1.
ENDCLASS.

CLASS C2 IMPLEMENTATION.
endclass.

 START-OF-SELECTION.
  data : OREF1 TYPE REF TO C1
,
         OREF2 TYPE REF TO C2.
  CREATE OBJECT oref1.
```

Instantiation of abstract class

```
REPORT YSUBDEL.

 CLASS C1 DEFINITION ABSTRACT.
  PUBLIC SECTION.
 ENDCLASS.

 CLASS C1 IMPLEMENTATION .
  METHOD : METH1.
 ENDCLASS.

CLASS C2 DEFINITION INHERITING
FROM C1.
ENDCLASS.

CLASS C2 IMPLEMENTATION.
endclass.

 START-OF-SELECTION.
  data : OREF1 TYPE REF TO C1 ,
         OREF2 TYPE REF TO C2.
  CREATE OBJECT oref2.
```

Instantiation of subclass of an abstract class

Output	Instantiation of abstract class will be resisted with error message at the time of compilation. Instantiation of subclass of an abstract class will be allowed.

4.4 Abstract methods cannot be implemented in abstract class

Theme	Abstract methods cannot be implemented in that class. It has to be implemented in one of its subclass. To implement an abstract method in a subclass, one need to redefine this subclass using the **REDEFINITION** addition.
Program Descr.	This program contains an abstract class **C1** with abstract method **METH1**, which is implemented in the same class.The program will not be compiled due to this. The program is then modified and the abstract method is implemented in class **C2**, subclass of C1. Now, the program gets successfully compiled.
Dump	**Incorrect**

```
REPORT YSUBDEL.

 CLASS C1 DEFINITION ABSTRACT.
  PUBLIC SECTION.
   METHODS : METH1 ABSTRACT.
 ENDCLASS.

 CLASS C1 IMPLEMENTATION .
  METHOD : METH1.
   WRITE:/5 'I am method : METH1 '.
  ENDMETHOD.
ENDCLASS.

CLASS C2 DEFINITION INHERITING FROM C1.
ENDCLASS.

CLASS C2 IMPLEMENTATION.
endclass.

 START-OF-SELECTION.
  data : OREF2 TYPE REF TO C2.
  CREATE OBJECT oref2.
```

Correct

```
REPORT YSUBDEL.

 CLASS C1 DEFINITION ABSTRACT.
  PUBLIC SECTION.
   METHODS : METH1 ABSTRACT.
 ENDCLASS.

 CLASS C1 IMPLEMENTATION .
  ENDCLASS.

CLASS C2 DEFINITION INHERITING
FROM C1.
 public section.
 methods : meth1 redefinition.
ENDCLASS.

CLASS C2 IMPLEMENTATION.
 METHOD : METH1.
 WRITE:/5 'I am method: METH1 '.
 ENDMETHOD.
endclass.

 START-OF-SELECTION.
  data : OREF2 TYPE REF TO C2.
  CREATE OBJECT oref2.
```

4.5 Final classes cannot have any subclass	
Theme	Subclasses cannot be inherited from a final Class. They can only be instantiated.
Program Descrip.	This program contains a final class **C1** and a subclass **C2**. This is not allowed and is resisted at the time of compilation. **Hence, the theme is properly established.**

Dump	`REPORT YSUBDEL.`
	
	`CLASS C1 DEFINITION FINAL.`
	`ENDCLASS.`
	
	`CLASS C1 IMPLEMENTATION .`
	`ENDCLASS.`
	
	`CLASS C2 DEFINITION INHERITING FROM C1.`
	`ENDCLASS.`
	
	`CLASS C2 IMPLEMENTATION.`
	`endclass.`
	
	`START-OF-SELECTION.`
	`data : OREF2 TYPE REF TO C2.`
	`CREATE OBJECT oref2.`

Output	Compilation error is generated:- **The final class C1 cannot have any subclasses.**

4.6 Final methods cannot be redefined in the subclasses	
Theme	Final method in a class can only be defined in that class. It cannot be redefined in any of its subclasses.
Program Descr.	This program contains a class **C1** which has a final method : **METH1**. Class **C2** is subclass of **C1** and tries to re-define the final method. Compilation error is genarated , resisting successful compilation. **This demonstrates the theme.**

Dump	`REPORT YSUBDEL.`
	
	`CLASS C1 DEFINITION .`
	`PUBLIC SECTION.`
	`METHODS : METH1 FINAL.`
	`ENDCLASS.`
	
	`CLASS C1 IMPLEMENTATION .`
	`method meth1.`
	`write:/5 'I am method meth1'.`
	`endmethod.`
	`ENDCLASS.`
	
	`CLASS C2 DEFINITION INHERITING FROM C1.`
	`PUBLIC SECTION.`
	`methods : meth1 redefinition.`
	
	`ENDCLASS.`
	
	`CLASS C2 IMPLEMENTATION.`
	`method : meth1.`
	`write:/5 ' I am meth1,modified in class C2'.`
	`Endmethod.`
	`endclass.`
	
	`START-OF-SELECTION.`
	`data : OREF2 TYPE REF TO C2.`
	`CREATE OBJECT oref2.`

Output	Program is not successfully compiled. The compilation error message is as follows:- **The final method METH1 cannot be redefined.**

4.7 Static attributes exist only once per inheritance tree	
Theme	Static attributes only exist once in each inheritance tree. One can change them from outside the class using the class component selector with any class name, or within any class in which they are shared. They are visible in all classes in the inheritance tree.
Program Descr.	Class **C1** contains static attribute , **NUM**. Class **C2** and **C3** are subclasses of class **C1**. In the START-OF-SELECTION block, the static attribute , **NUM** is changed using reference of class **C3**. It gets changed with reference to class **C2** also. Hence, static attribute, NUM, changed via class C3 is also changed with respect to C2 also. **This demonstrates the theme.**

Dump	`REPORT YSUBDEL.`
	
	`CLASS C1 DEFINITION .`
	`PUBLIC SECTION.`
	`class-data : num type i.`
	`ENDCLASS.`
	
	`CLASS C1 IMPLEMENTATION .`
	`ENDCLASS.`
	
	`CLASS C2 DEFINITION INHERITING FROM C1.`
	`ENDCLASS.`
	
	`CLASS C2 IMPLEMENTATION.`
	`endclass.`
	
	`CLASS C3 DEFINITION INHERITING FROM C1.`
	`ENDCLASS.`
	
	`START-OF-SELECTION.`
	`C3=>NUM = 10.`
	`WRITE:/5 C2=>NUM.`

Output	10

4.8 Constructors of superclass flows down the chain	
Theme	Constructor of superclass is inherited by the subclass also.
Program Descr.	Class **C1** contains a constructor method, but its subclass **C2** does not explicitly have its own. When object from class **C2** is created, the constructor of class **C1** is triggered. **This establishes the theme.**

Dump	`REPORT YSUBOOPS18.`
	
	`CLASS C1 DEFINITION.`
	`PUBLIC SECTION.`
	`METHODS : CONSTRUCTOR .`
	`ENDCLASS.`
	
	`CLASS C1 IMPLEMENTATION.`
	
	`METHOD constructor.`
	`WRITE:/5 'I am C1'.`
	`skip.`
	`ENDMETHOD.`
	`ENDCLASS.`
	
	`CLASS C2 DEFINITION INHERITING FROM C1.`
	`ENDCLASS.`
	
	`CLASS C2 IMPLEMENTATION.`
	`ENDCLASS.`
	
	`START-OF-SELECTION.`
	`DATA: obj type ref to C2.`
	`CREATE OBJECT: obj.`

Output	I am C1.

4.9 Subclass can have enhanced constructor than its superclass.	
Theme	A subclass can modify the constructor method and add some extra functionalities. In the instance constructor method of the child class, the one for the superclass should be called first using : **CALL METHOD super->CONSTRUCTOR** statement and then additional statements can be added. Pl. note that REDEFINITION statement is not required to enhance constructors for a subclass.
Program Descrip.	This program contains three classes:- ❖ **GRANDFATHER** at the top of the node with its own constructor method ❖ **FATHER**, subclass of GRANDFATHER with enhanced constructor ❖ **SON**, subclass of FATHER with its own enhanced constructor. An object is created finally from the class **SON**, which triggers the constructor methods in the order: GRANDFATHER→FATHER→SON.
	REPORT YSUBOOPS18. CLASS grandfather DEFINITION. PUBLIC SECTION. METHODS : CONSTRUCTOR . ENDCLASS. CLASS grandfather IMPLEMENTATION. METHOD constructor. WRITE:/5 'I am grandfather'. skip. ENDMETHOD. ENDCLASS. CLASS father DEFINITION INHERITING FROM GRANDFATHER. public section. METHODS : CONSTRUCTOR. ENDCLASS. CLASS father IMPLEMENTATION. METHOD constructor . call method super->constructor. WRITE:/5 'I am father'. skip. ENDMETHOD. ENDCLASS. CLASS son DEFINITION INHERITING FROM FATHER. public section. METHODS : CONSTRUCTOR. ENDCLASS. CLASS son IMPLEMENTATION. METHOD constructor . call method super->constructor. WRITE:/5 'I am son'. skip. ENDMETHOD. ENDCLASS. START-OF-SELECTION. DATA: myson type ref to son.

	CREATE OBJECT: myson.
Output	I am grandfather I am father I am son

4.10 Static constructor of a class is called only once per program.

Theme	The first when a subclass in a program is accessed, its static constructor is executed. But, before it can be executed, the static constructors of all of its superclasses must already have been executed. A static constructor may only be called once per program. Therefore, when one first address a subclass, the system looks for the next-highest superclass whose static constructor has not yet been executed. It executes the static constructor of that class, followed by those of all classes between that class and the subclass that is addressed.
Program Descr.	This program contains three classes:- ❖ **FATHER** with its own static constructor method ❖ SON, subclass of FATHER with its own static constructor method. An object is created finally from the class SON, which triggers the constructor methods in the order: FATHER→SON. Now, an object is created from the class FATHER. But, that did not trigger constructor of class FATHER, because that had already been triggered by the program when an object was created from the class SON. **This establishes the theme.**

Dump	`REPORT YSUBOOPS18.`
	
	`CLASS father DEFINITION.`
	`public section.`
	`class-METHODS : class_CONSTRUCTOR.`
	`ENDCLASS.`
	
	`CLASS father IMPLEMENTATION.`
	`METHOD class_constructor .`
	`WRITE:/5 'I am father'.`
	`skip.`
	`ENDMETHOD.`
	`ENDCLASS.`
	
	`CLASS son DEFINITION INHERITING FROM FATHER.`
	`public section.`
	`class-METHODS : class_CONSTRUCTOR.`
	`ENDCLASS.`
	
	`CLASS son IMPLEMENTATION.`
	`METHOD class_constructor .`
	`WRITE:/5 'I am son'.`
	`skip.`
	`ENDMETHOD.`
	`ENDCLASS.`
	
	`START-OF-SELECTION.`
	`DATA: myson type ref to son.`
	`CREATE OBJECT: myson.`
	`data : myfather type ref to father.`
	`create object : myfather.`

Output	I am father I am son

4.11 Static type and Dynamic type of a variable

Theme

Static type of a reference variable can point to a superclass; whereas its dynamic type can point to one of its subclasses.
This program will show you various ways to do that.

Program Descrip.

This program contains class C1 with method M1. Class C2 is a subclass of C1 and contains redefined implementation of method M1.
Reference variables are created in the program as follows:-

Reference Variable	Static type	Dynamic type	Dynamic type assigned by
OREF1	C1	C1	CREATE object oref1.
OREF11	C1	C2	CREATE OBJECT oref11 TYPE C2.
OREF111	C1	C2	CREATE OBJECT OREF111. OREF111 = OREF2.
OREF2	C2	C2	CREATE OBJECT oref2.

Finally, method M1 ic called using all objects.The observations are as follows:-

Method call	Calls method	Reason
OREF1->M1	M1 of class C1.	Both Static & Dynamic type of OREF1 refers to C1.
OREF11->M1	M1 of class C2.	Static type of OREF11 refers to C1, dynamic type to C2.
OREF111->M1	M1 of class C2.	Static type of OREF111 refers to C1, dynamic type to C2.
OREF2->M1	M1 of class C2	Both Static & Dynamic type of OREF2 refers to C2.

Dump

```
REPORT  YSUBOOPS18.

class c1 definition.
public section.
 methods : m1.
endclass.

class c1 implementation.
 method m1 .
  write:/5 ' I am m1 of c1'.
 endmethod.
endclass.

 class c2 definition inheriting from c1.
  public section.
   methods : m1 redefinition.
 endclass.

 class c2 implementation.
   method m1.
    write:/5 'I am m1 of c2'.
   endmethod.
 endclass.

 START-OF-SELECTION.
  DATA : OREF1   TYPE REF TO C1,
         OREF11  TYPE REF TO C1,
         OREF111 TYPE REF TO C1,
         OREF2   TYPE REF TO C2 .
  CREATE OBJECT : OREF1         ,
                  OREF11 TYPE C2,
                  OREF111       ,
                  OREF2         .
  OREF111 = OREF2.
  CALL METHOD : OREF1->M1  , " Output : I am m1 of c1
                OREF11->M1 , " Output : I am m1 of c2
```

	OREF111->M1, " Output : I am m1 of c2 OREF2->M1 . " Output : I am m1 of c2
Output	I am m1 of c1 I am m1 of c2 I am m1 of c2 I am m1 of c2

4.12 Static type should be more general than dynamic type of a reference variable	
Theme	Static type of a reference variable can refer to a superclass, whereas its dynamic type can refer to a subclass of the superclass. In that case, the reference variable will identify all the common components of the superclass and subclass. It will not be able to identify any new components in the subclass, which are not present in its superclass.
Program Descr.	This program contains class C1 and its subclass C2. Class C1 contains method M1, which is also redefined in class C2. Class C2 contains a new method M2. A reference variable OREF11 is created with static type of C1 and dynamic type of C2. Method M2 is attempted to be called using OREF11. This produces compilation error, establishing the theme.

Dump	`REPORT YSUBOOPS18.`
	
	`class c1 definition.`
	`public section.`
	`methods : m1.`
	`endclass.`
	
	`class c1 implementation.`
	`method m1 .`
	`write:/5 ' I am m1 of c1'.`
	`endmethod.`
	`endclass.`
	
	`class c2 definition inheriting from c1.`
	`public section.`
	`methods : m1 redefinition.`
	`methods : m2 .`
	`endclass.`
	
	`class c2 implementation.`
	`method m1.`
	`write:/5 'I am m1 of c2'.`
	`endmethod.`
	`method m2.`
	`write:/5 'I am m2'.`
	`endmethod.`
	`endclass.`
	
	`START-OF-SELECTION.`
	`DATA : OREF11 TYPE REF TO C1.`
	`CREATE OBJECT : OREF11 TYPE C2.`
	
	`CALL METHOD : OREF11->M2 .`

Output	Compilation error fails to identify method M2 in the last statement of the program.

4.13 Method of a parent class, used from its subclass, uses attributes of the parent class only, if the method is not re-defined in subclass.

Theme	As long as a method(using private attributes) inherited from a superclass is not redefined, it still uses the private attributes of the superclass, not those of the subclass, even if the subclass has private attributes of the same name.
Program Descrip.	Class **C1** contains a method **M1** in the public section and a private variable, **NUM** of value = 5. Method **M1** in class **C1** displays the value of private variable, **NUM**. Class **C2** is a subclass of class **C1**. It does not redefine method M1. But, it has also a private variable , **NUM** with value = 6. An object is created from class C2 and the method **M1** is called. The output shows that the variable **NUM**(as displayed by method M1) has been taken from class **C1**, not **C2**. **This establishes the theme.**

Dump	`report ysubdel .`
	
	`CLASS c1 DEFINITION.`
	`PUBLIC SECTION .`
	`METHODS : m1 .`
	`PRIVATE SECTION.`
	`DATA : num TYPE I VALUE 5 .`
	`ENDCLASS.`
	
	`CLASS c1 IMPLEMENTATION.`
	`METHOD : m1 .`
	`write:/5 num .`
	`ENDMETHOD.`
	`ENDCLASS.`
	
	`CLASS c2 DEFINITION INHERITING FROM c1.`
	`PUBLIC SECTION .`
	`DATA : num TYPE I VALUE 6.`
	`ENDCLASS.`
	
	`CLASS c2 IMPLEMENTATION.`
	`ENDCLASS.`
	
	`START-OF-SELECTION.`
	`DATA : oref2 TYPE REF TO c2 .`
	
	`CREATE OBJECT : oref2 .`
	
	`CALL METHOD oref2->m1 .`

Output	5

4.14 Demo on Widening Cast	
Theme	This program will show the use of widening cast operator
Program Description	Class **C1** is superclass of **C2**. Object of class **C2** is assigned the object of class **C1** using widening cast operator. This helps to avoid the compilation error, but genarates the error 'cx_sy_move_cast_error trapped' at runtime, which is handled and reported properly in the program.
Dump	REPORT YSUBDEL . class c1 definition. public section. data : num type i value 5. endclass. class c1 implementation. endclass. class c2 definition inheriting from c1. public section. endclass. class c2 implementation. endclass. start-of-selection . data : obj1 type ref to c1 , obj2 type ref to c2 . create object : obj1 , obj2 . TRY. obj2 ?= obj1. CATCH cx_sy_move_cast_error. write:/5 'cx_sy_move_cast_error trapped'. ENDTRY.
Output	cx_sy_move_cast_error trapped

5 Interface

5.1 Simple use of an interface	
Theme	This program will show simple use of an interface with its own data and methods and how it is implemented in a class. It will also show that there can be methods of same name for an interface and the class implementing the interface.
Program Desc	This program contains an interface **I1** with attribute : **NUM** an method : **METH1**. This interface is implemented in a class : **C1** which also has its own method METH1. An object **OREF** is created from class **C1** and both the methods **METH1** , one for class and another for interface is called using the object.

Dump	`report ysubdel .`
	
	`interface i1.`
	` data : num type i .`
	` methods : meth1.`
	`endinterface.`
	
	` class c1 definition.`
	`  public section.`
	`  methods : meth1.  " class C1's own method`
	`  interfaces : i1.`
	` endclass.`
	
	` class c1 implementation.`
	`  method : meth1.`
	`  write:/5 'I am meth1 in c1'.`
	`  endmethod.`
	
	`  method i1~meth1.`
	`  write:/5 'I am meth1 from i1'.`
	`  endmethod.`
	
	` endclass.`
	
	` start-of-selection.`
	`  data : oref type ref to c1.`
	`  create object oref.`
	`  write:/5 oref->i1~num.`
	`  call method oref->meth1.`
	`  call method oref->i1~meth1.`

Output	0 I am meth1 in c1 I am meth1 from i1

5.2 Interfaces can only be implemented in the public section of a class	
Theme	This program will show you that classes implementing an interface can only contain the features of the interface in its public section.
Program Description	In this program, class **C1** is trying to accommodate interface **I1** in its **PRIVATE SECTION**. **This creates a compilation error, establishing the theme**.

Dump	`report ysubdel .`
	
	`interface i1.`
	`methods : meth1.`
	`endinterface.`
	
	`class c1 definition.`
	`protected section.`
	`interfaces : i1.`
	`endclass.`

Output	Compilation error with error message :- **INTERFACES may only be implemented in the public section.**

5.3 A class with an interface should implement all the methods of that interface	
Theme	This program will show that a class containing an interface should implement all the methods of the interface in its implementation section.
Program Descrip	Class **C1** implements interface **I1**, which has got two methods , **METH1** and **METH2**. But, in the IMPLEMENTATION section of class **C1**, only **METH1** is implemented. This program will create a compilation error, **establishing the theme.**

Dump	`report ysubdel .`
	
	`interface i1.`
	` methods : meth1 ,`
	`  meth2 .`
	`endinterface.`
	
	` class c1 definition.`
	`  public section.`
	`  interfaces : i1.`
	` endclass.`
	
	` class c1 implementation.`
	`  method i1~meth1.`
	`  write:/5 'I am meth1 from i1'.`
	`  endmethod.`
	` endclass.`
	
	` start-of-selection.`
	`  data : oref type ref to c1.`
	`  create object oref.`
	`  call method oref->i1~meth1.`

Output	Compilation error with error message :- **Implementation missing for method "I1~METH2"**

5.4 Values for interface attributes are assigned at the time of inclusion in a class

Theme

One cannot specify values for attributes while declaring them in an interface like the following fashion : DATA : <var> TYPE <type> VALUE <val>.
Instead of doing that, one has to specify the values for different attributes of interface at the point where the interface is declared in the public section of a class.

Program Descr.

Interface **I1** contains two numeric attributes , **NUM1** and **NUM2** .
In version 1 of the program, attempt is made to specify the values while defining those attributes in the interface. This version does not get successfully compiled and **thus establishes the theme**.
In version 2, values for interface attributes are specified at the time when **I1** is included in the public section of class **C1**. This version gets successfully compiled and produces a result.

Version 1

```
report ysubdel .

interface i1 .
  data : num1 type i value 5  ,
         num2 type i value 6  .
endinterface.

 class c1 definition.
  public section.
   interfaces : i1 .
   methods m1.
 endclass.

 class c1 implementation.
  method m1.
   write:/5 i1~num1,
            i1~num2.
  endmethod.
 endclass.

 start-of-selection.
  data : oref type ref to c1.
   create object oref.
   call method oref->m1.
```

Version 2

```
report ysubdel .

interface i1 .
  data : num1 type i    ,
         num2 type i    .
endinterface.

 class c1 definition.
  public section.
   interfaces : i1 DATA VALUES
num1 = 5 num2 = 6 .
   methods m1.
 endclass.

 class c1 implementation.
  method m1.
   write:/5 i1~num1,
            i1~num2.
  endmethod.
 endclass.

 start-of-selection.
  data : oref type ref to c1.
   create object oref.
   call method oref->m1.
```

Output

Output of version 1:-
Compilation error with error message:- **Within an interface, you cannot use VALUE with attributes(except constants)**
Output of version 2:-
5 6

5.5 Use of FINAL methods from Interface	
Theme	This program will demonstrate how to create final method in a class from one of the methods of an interface.
Program Description	Interface **I1** contains two methods : **M1** and **M2**. I1 is included and incorporated in class : **C1** with **M2** as a final method. Both the methods are implemented in class **C1**. Class **C2** is a subclass of class C1. It redefines method : **I1~M1** and re-implements it, but it does not do that for **I1~M2** as that is declared as final method. In the START-OF-SELECTION block, object **OREF1** is created from class **C1** and **OREF2** from class **C2** and both the methods M1 and M2 are called using both the objects.

Dump	`report ysubdel .`
	
	`interface i1 .`
	`  methods : m1 ,`
	`  m2 .`
	`endinterface.`
	
	`class c1 definition.`
	`  public section.`
	`  interfaces : I1 final methods m2 .`
	`endclass.`
	
	`class c1 implementation.`
	`  method i1~m1.`
	`  write:/5 'I am m1 in c1'.`
	`  endmethod.`
	`  method i1~m2.`
	`  write:/5 'I am m2 in c1'.`
	`  endmethod.`
	`endclass.`
	
	`class c2 definition inheriting from c1.`
	`  public section.`
	`  methods : i1~m1 redefinition .`
	`endclass.`
	
	`class c2 implementation.`
	`  method : i1~m1.`
	`  write:/5 'I am m1 in c2'.`
	`  endmethod.`
	`endclass.`
	
	`start-of-selection.`
	`  data : oref1 type ref to c1,`
	`  oref2 type ref to c2 .`
	`  create object : oref1 , oref2.`
	`  call method : oref1->i1~m1 , " Output : I am m1 in c1`
	`  oref2->i1~m1 , " Output : I am m1 in c2`
	`  oref1->i1~m2 , " Output : I am m2 in c1`
	`  oref2->i1~m2 . " Output : I am m2 in c1`

Output	I am m1 in c1 I am m1 in c2 I am m2 in c1 I am m2 in c1

5.6 Use of Abstract methods from Interface	
Theme	This program will demonstrate the way by which a method from an interface can be used as an abstract method for a class. Abstract methods can only be implemented by the subclasses . A class containing an abstract method should be abstract itself.
Program Desc.	❖ This program contains an interface **I1** with two methods , **M1** and **M2**. ❖ Class **C1** includes and implements methods of interface **I1**, declaring method **M2** as an abstract method. Hence, class **C1** was also declared as an abstract class. ❖ Class **C1** implements method **I1~M1** , but not **I1~M2** as this is an abstract method. ❖ Class **C2** is a subclass of **C1** , which defines **I1~M2**. ❖ In the START-OF-SELECTION block,object **OREF2** is created from class **C2**(class C1 cannot be instantiated, as this is an abstract class) and both the methods : **I1~M1** and **I1~M2** are called.

Dump	`report ysubdel .`
	
	`interface i1 .`
	`  methods : m1 ,`
	`  m2 .`
	`endinterface.`
	
	`class c1 definition abstract.`
	`  public section.`
	`  interfaces : I1 abstract methods m2 .`
	`endclass.`
	
	`class c1 implementation.`
	`  method i1~m1.`
	`  write:/5 'I am m1 in c1'.`
	`  endmethod.`
	`endclass.`
	
	`class c2 definition inheriting from c1.`
	`  public section.`
	`  methods : i1~m2 redefinition.`
	`endclass.`
	
	`class c2 implementation.`
	`  method : i1~m2.`
	`  write:/5 'I am m2 in c2'.`
	`  endmethod.`
	`endclass.`
	
	`start-of-selection.`
	`  data : oref2 type ref to c2 .`
	`  create object : oref2.`
	`  call method : oref2->i1~m1 ,`
	`  oref2->i1~m2.`

Output	I am m1 in c1 I am m2 in c2

5.7 Use of Interface Reference Variable

Theme

This program will show the use of interface reference variable and how it can be used to access the components of an interface in a class(implementing that interface). Use of interface reference variable paves the way for polymorphism via interface.

Program Descrip.

Interface **I1** , included/ implemented in class **C1** has the following components:-

component	nature
C_name	Constant with value =ABAP
inum	Instance attribute with value = 5
cnum	Static attribute of value 6
M1	Instance method
M2	Static method

Class **C1** implements all the methods in its IMPLEMENTATION section.
In the START-OF-SELECTION block, all the different attributes and methods are called using class reference variable OREF first.
Then, interface reference variable IREF is used to do similar jobs, after the assignment IREF = OREF.

Dump

```
report ysubdel .
interface i1 .
 constants     : c_name(4) type c value 'ABAP'.
 data          : inum type i  .
 class-data    : cnum type i  .
 methods       : m1 .
 class-methods : m2.
endinterface.

 class c1 definition .
  public section.
   interfaces : I1 data values inum = 5 cnum = 6  .
 endclass.

 class c1 implementation.
  method i1~m1.
   write:/5 'I am m1 in c1'.
  endmethod.

  method i1~m2.
   write:/5 'I am class method m2 in c1'.
  endmethod.
 endclass.

 start-of-selection.
  data : iref type ref to i1 ,
         oref type ref to c1 .
   create object : oref.
   write:/5   oref->i1~inum ,
              oref->i1~cnum ,
              c1=>i1~cnum   .
   call method : oref->i1~m1 ,
                 oref->i1~m2 ,
                 c1=>i1~m2   .
   write:/5 sy-uline .
   iref = oref .
   write:/5   iref->inum ,
              iref->cnum ,
              i1=>c_name .
   call method : iref->m1 ,
```

	`iref->m2 .`
Output	5 6 6 I am m1 in c1 I am class method m2 in c1 I am class method m2 in c1 --- 5 6 ABAP I am m1 in c1 I am class method m2 in c1

5.8 Use of Nested Interface

Theme

This program will demonstrate how an interface can be included in another interface …. And the final interface containing all the interfaces can be used inside a class.

Program Descr.

- Interface **I1** contains method **M1**.
- Interface **I2** includes interface **I1**. However, it also contains two methods **M1** and **M2** of its own.
- Class **C1** contains interface **I2** and implements methods : **I1~M1** , **I2~M1** and **I2~M2**.
- Object is created from class **C1** and all the methods are called.

```
report ysubdel .
interface i1 .
 methods m1.
endinterface.

interface i2.
 methods : m1 , m2.
 interfaces i1.
endinterface.

 class c1 definition.
  public section.
   interfaces : i2.
 endclass.

 class c1 implementation.
  method : i1~m1.
   write:/5 'I am m1 from i1'.
  endmethod.

  method : i2~m1.
   write:/5 'I am m1 from i2'.
  endmethod.

  method : i2~m2.
   write:/5 'I am m2 from i2'.
  endmethod.
 endclass.

 START-OF-SELECTION.
  data : oref type ref to c1.
  create object oref.
  call method : oref->i1~m1  , " Output : I am m1 from i1
                oref->i2~m1  , " Output : I am m1 from i2
                oref->i2~m2  . " Output : I am m1 from i2
```

Output

I am m1 from i1
I am m1 from i2
I am m2 from i2

5.9 Using ALIASES

Theme	The full name of a component which an Interface adds to a class or another interface is intf~comp. Alias names can be substituted for this name when -defining compound interfaces, or -declaring Interfaces in a class
Program Descr.	Interface **I1** contains method **M1**. Interface **I2** contains method : **M1** and **M2** and interface **I1**. It aliases method **M1** of **I1** as **METH1**. Class **C1** contains interface **I2** and aliases method **M2** of **I2** as **METH2**. All the methods :- **I1~M1** , **I2~M1** and **I2~M2** are implemented in class **C1**. In the START-OF-SELECTION block, object **OREF** is created from class **C1** and the alias names are used to call the methods.

Dump	`report ysubdel .`
	`interface i1 .`
	`  methods m1.`
	`endinterface.`
	
	`interface i2.`
	`  methods : m1 , m2 .`
	`  interfaces i1.`
	`  aliases meth1 for i1~m1.`
	`endinterface.`
	
	`  class c1 definition.`
	`    public section.`
	`    interfaces :  i2.`
	`    aliases meth2 for i2~m2.`
	`  endclass.`
	
	`  class c1 implementation.`
	`   method i1~m1.`
	`    write:/5 'I am m1 from i1'.`
	`   endmethod.`
	
	`   method : i2~m1.`
	`    write:/5 'I am m1 from i2'.`
	`   endmethod.`
	
	`   method : i2~m2.`
	`    write:/5 'I am m2 from i2'.`
	`   endmethod.`
	
	`  endclass.`
	
	`  START-OF-SELECTION.`
	`   data : oref type ref to c1.`
	`   create object oref.`
	`   call method : oref->i2~meth1.`
	`   call method : oref->meth2 .`

Output	I am m1 from i1 I am m2 from i2

5.10 Polymorphism via Interfaces

Theme	This program will demonstrate how a method of an interface can be interpreted differently in different classes. At runtime, one can use different class reference variables to call same method of the interface to have different things done. Use of interface reference variable in this context further simplifies the work.
Program Descrip.	❖ Both the classes C1 and C2 , totally different from each other, contains interface I1. ❖ Interface I1 contains method M1 , which is implemented differently in C1 and C2. ❖ In the START-OF-SELECTION block, objects are created from class C1 and C2. An Interface reference variable IREF is also defined. ❖ By assigning the class reference variables(of C1 and C2 , one at a time) to interface reference variable IREF and then calling method M1 (using IREF) clearly demonstrates how polymorphism can be achieved using the concept of interface.
Dump	See code block below
Output	I am method m1 in c1 I am method m1 in c2

```
REPORT YSUBDEL.

interface I1.
 METHODS : M1 .
ENDINTERFACE.

 CLASS C1 DEFINITION.
  PUBLIC SECTION.
   INTERFACES : I1.
 ENDCLASS.

 CLASS C1 IMPLEMENTATION.
  METHOD I1~M1.
   WRITE:/5 'I am method m1 in c1'.
  ENDMETHOD.
 ENDCLASS.

 CLASS C2 DEFINITION.
  PUBLIC SECTION.
   INTERFACES : I1.
 ENDCLASS.

 CLASS C2 IMPLEMENTATION.
  METHOD I1~M1.
   WRITE:/5 'I am method m1 in c2'.
  ENDMETHOD.
 ENDCLASS.

START-OF-SELECTION.
 DATA : OREF1 TYPE REF TO C1 ,
        OREF2 TYPE REF TO C2 ,
        IREF TYPE REF TO I1 .
  CREATE OBJECT : OREF1 ,
                  OREF2 .
  IREF = OREF1.
  CALL METHOD IREF->M1.
  IREF = OREF2.
  CALL METHOD IREF->M1.
```

6 Friendship

6.1 Friendship between Classes

Theme

A class can grant friendship to another class. By granting friendship , it allows another class to:-

- Use its private components.
- Instantiate it, irrespective of the CREATE PRIVATE addition.

Program Descr.

- Class **C2** is created using CREATE PRIVATE option. That means, only the class itself and its friends can instantiate this class.
- Class **C2** has a private method **M2** and a private attribute , **NUM**. This means that these components can be accessed by class C2 itself and its friends.
- Now, **C2** has granted friendship to class C1.
- So, methods of class **C1** can access private components of **C2** as well as can instantiate class **C2**.

This establishes the theme.

Dump

```
REPORT YSUBDEL.

 CLASS C1 DEFINITION DEFERRED.

 CLASS C2 DEFINITION CREATE PRIVATE FRIENDS C1  .
  PROTECTED SECTION.
   DATA : NUM TYPE I VALUE 5.
   METHODS : M2.
 ENDCLASS.

 CLASS C2 IMPLEMENTATION.
  METHOD  M2.
   WRITE:/5 'I am method m2 in C2'.
  ENDMETHOD.
 ENDCLASS .

 class c1 definition.
  public section .
   methods : m1.
 endclass.

 class c1 implementation.
  method m1.
   DATA : OREF2 TYPE REF TO C2.
   CREATE OBJECT OREF2.
   WRITE:/5 OREF2->NUM.
   CALL METHOD OREF2->M2.
  ENDMETHOD.
 endclass.

 START-OF-SELECTION.
  DATA : OREF1 TYPE REF TO C1.
  CREATE OBJECT OREF1.
  CALL METHOD OREF1->M1.
```

Output

```
 5
I am method m2 in C2
```

6.2 Subclasses of friends can also become friends.	
Theme	Subclasses of the friend class are also friends of the class granting friendship(to their super classes)
Program Descrip.	❖ Class **C2** has granted friendship to class **C1**.Hence, C1 is friend of class C2. ❖ Class **C11** is a subclass of class **C1**. ❖ So, class **C11** is also a friend of class **C2**.Class **C11** can thus access the protected components of class **C2**. **This establishes the theme**.

	`REPORT YSUBDEL.`
	
	`CLASS C1 DEFINITION DEFERRED.`
	
	`CLASS C2 DEFINITION FRIENDS C1 .`
	`PROTECTED SECTION.`
	`DATA : NUM TYPE I VALUE 5.`
	`ENDCLASS.`
	
	`CLASS C2 IMPLEMENTATION.`
	`ENDCLASS .`
	
	`class c1 definition.`
	`public section .`
	`methods : m1.`
	`endclass.`
	
	`class c1 implementation.`
	`method m1.`
	`DATA : OREF2 TYPE REF TO C2.`
	`CREATE OBJECT OREF2.`
	`WRITE:/5 OREF2->NUM.`
	`ENDMETHOD.`
	`endclass.`
	
	`class c11 definition inheriting from c1.`
	`public section.`
	`methods : m11.`
	`endclass.`
	
	`class c11 implementation.`
	`method m11.`
	`DATA : OREF2 TYPE REF TO C2.`
	`CREATE OBJECT OREF2.`
	`WRITE:/5 OREF2->NUM.`
	`endmethod.`
	`endclass.`
	
	`START-OF-SELECTION.`
	`DATA : OREF11 TYPE REF TO C11.`
	`CREATE OBJECT OREF11.`
	`CALL METHOD OREF11->M11.`

Output	5

6.3 Friendship is one sided

Theme	In principle, granting of friendship is one-sided: A class granting a friendship is not automatically a friend of its friends. If the class granting the friendship wants to access the private components of a friend, then the latter has to explicitly grant friendship to the former.
Program Descr.	Class **C2** grants friendship to class **C1**. Hence, class **C**1 can access protected attribute(num2) of **C2** . But, class **C2** cannot access protected attribute(**num1**) of class **C1**. This is because friendship is one-sided. To allow **C2** access protected attribute of **C1**, class C1 must also declare C2 as its friend.

```
REPORT YSUBDEL.

 CLASS C1 DEFINITION DEFERRED.

 CLASS C2 DEFINITION FRIENDS C1
.
  PROTECTED SECTION.
   DATA : NUM2 TYPE I VALUE 15.
   METHODS : M2.
 ENDCLASS.

class c1 definition    .
 public section.
  methods : methpub.
  private section .
   data : num1 type i value 10 .
   methods : m1.
 endclass.

 CLASS C2 IMPLEMENTATION.
  METHOD M2.
   data : oref1 type ref to c1.
    create object oref1.
    write:/5 oref1->num1.
  ENDMETHOD.
 ENDCLASS .

 class c1 implementation.
  method m1.
   DATA : OREF2 TYPE REF TO C2.
   CREATE OBJECT OREF2.
   WRITE:/5 OREF2->NUM2.
  ENDMETHOD.

  method methpub.
   call method m1.
  endmethod.
 endclass.

 START-OF-SELECTION.
  DATA : OREF  TYPE REF TO C1.
  CREATE OBJECT OREF .
  CALL METHOD OREF ->METHPUB.
```

Incorrect

```
REPORT YSUBDEL.

 CLASS C1 DEFINITION DEFERRED.

 CLASS C2 DEFINITION FRIENDS C1
.
  PROTECTED SECTION.
   DATA : NUM2 TYPE I VALUE 15.
   METHODS : M2.
 ENDCLASS.

class c1 definition friends c2.
 public section.
  methods : methpub.
  private section .
   data : num1 type i value 10 .
   methods : m1.
 endclass.

 CLASS C2 IMPLEMENTATION.
  METHOD M2.
   data : oref1 type ref to c1.
    create object oref1.
    write:/5 oref1->num1.
  ENDMETHOD.
 ENDCLASS .

 class c1 implementation.
  method m1.
   DATA : OREF2 TYPE REF TO C2.
   CREATE OBJECT OREF2.
   WRITE:/5 OREF2->NUM2.
  ENDMETHOD.

  method methpub.
   call method m1.
  endmethod.
 endclass.

 START-OF-SELECTION.
  DATA : OREF  TYPE REF TO C1.
  CREATE OBJECT OREF .
  CALL METHOD OREF ->METHPUB.
```

Correct

Output	15

7 Events

7.1 Events with Handler Method in the same class	
Theme	Event is a mechanism by which method of one class can raise method of another class, without the hazard of instantiating that class . The steps to be followed are as follows:- ❖ Create an event in a class ❖ Create a triggering method in the same class which will raise the event. ❖ Create an event handler method for the event in same/other class. ❖ Register the event handler method in the program. Now, your settings are complete. Create an object from the class containing the event and call the triggering method to raise the event.
Program Descr.	Class **C1** contains an event **E1**, for which the triggering method is **T1**. Event handler method for event **E1** is **M1**, placed in the same class **C1**. Registration is done at runtime for M1. Object is created from class **C1** and the triggering method **T1** is called, which raises the event and ultimately calls event handler method **M1**.

Dump	`REPORT YSUBOOPS7 .`
	
	`CLASS c1 DEFINITION.`
	`PUBLIC SECTION.`
	`*(1)Creating event : E1`
	`EVENTS: E1.`
	`*(2) Creating an event handling method. This method can belong to`
	`* same or different class`
	`METHODS: M1 FOR EVENT E1 OF c1.`
	`* Method to raise the event`
	`METHODS : T1.`
	`ENDCLASS.`
	
	`CLASS c1 IMPLEMENTATION.`
	`* Method : M1 will be called when the event is raised`
	`METHOD : M1.`
	`write:/5 ' I am the event handler method'.`
	`ENDMETHOD.`
	`* Method : T1 will raise the event`
	`METHOD : T1.`
	`write:/5 'I am T1, going to raise event E1'.`
	`raise event E1.`
	`ENDMETHOD.`
	`ENDCLASS.`
	
	`Start-of-selection.`
	`Data: oref type ref to c1.`
	`Create object: oref .`
	`* Registering the event handler method`
	`SET HANDLER oref->M1 FOR oref .`
	`* Calling the event which will raise the event.`
	`call method oref->T1.`

Output	I am T1, going to raise event E1 I am the event handler method

7.2 Event with event handler method in different class	
Theme	Similar to above. Here, event handler method is in different class
	Class **C1** contains an event **E1**, for which the triggering method is **T1**. Event handler method for event **E1** is **M1**, placed in the another class,**C2**. Registration is done at runtime for **M1**. Object is created from class **C1** and the triggering method **T1** is called, which raises the event and ultimately calls event handler method **M1** in class **C2**.
Dump	
Output	I am T1, going to raise event E1 I am the event handler method in c2

```
REPORT  YSUBOOPS7                                          .

CLASS c1 DEFINITION.
PUBLIC SECTION.
* Creating event : E1
EVENTS: E1.
* Triggering method : T1
METHODS : T1.
ENDCLASS.

CLASS C2 DEFINITION.
 PUBLIC SECTION.
*  Creating an event handling method.
METHODS: M1 FOR EVENT E1 OF  c1.
endclass.

CLASS c1 IMPLEMENTATION.
* Method : T1 will raise the event
 METHOD : T1.
  write:/5 'I am T1, going to raise event E1'.
  raise event E1.
 ENDMETHOD.
ENDCLASS.

class c2 implementation.
* Method : M1 will be called when the event is raised
METHOD : M1.
   write:/5 ' I am the event handler method in c2'.
 ENDMETHOD.
endclass.

Start-of-selection.
Data: oref1 type ref to c1,
      oref2 type ref to c2.
Create object: oref1 , oref2  .
* Registering the event handler method
SET HANDLER oref2->M1 FOR oref1  .
* Calling the event which will raise the event.
  call method oref1->T1.
```

7.3 More than one event handler method can exist for same event	
Theme	For an event in a class, there can be more than one event handler methods in same or different class. However, at runtime only one event handler method will be triggered at a time, based on the registration.
Program Descr.	❖ Class **C1** contains an event **E1**, for which the triggering method is **T1** and the event handler methods are :- ➢ **M1** in same class **C1**. ➢ **M2** in another class **C2**. ❖ In the START-OF-SELECTION block, objects are created from class **C1** and **C2**. ❖ First, registration is made using method **M1** of class **C1** as event handler method. ❖ Then, the event **E1** is raised, calling method **T1**. This raises event handler method **M1** of class **C1**. ❖ After that, the earlier registration is de-activated and new registration is made for method **M2** of class **C2** as event handler method . ❖ Event **E1** is raised calling method **T1**. This raises event handler method **M2** of class **C2**.
Dump	

```
REPORT  YSUBOOPS7                                          .

CLASS c1 DEFINITION.
PUBLIC SECTION.
* Creating event : E1
EVENTS: E1.
*  Creating an event handling method.
METHODS: M1 FOR EVENT E1 OF  c1.
* Method to raise the event
METHODS : T1.
ENDCLASS.

CLASS C2 DEFINITION.
 PUBLIC SECTION.
*  Creating an event handling method.
METHODS: M2 FOR EVENT E1 OF  c1.
endclass.

CLASS c1 IMPLEMENTATION.
* Method : T1 will raise the event
 METHOD : T1.
  write:/5 'I am T1, going to raise event E1'.
  raise event E1.
 ENDMETHOD.
* Method : M1 will be called when the event is raised
METHOD : M1.
   write:/5 ' I am the event handler method M1 in c1'.
 ENDMETHOD.
ENDCLASS.

class c2 implementation.
* Method : M2 will be called when the event is raised
METHOD : M2.
   write:/5 ' I am the event handler method M2 in c2'.
 ENDMETHOD.
endclass.

Start-of-selection.
Data: oref1 type ref to c1,
```

	oref2 type ref to c2. Create object: oref1 , oref2 . * Registering the event handler method SET HANDLER oref1->M1 FOR oref1 . * Calling the event which will raise the event. call method oref1->T1. * De-Registering the earlier event handler method SET HANDLER oref1->M1 FOR oref1 ACTIVATION space . * Registering the new event handler method SET HANDLER oref2->M2 FOR oref1 . * Calling the event which will raise the event. call method oref1->T1.
Output	I am T1, going to raise event E1 I am the event handler method M1 in c1 I am T1, going to raise event E1 I am the event handler method M2 in c2

7.4 Use of static event	
Theme	Static methods can only raise static events. The FOR…addition is not required to register for static events.
Program	Class **C1** contains a static event **E1** and static triggering method **T1**. The event handler method **M1** is in class **C1** itself. At the time of registering event **M1** as event handler method, the **FOR**…addition is omitted.

Dump	`REPORT YSUBOOPS7 .`
	
	`CLASS c1 DEFINITION.`
	`PUBLIC SECTION.`
	`* Creating event : E1`
	`CLASS-EVENTS: E1.`
	`* Creating an event handling method.`
	`METHODS: M1 FOR EVENT E1 OF c1.`
	`* Method to raise the event`
	`CLASS-METHODS : T1.`
	`ENDCLASS.`
	
	`CLASS c1 IMPLEMENTATION.`
	`* Method : T1 will raise the event`
	`METHOD : T1.`
	`write:/5 'I am T1, going to raise event E1'.`
	`raise event E1.`
	`ENDMETHOD.`
	`* Method : M1 will be called when the event is raised`
	`METHOD : M1.`
	`write:/5 ' I am the event handler method M1 in c1'.`
	`ENDMETHOD.`
	`ENDCLASS.`
	
	`Start-of-selection.`
	`Data: oref1 type ref to c1.`
	`Create object: oref1 .`
	`* Registering the event handler method`
	`SET HANDLER oref1->M1 .`
	`* Calling the event which will raise the event.`
	`call method oref1->T1.`

Output	I am T1, going to raise event E1 I am the event handler method M1 in c1

7.5 Events with export parameters	
Theme	Events can have export parameters, which it passes to its event handler method. The triggering method must pass values for all the exporting parameters of the event while raising the event using RAISE EVENT statement. The interface of an event handler method consists of a list of **IMPORTING** parameters, whose names are identical with those in the EXPORTING list and which are automatically created from the interface of the event. Each handler method can however specify which event parameters it wants to handle and which it does not.
Program Descr.	Class **C1** contains event E1 which exports two parameters , **NUM1** and **NUM2** to its event handler method , **M1** in class **C1**. Method **T1** is the triggering method for the event, which passes values to the EXPORTING parameters of the event at the time of **RAISE EVENT** statement.

Dump	`REPORT YSUBDEL1.`
	
	`CLASS c1 DEFINITION.`
	`PUBLIC SECTION.`
	`EVENTS : E1 EXPORTING value(NUM1) TYPE I`
	`value(NUM2) TYPE I.`
	
	`METHODS : M1 FOR EVENT E1 OF C1`
	`IMPORTING NUM1`
	`NUM2`
	`.`
	`METHODS : T1.`
	`ENDCLASS.`
	
	`CLASS C1 IMPLEMENTATION.`
	`METHOD : M1.`
	`WRITE:/5 'First input ' , num1 .`
	`write:/5 'Second input ' , num2 .`
	`ENDMETHOD.`
	
	`METHOD T1.`
	`RAISE EVENT E1 exporting num1 = 2`
	`num2 = 3.`
	`ENDMETHOD.`
	`ENDCLASS.`
	
	`START-OF-SELECTION.`
	`DATA : oref TYPE REF TO c1.`
	`CREATE OBJECT oref.`
	`SET HANDLER oref->M1 for oref.`
	`call method oref->T1.`

Output	First input 2 Second input 3

8 Class-Based Exceptions

8.1 Using SAP provided exception class

Theme	Errors in a program, which are detected at runtime and can be trapped, can be dealt with using SAP provided standard exception-classes.
Program Descr.	This program makes a runtime error where a division by zero is observed. Let us take three different versions of the program and see the outputs

Ver.No	Program	Output
1	REPORT YSUBCLASS_EXCEPTION. DATA: i TYPE i VALUE 1. START-OF-SELECTION. **i = i / 0**.	Short Dump as follows:- Runtime errors **COMPUTE_INT_ZERODIVIDE** Exception **CX_SY_ZERODIVIDE** Occurred on 12.04.2004 at 17:02:18 Divide by 0 (type 1).
2	REPORT YSUBCLASS_EXCEPTION. DATA: i TYPE i VALUE 1. START-OF-SELECTION. catch system-exceptions COMPUTE_INT_ZERODIVIDE = 2. **i = i / 0.** endcatch. if sy-subrc = 2. write:/5 'Division by zero!!!Check'. endif.	'Division by zero!!!Check
3	REPORT YSUBCLASS_EXCEPTION. DATA: i TYPE i VALUE 1. START-OF-SELECTION. **TRY.** **i = i / 0.** **CATCH** cx_sy_zerodivide. write:/5 'Divide by zero caught'. **ENDTRY.**	Divide by zero caught

The three versions basically represent the same program, but shows how an error can be trapped using SAP provided standard exception class.

8.2 When both superclass and subclass are used to track error

Theme

SAP provided standard exception classes can reside in different levels of hierarchy tree; **CX_ROOT** being at the top. So, if both superclass and its subclass are used in a program to detect errors in TRY…ENDTRY block, the subclass should be used first, then the superclass.

Program Descr.

This program creates a division by zero problem. Here, both the superclass CX_ROOT and subclass CX_SY_ZERODIVIDE is used to trap errors.

In version 1, superclass is used first to trap the error- which creates a compilation error.
In version 2, subclass is used first – which gets compiled and executed successfully.

Dump

Version	Code	Output

1	`REPORT YSUBCLASS_EXCEPTION.`
	
	`DATA: i TYPE i VALUE 1.`
	
	`START-OF-SELECTION.`
	`TRY.`
	`i = i / 0.`
	`CATCH cx_root.`
	`write:/5 'Error trapped'.`
	`CATCH cx_sy_zerodivide.`
	`write:/5 'Div. by zero!'.`
	`ENDTRY.`
		Compilation error :- Exception in the CATCH clauses are not sorted in ascending order

2	`REPORT YSUBCLASS_EXCEPTION.`
	
	`DATA: i TYPE i VALUE 1.`
	
	`START-OF-SELECTION.`
	`TRY.`
	`i = i / 0.`
	`CATCH cx_sy_zerodivide.`
	`write:/5 'Div. by zero!'.`
	`CATCH cx_root.`
	`write:/5 'Error trapped'.`
	`ENDTRY.`
		Div. by zero!

8.3 Propagation of Class-Based exceptions in procedures to the caller	
Theme	Class-based exceptions in procedures can be propagated to the caller in the definition of the interface using the RAISING addition, if the exception is not to be handled in the procedure.
Program Descr.	In the following program, the piece of code which may contain error is inside a subroutine , SUB_CHECK_NO. But, the error is not handled in the procedure itself. So, a RAISING statement (with probable class-based exception that might be raised by the procedure) is specified at the definition of the procedure itself, and is later trapped using CATCH statement.

	`REPORT YSUBOOPS17 .`
	
	`start-of-selection.`
	
	`try.`
	`perform sub_check_no using 5 .`
	`catch cx_sy_zerodivide.`
	`write:/5 'Hello' .`
	`endtry.`
	
	`FORM sub_check_no USING P_P_NO`
	`RAISING CX_SY_ZERODIVIDE.`
	`p_p_no = p_p_no / 0 .`
	
	`ENDFORM. " sub_check_no`

Output	Hello

8.4 Program can raise exceptions based on SAP standard exception-classes	
Theme	The runtime environment only causes exceptions that are based on pre-defined classes, while in ABAP programs one can use raise pre-defined as well as user-specific exception classes.
Program Descr.	This program will show how exceptions based on SAP provided exception classes can be manually raised. Here, exception based on SAP exception-class CX_SY_ZERODIVIDE is raised manually.

Dump	`REPORT YSUBOOPS17 .`
	`data : inum type i .`
	
	`try.`
	`raise exception type cx_sy_zerodivide.`
	`CATCH cx_sy_zerodivide.`
	`write:/5 'Exception caught'.`
	`endtry.`

Output	Exception caught

8.5 Objects are created from exception classes when error is trapped	
Theme	When a class-based exception is trapped using TRY…CATCH…ENDTRY statement, objects are created from the exception class. One can create the object using CATCH <exception name> INTO <exception class reference variable> statement. CX_ROOT is at the top of the inheritance tree for all SAP provided exception class and have some pre-defined methods available, which are adopted by all exception-classes.
Program Descr.	The program involves a division by zero error in the guarded section, which raises an exception on exception-class : CX_SY_ZERODIVIDE. A reference variable , EREF with static type referring to the exception class CX_SY_ZERODIVIDE is used to create an object while using the CATCH statement. Once the object is created, it can be used to manipulate some of the methods and attributes of the class CX_SY_ZERODIVIDE, which has been inherited by this class from CX_ROOT.

Dump	`REPORT YSUBOOPS17 .`
	`data : inum type i value 5 ,`
	`descrip type string ,`
	`progname like sy-repid ,`
	`lineno type i .`
	
	`data : eref type ref to cx_sy_zerodivide.`
	
	`try.`
	`inum = inum / 0.`
	`CATCH cx_sy_zerodivide into eref.`
	`* Utilizing methods/attributes using object of the exception classes`
	`call method eref->get_text`
	`receiving result = descrip.`
	`write:/5 'Name of the error trapped : ' , descrip.`
	
	`call method eref->get_source_position`
	`importing program_name = progname`
	`source_line = lineno .`
	`write:/5 'Error detected in program' ,`
	`progname(15) ,`
	`'line number' ,`
	`lineno.`
	`write:/5 eref->kernel_errid.`
	`endtry.`

Output	Name of the error trapped : Division by zero Error detected in program YSUBDEL line number 10 COMPUTE_INT_ZERODIVIDE

8.6 Demo on Locally Defined Exception-Class	
Theme	One can create his own exception-class locally in a program and raise exceptions related to his own class. This program will show how to do that.
Program Descrip.	In this program, an exception class **CX_MY_EXCEPTION** is defined locally, inheriting from standard exception class CX_STATIC_CHECK. Method **M**1 of class **C1** raises it in the START-OF-SELECTION block, in the guarded section(between TRY.. and CHECK), which is trapped and dealt with.

Dump	`REPORT YSUBCLASS_EXCEPTION_3.`
	
	`CLASS cx_my_exception DEFINITION`
	`  INHERITING FROM CX_STATIC_CHECK.`
	`ENDCLASS.`
	
	`CLASS cx_my_exception IMPLEMENTATION.`
	`ENDCLASS.`
	
	`CLASS C1 DEFINITION.`
	`  PUBLIC SECTION.`
	`  METHODS: m1 raising cx_my_exception .`
	`ENDCLASS.`
	
	`CLASS c1 IMPLEMENTATION.`
	`  METHOD m1.`
	`  RAISE EXCEPTION TYPE cx_my_exception.`
	`  ENDMETHOD.`
	`ENDCLASS.`
	
	`DATA: ex TYPE REF TO cx_my_exception,`
	`  oref TYPE REF TO c1.`
	
	`START-OF-SELECTION.`
	` TRY.`
	`  CREATE OBJECT oref.`
	`  oref->m1( ).`
	`  CATCH cx_my_exception INTO ex.`
	`  write:/5 'My Exception caught'.`
	
	` ENDTRY.`

Output	My exception caught

8.7 Nested TRY…ENDTRY block	
Theme	Try…Endtry blocks can be nested. The inner Try…endtry block can be in the guraded section of outer Try…Endtry block.
Program Descr.	The program shown below uses one nested try…endtry statement. For the inner block, the error for division by zero is properly caught from the system provided exception-class : CX_SY_ZERODIVIDE. But, there is a character to integer conversion statement specified in the inner block, which creates an error of exception class CX_SY_CONVERSION_ NO_NUMBER trapped by the outer Try…Endtry block.

	`REPORT YSUBCLASS_EXCEPTION_3.`
	
	`START-OF-SELECTION.`
	
	`DATA : num type i value 5 .`
	
	`TRY.`
	`  TRY.`
	`  NUM = NUM / 0.`
	`  CATCH cx_sy_ZERODIVIDE .`
	`  WRITE:/5 'Division by 0 caught'.`
	`  NUM = 'SUBHENDU'.`
	`  ENDTRY.`
	`  CATCH cx_sy_conversion_no_number.`
	`  WRITE:/5 'Cannot be converted to number'.`
	`ENDTRY.`

Output	Division by 0 caught Cannot be converted to number

8.8 Use of CLEANUP section	
Theme	Clean up block is executed whenever an exception occurs within the TRY block and is not handled by a CATCH within the same TRY block, but is handled by an surrounding TRY block
Program Descr.	This program uses a nested TRY…ENDTRY statement. In the inner block, there is an attempt to character-to-integer conversion, which raises an error of exception-class : CX_SY_CONVERSION_NO_NUMBER. But, the inner TRY block does not trap the error – rather, it is trapped by the outer TRY…ENDTRY block. Under such circumstances, the CLEANUP section of the inner block gets executed first – then the CATCH section of the outer block works.

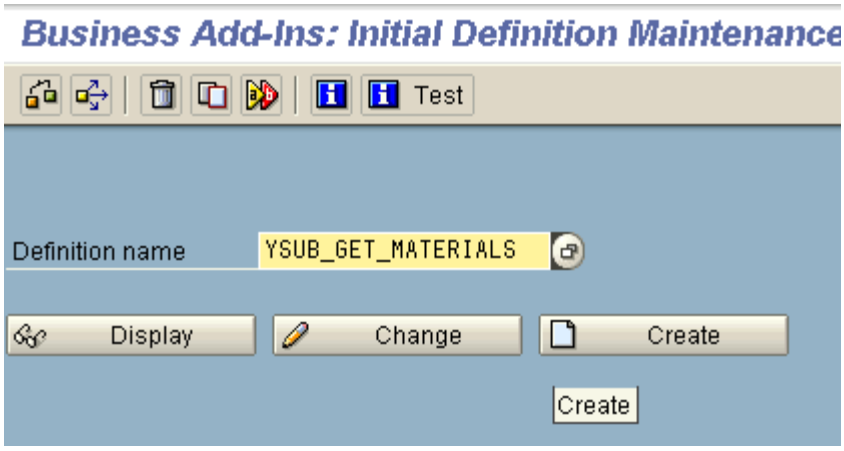
Dump	`REPORT YSUBCLASS_EXCEPTION_3.`
	
	`START-OF-SELECTION.`
	
	`DATA : num type i value 5 .`
	
	`TRY.`
	`  TRY.`
	`  num = 'subhendu'.`
	`  cleanup.`
	`  write:/5 'In cleanup'.`
	`  ENDTRY.`
	`  CATCH cx_sy_conversion_no_number.`
	`  WRITE:/5 'Cannot be converted to number'.`
	`ENDTRY.`

Output	In cleanup Cannot be converted to number

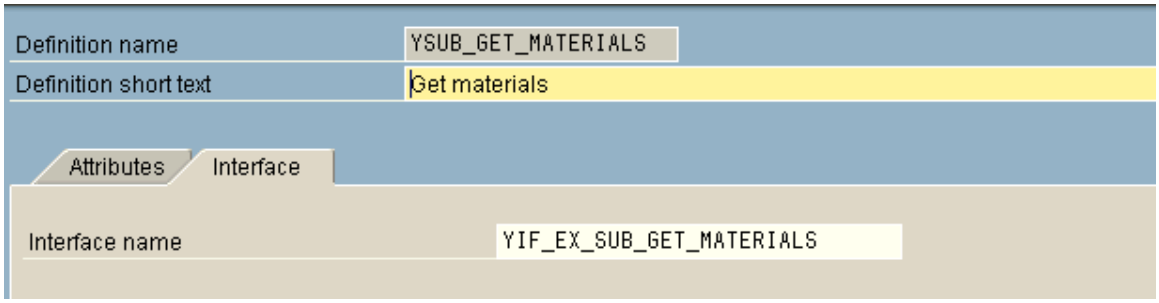
9 BADIs (Business Add-Ins)

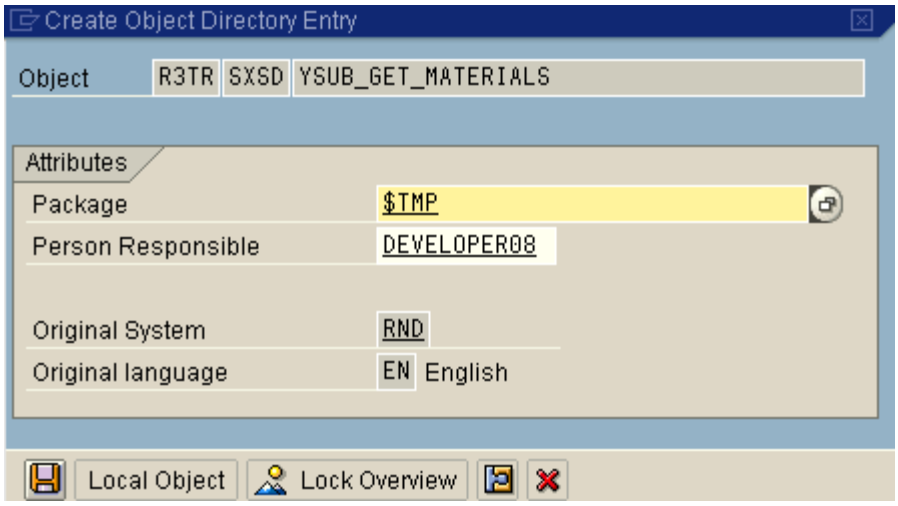
9.1 Single Implementation of BADI

Go to transaction SE18 and create a BADI Definition.

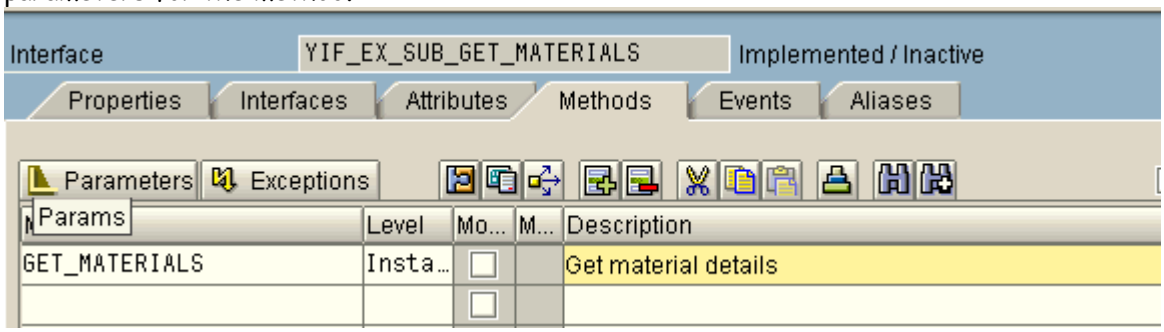


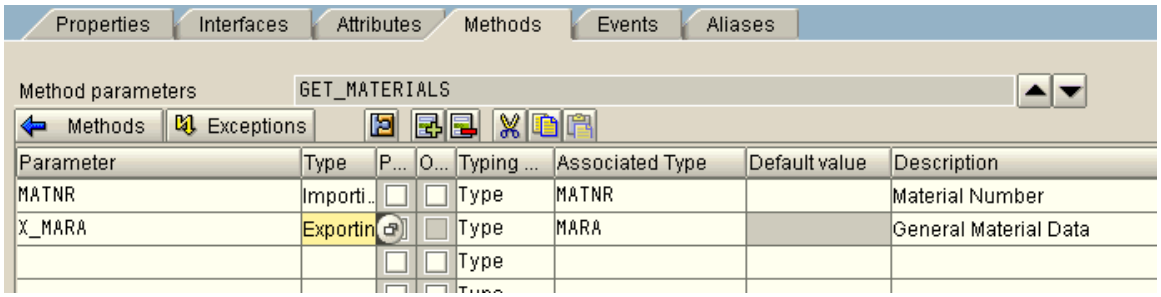
Enter the description. The name of the interface will be automatically proposed. Double click on it.





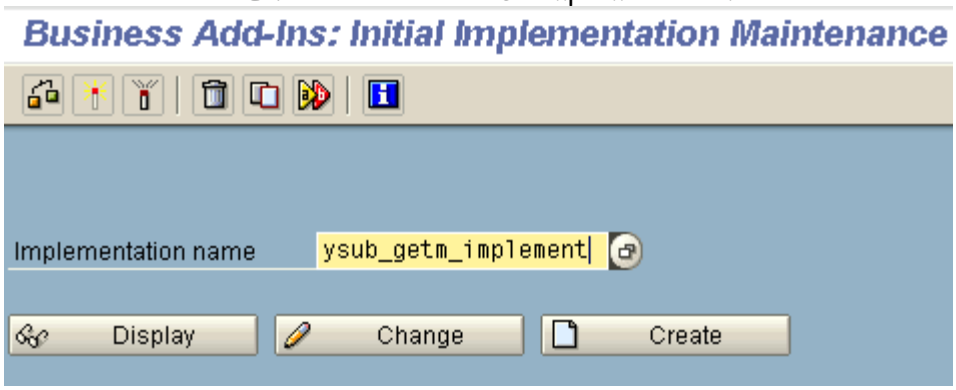
Enter the name of the method you want to create. Click the Paramters pushbutton to create parameters for the method.



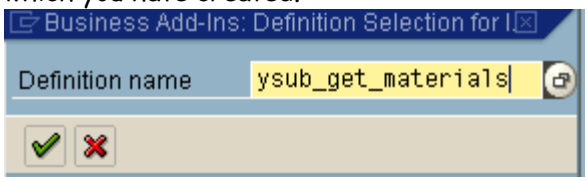


Save and activate it.

Go to transaction SE19 and create a BADI implementation.

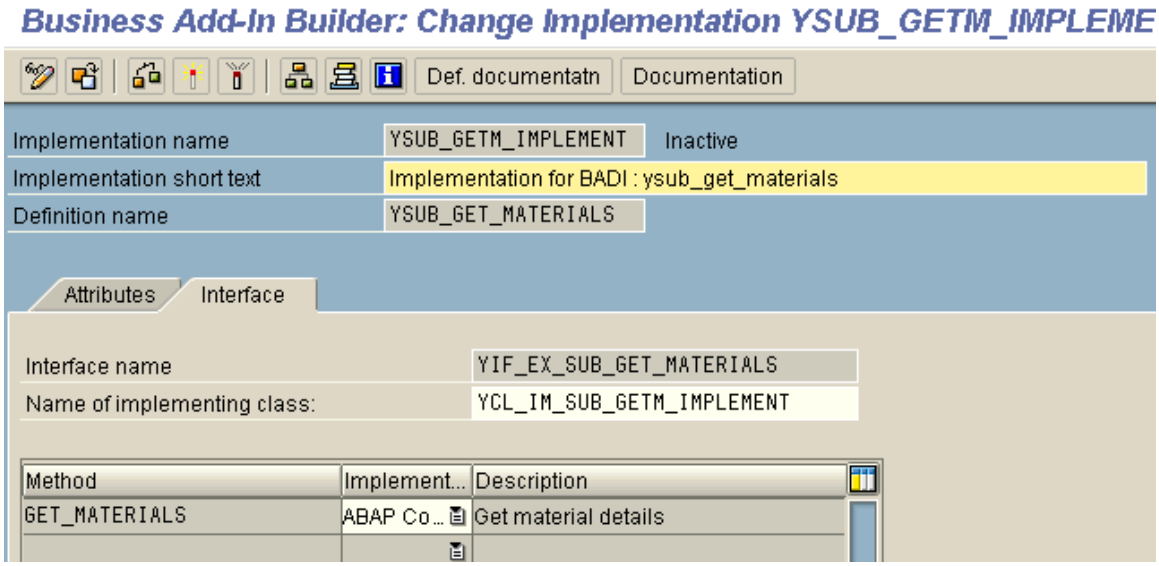


A popup window will ask you for the definition name. Enter the name of the BADI definition which you have created.

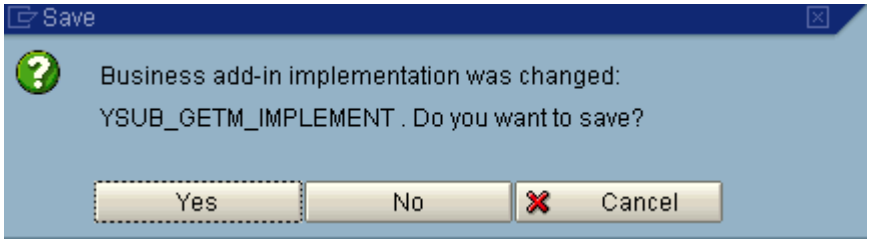


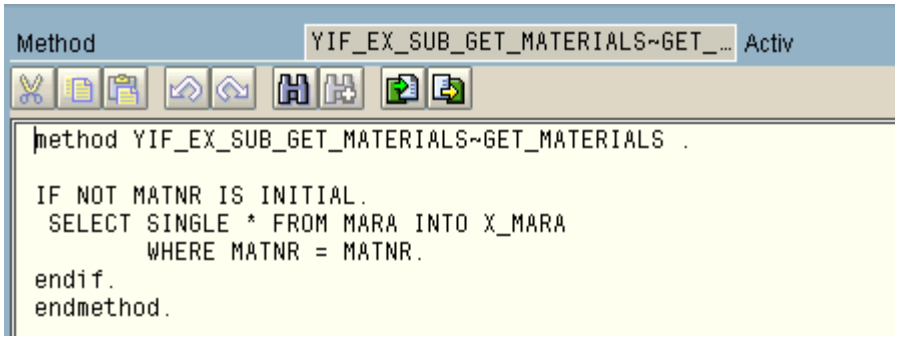
Press Enter.

Enter the description for the implementation. Then save and activate it.



Double click on the method name.





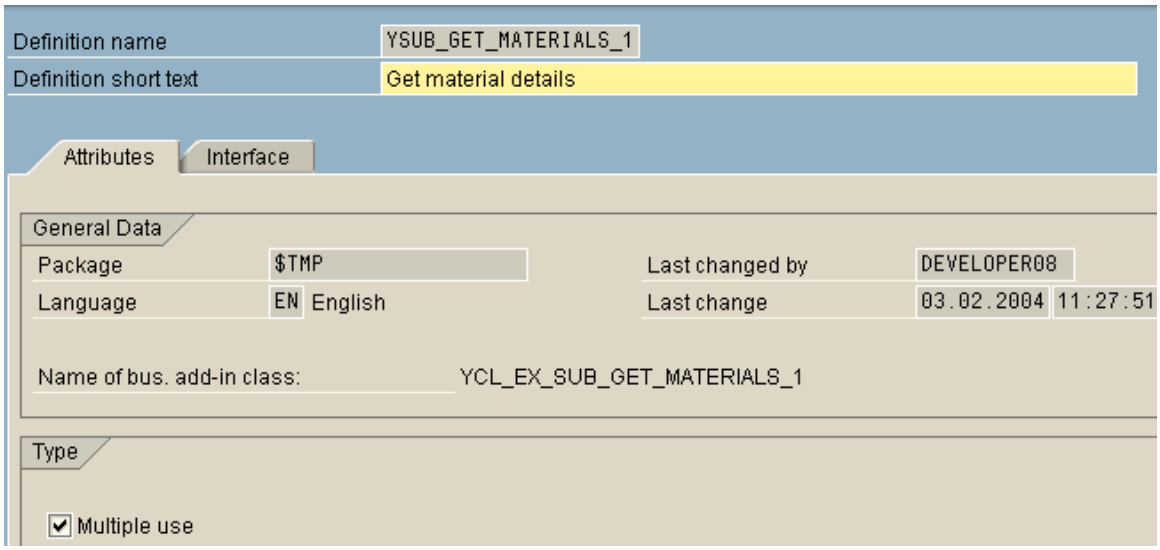
Write the code. Save and activate it.

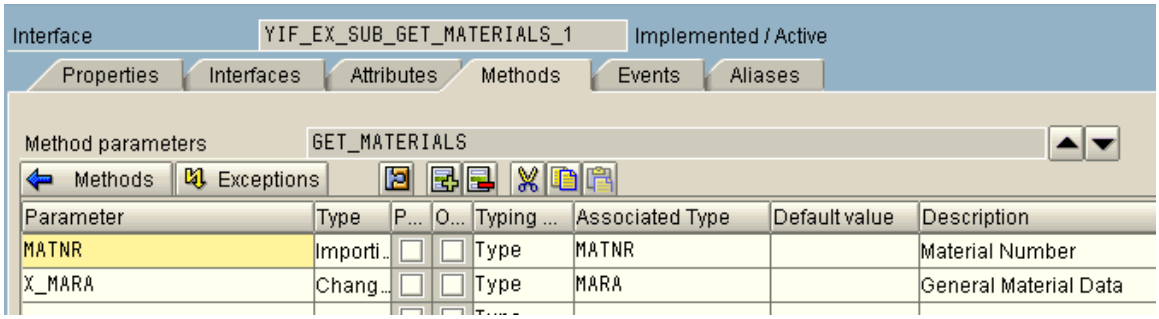
Then, create a code using the BADI

```
REPORT  YSUB_GET_MATERIALS_PROGRAM.

  CLASS cl_exithandler DEFINITION LOAD.
  DATA : L_BADI_INSTANCE TYPE REF TO YIF_EX_SUB_GET_MATERIALS.
  DATA : X_MARA LIKE MARA.

  PARAMETERS : P_MATNR LIKE MARA-MATNR OBLIGATORY.

  START-OF-SELECTION.

  CALL METHOD CL_EXITHANDLER=>GET_INSTANCE
       EXPORTING EXIT_NAME = 'YSUB_GET_MATERIALS'
                 NULL_INSTANCE_ACCEPTED = 'X'
       CHANGING INSTANCE = L_BADI_INSTANCE.

   CALL METHOD  L_BADI_INSTANCE->GET_MATERIALS
         EXPORTING MATNR = P_MATNR
        IMPORTING X_MARA = X_MARA.

         WRITE:/5 X_MARA-MATNR ,
                  X_MARA-MATKL ,
                  X_MARA-MEINS .
```

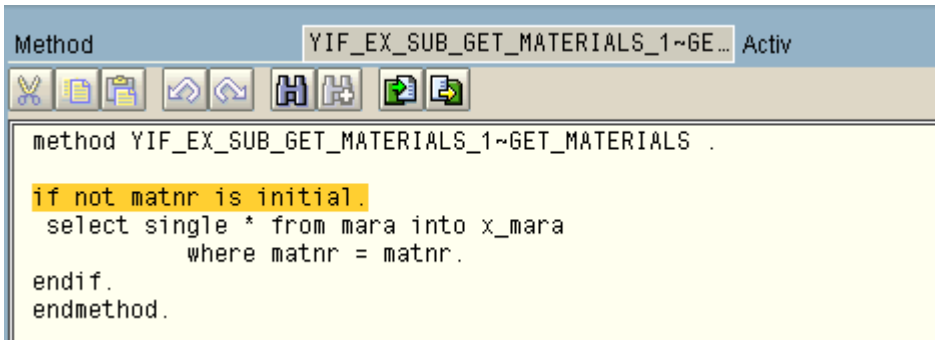
9.2 Multiple Implementation

Create a BADI: YSUB_GET_MATERIALS_1 in a manner similar to that created above. But, check the checkbox for Multiple Use





Then, create one implementations for the same BADI:-

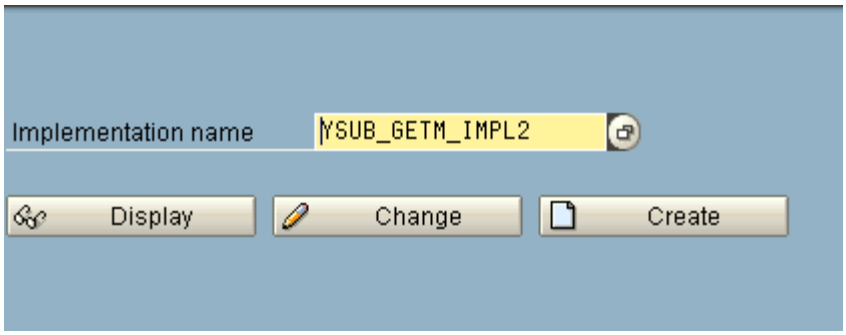


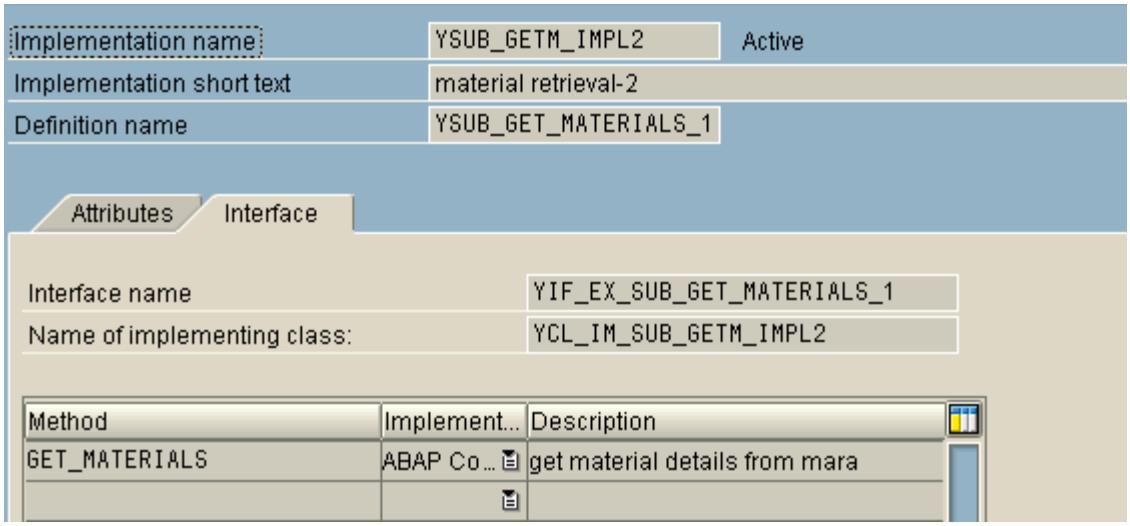
(Code is similar to the previous one)

Then, create a program utilizing the BADI:-

```
REPORT  YSUB_GET_MATERIALS_PROGRAM_1.

  CLASS cl_exithandler DEFINITION LOAD.
  DATA : L_BADI_INSTANCE TYPE REF TO YIF_EX_SUB_GET_MATERIALS_1.
  DATA : X_MARA LIKE MARA.

  PARAMETERS : P_MATNR LIKE MARA-MATNR OBLIGATORY.

  START-OF-SELECTION.

  CALL METHOD CL_EXITHANDLER=>GET_INSTANCE
       EXPORTING EXIT_NAME = 'YSUB_GET_MATERIALS_1'
                 NULL_INSTANCE_ACCEPTED = 'X'
       CHANGING INSTANCE = L_BADI_INSTANCE.

   CALL METHOD  L_BADI_INSTANCE->GET_MATERIALS
         EXPORTING MATNR = P_MATNR
         CHANGING  X_MARA = X_MARA.

        WRITE:/5 X_MARA-MATNR ,
                 X_MARA-MATKL ,
                 X_MARA-MEINS .
```

Now, you want to create another implementation of the same BADI. Let us examplify the concept. Say, you want that when the user will enter 'GARI' in the selectiuon-screen, it will stand for 'CAR' internally and selection will be done out of MARA table based on material code : 'CAR'. O, you define another implementation of the same BADI from transaction : SE19.





```
method YIF_EX_SUB_GET_MATERIALS_1~GET_MATERIALS .
  data : l_matnr type matnr.
   l_matnr = matnr.
   if l_matnr = 'GARI'.
     l_matnr = 'CAR'.
   endif.

   select single * from mara into x_mara
    where matnr = l_matnr.

endmethod.
```

Now, when you will execute the program and enter 'GARI' in the material code field in the selection-screen, it will get internally translated to 'CAR' when the second implementation will be active.

9.3 Searching for BADI in SAP Transaction and Implementing it

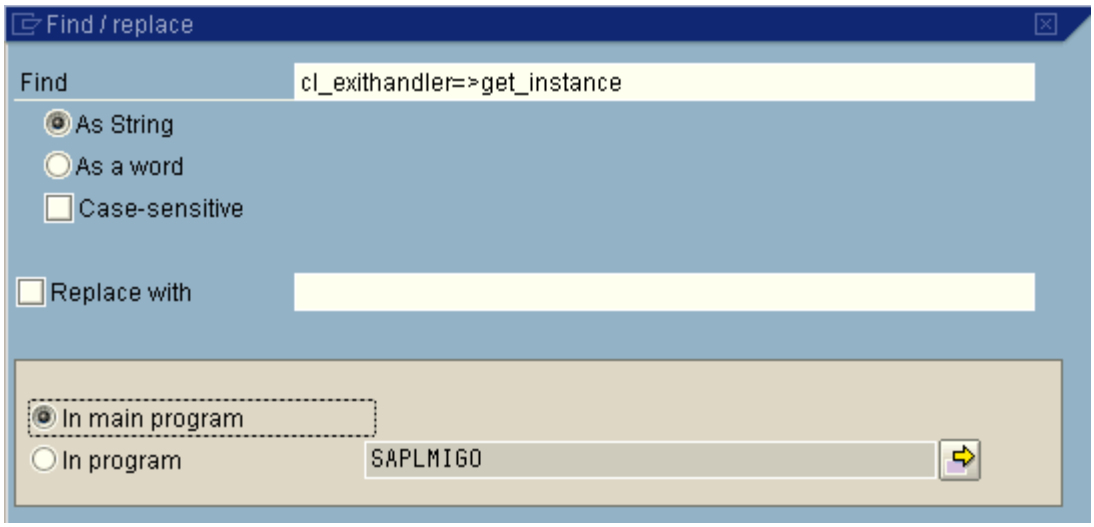
There is a business demand in ABC corporation . when the user will post goods receipt via transaction MIGO, he should enter same date in document date and posting date field. Else, an information message will ask the user to do that.

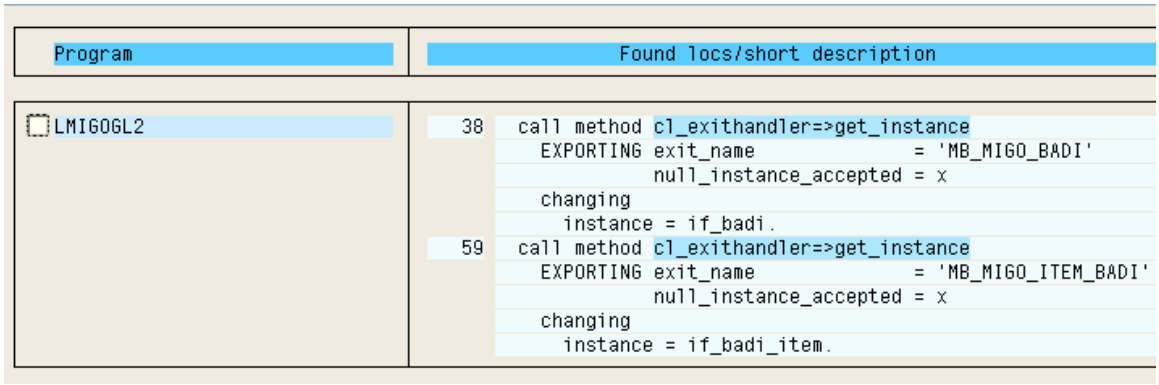
The Bill of Lading number should start with 'NP'

You, as a SAP Technical Consultant, is asked to translate this idea into the appropriate section of the code.

Your manager has asked you to use BADI instead of any user or field exits to implement the idea.

Go to the program behing MIGO and search for the phrase : CL_EXITHANDLER=>GET_INSTANCE in the main program. This will show you the BADIs which can be implemented by you to incorporate the business demand.





So, you get to know now that there are two BADIs which can come to your use. They are: MB_MIGO_BADI

MB_MIGO_ITEM_BADI.

Now, you have to go to transaction SE18 and explore each of the BADIs to find out the suitable one. In fact, the suitable one will have a method in it for which import/export parameters should have some reference to document/posting dates.

On investigation, you will find that in BADI : MB_MIGO_ITEM_BADI, there is a method : ITEM_MODIFY which uses : is_gohead as import parameter. This has the structure GOHEAD which contains the fields for document and posting date as columns.

Now, you will implement this BADI. Go to transaction SE19 and create an implementation for the BADI. In the code for the method, write the following:-

---

```
method IF_EX_MB_MIGO_ITEM_BADI~ITEM_MODIFY .

DATA : L_INI(2) TYPE C.

IF is_gohead-bldat ne is_gohead-budat.
 message i398(00) with 'Both posting and document dates should be same'.
ENDIF.

L_INI = IS_GOHEAD-FRBNR+0(2).
TRANSLATE L_INI TO UPPER CASE.
IF L_INI NE 'NP'.
 MESSAGE I398(00) WITH 'Bill of Lading should start with NP'.
ENDIF.

endmethod.
```

Then, save and activate it. Then, perform a transaction via MIGO. Your requirement will be fulfilled.

9.4 Menu Enhancements

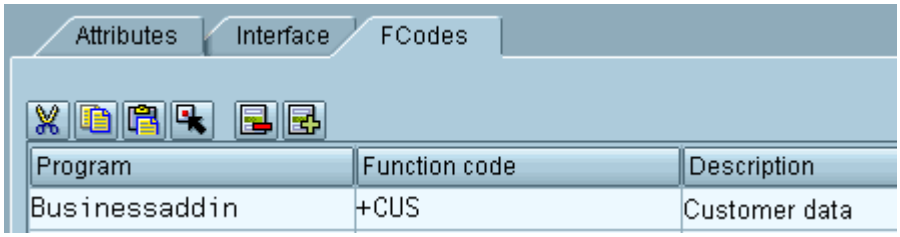
SAP allows you to enhance menus in its user interfaces using function codes. These function codes must adhere to the form /namespace/+<...>, just like in SMOD/CMOD enhancements. They are assigned to a specific enhancement and only appear in their corresponding menus once an implementation of this enhancement has been activated.

Application developers reserve specific function codes for customers when defining a Business Add-In. They use the Menu Painter to include these codes in the appropriate menu lists. Application developers must also ensure that these menu options are called in their applications and that the corresponding add-in methods are also retrieved. Customers can take advantage of menu enhancements by creating a new implementation, choosing a text for the menu option, and then programming the method used to determine what action is performed when the menu enhancement is called.

Menu enhancement is only possible using single use add-ins (not multiple use add-ins) that are not filter-dependent. Currently, menu enhancements can only be created in conjunction with program enhancements (interfaces).

To create a menu enhancement, proceed as follows:

1. Create an add-in and define its interface.
2. Choose *Fcodes* from the tabstrip.
3. Enter the name of your program, the function code, and a description.



4. Call the Menu Painter or double-click on your program name or function code to branch to user interface maintenance in the Menu Painter. Enter your function code in the appropriate menu list. If you have accessed the Menu Painter directly during add-in definition, you can call your menu lists by choosing *Goto --> Object lists --> Menu list* instead.

Calling a Menu Enhancement from an Application Program

You programming should look like this:

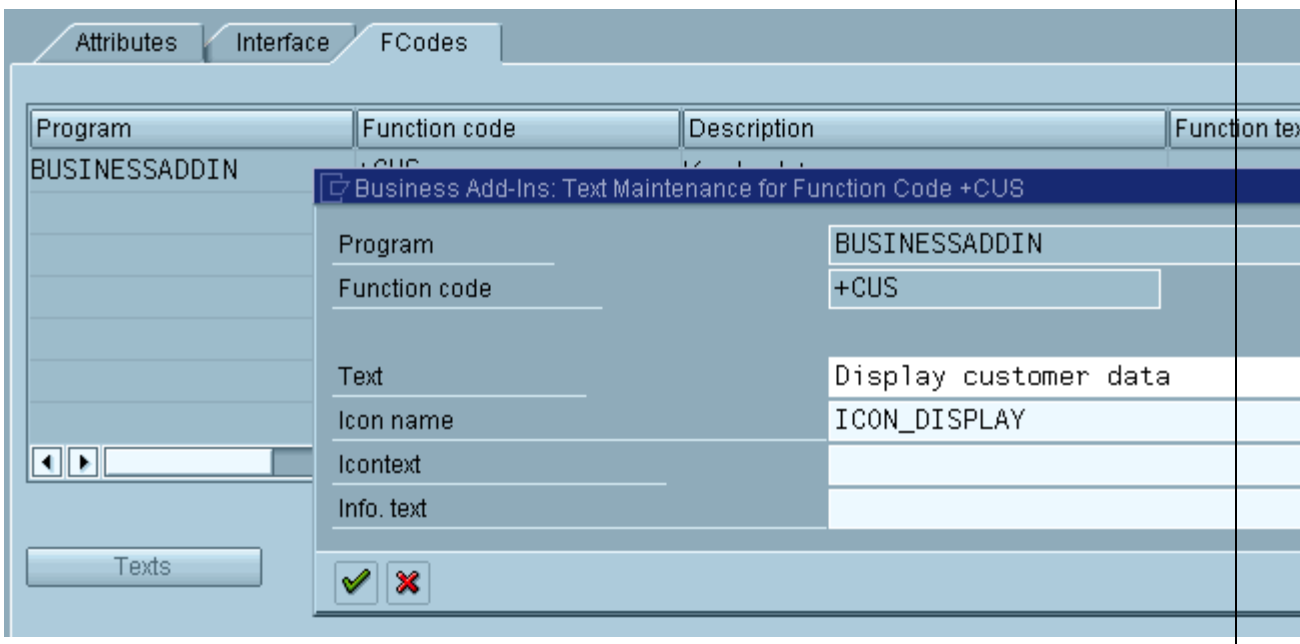
```
(...)
case fcode.
  when 'SAP'.
    (...)
```

```
when '+CUS'
  call method …
```

Implementing a Menu Enhancement

When implementing menu enhancements, proceed as follows:

1. Create an implementation and choose *Fcodes.* All data adopted from your Business Add-In's definition is displayed here. You can make entries for the implementation on the right. You can also double-click on the first input field. The following dialog box appears:



Here you may enter a text for your function code, the name of an icon and a text for the icon, and a short informational text.

The actions that you want the system to perform after the pushbutton is chosen must be programmed in the appropriate method, either manually or using default source code that has been provided to you.

Menu enhancements only become visible after the implementation has been activated and the application program that calls the Business Add-In has been executed.