Developing NaturalX Applications

This chapter describes how to develop an application by defining and using classes.

The following topics are covered:

- Development Environments

- Defining Classes

- Using Classes and Objects

Development Environments

- **Developing Classes on Windows Platforms**
  On Windows platforms, Natural provides the Class Builder as the tool to develop Natural classes.
  The Class Builder shows a Natural class in a structured hierarchical order and allows the user to
  manage the class and its components efficiently. If you use the Class Builder, no knowledge or only a
  basic knowledge of the syntax elements described below is required.

- **Developing Classes Using SPoD**
  In a Natural Single Point of Development (SPoD) environment that includes a Mainframe, UNIX
  and/or OpenVMS remote development server, you can use the Class Builder available with the
  Natural Studio front-end to develop classes on Mainframe, UNIX and/or OpenVMS platforms. In
  this case, no knowledge or only a basic knowledge of the syntax elements described below is
  required.

- **Developing Classes on Mainframe, UNIX or OpenVMS Platforms**
  If you do not use SPoD, you develop classes on these platforms using the Natural program editor. In
  this case, you should know the syntax of class definition described below.

Defining Classes

When you define a class, you must create a Natural class module, within which you create a `DEFINE`
`CLASS` statement. Using the `DEFINE CLASS` statement, you assign the class an externally usable name
and define its interfaces, methods and properties. You can also assign an object data area to the class,
which describes the layout of an instance of the class.

This section covers the following topics:

- Creating a Natural Class Module

- Specifying a Class

- Defining an Interface

- Assigning an Object Data Variable to a Property

- Assigning a Subprogram to a Method

- Implementing Methods

Creating a Natural Class Module

▶ To create a Natural class module

- Use the `CREATE OBJECT` statement to create a Natural object of type Class.

Specifying a Class

The `DEFINE CLASS` statement defines the name of the class, the interfaces the class supports and the structure of its objects.

▶ To specify a class

- Use the `DEFINE CLASS` statement as described in the *Statements* documentation.

Defining an Interface

Each interface of a class is specified with an `INTERFACE` statement inside the class definition. An `INTERFACE` statement specifies the name of the interface and a number of properties and methods. For classes that are to be registered as COM classes, it specifies also the globally inique ID of the interface.

A class can have one or several interfaces. For each interface, one `INTERFACE` statement is coded in the class definition. Each `INTERFACE` statement contains one or several `PROPERTY` and `METHOD` clauses. Usually the properties and methods contained in one interface are related from either a technical or a business point of view.

The `PROPERTY` clause defines the name of a property and assigns a variable from the object data area to the property. This variable is used to store the value of the property.

The `METHOD` clause defines the name of a method and assigns a subprogram to the method. This subprogram is used to implement the method.

▶ To define an interface

- Use the `INTERFACE` statement as described in the *Statements* documentation.

Assigning an Object Data Variable to a Property

The `PROPERTY` statement is used only when several classes are to implement the same interface in different ways. In this case, the classes share the same interface definition and include it from a Natural copycode. The `PROPERTY` statement is then used to assign a variable from the object data area to a property, *outside* the interface definition. Like the `PROPERTY` clause of the `INTERFACE` statement, the `PROPERTY` statement defines the name of a property and assigns a variable from the object data area to the property. This variable is used to store the value of the property.

▶ To assign an object data variable to a property

- Use the PROPERTY statement as described in the *Statements* documentation.

Assigning a Subprogram to a Method

The METHOD statement is used only when several classes are to implement the same interface in different ways. In this case, the classes share the same interface definition and include it from a Natural copycode. The METHOD statement is then used to assign a subprogram to the method, *outside* the interface definition. Like the METHOD clause of the INTERFACE statement, the METHOD statement defines the name of a method and assigns a subprogram to the method. This subprogram is used to implement the method.

▶ To assign a subprogram to a method

- Use the METHOD statement as described in the *Statements* documentation.

Implementing Methods

A method is implemented as a Natural subprogram in the following general form:

```
DEFINE DATA statement
*
* Implementation code of the method
*
END
```

For information on the DEFINE DATA statement see the *Statements* documentation.

All clauses of the DEFINE DATA statement are optional.

It is recommended that you use data areas instead of inline data definitions to ensure data consistency.

If a PARAMETER clause is specified, the method can have parameters and/or a return value.

Parameters that are marked BY VALUE in the parameter data area are input parameters of the method.

Parameters that are not marked BY VALUE are passed "by reference" and are input/output parameters. This is the default.

The first parameter that is marked BY VALUE RESULT is returned as the return value for the method. If more than one parameter is marked in this way, the others will be treated as input/output parameters.

Parameters that are marked OPTIONAL are available with Natural Version 4.1 and all subsequent releases. Optional parameters need not be specified when the method is called. They can be left unspecified by using the *n*X notation in the SEND METHOD statement.
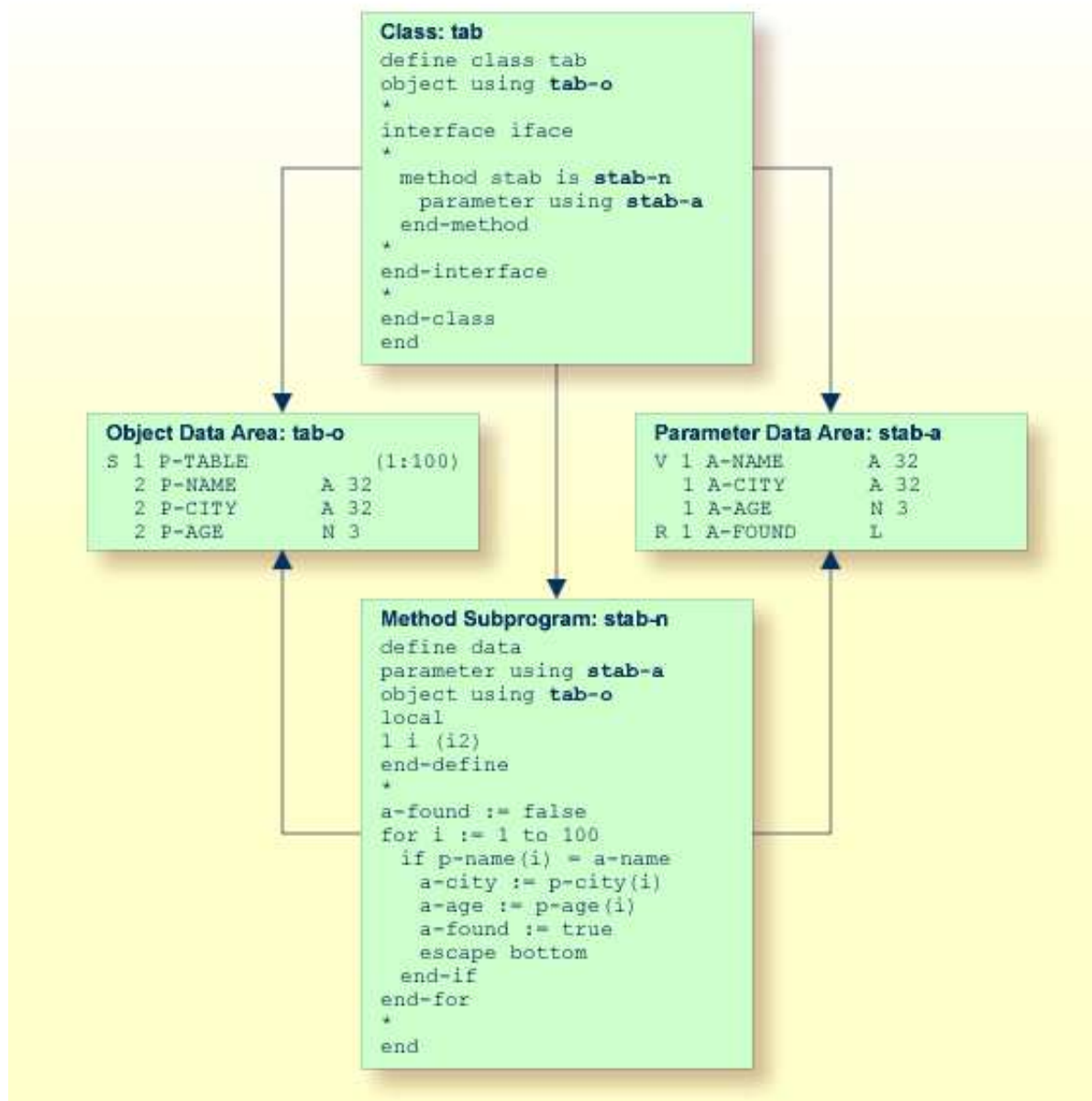
To make sure that the method subprogram accepts exactly the same parameters as specified in the corresponding METHOD statement in the class definition, use a parameter data area instead of inline data definitions. Use the same parameter data area as in the corresponding METHOD statement.

To give the method subprogram access to the object data structure, the OBJECT clause can be specified. To make sure that the method subprogram can access the object data correctly, use a local data area instead of inline data definitions. Use the same local data area as specified in the OBJECT clause of the DEFINE CLASS statement.

The GLOBAL, LOCAL and INDEPENDENT clauses can be used as in any other Natural program.

While technically possible, it is usually not meaningful to use a CONTEXT clause in a method subprogram.

The following example retrieves data about a given person from a table. The search key is passed as a BY VALUE parameter. The resulting data is returned through "by reference" parameters ("by reference" is the default definition). The return value of the method is defined by the specification BY VALUE RESULT.

```
Class: tab
define class tab
object using tab-o
*
interface iface
*
  method stab is stab-n
    parameter using stab-a
  end-method
*
end-interface
*
end-class
end
```

```
Object Data Area: tab-o
S 1  P-TABLE        (1:100)
  2  P-NAME    A 32
  2  P-CITY    A 32
  2  P-AGE     N 3
```

```
Parameter Data Area: stab-a
V 1  A-NAME    A 32
  1  A-CITY    A 32
  1  A-AGE     N 3
R 1  A-FOUND   L
```

```
Method Subprogram: stab-n
define data
parameter using stab-a
object using tab-o
local
1 i (i2)
end-define
*
a-found := false
for i := 1 to 100
  if p-name(i) = a-name
    a-city := p-city(i)
    a-age := p-age(i)
    a-found := true
    escape bottom
  end-if
end-for
*
end
```

Using Classes and Objects

Objects created in a local Natural session can be accessed by other modules in the same Natural session.

The statement `CREATE OBJECT` is used to create an object (also known as an instance) of a given class.

To reference objects in Natural programs, object handles have to be defined in the `DEFINE DATA` statement. Methods of an object are invoked with the statement `SEND METHOD`. Objects can have properties, which can be accessed using the normal assignment syntax.

These steps are described below:

- Defining Object Handles

- Creating an Instance of a Class

- Invoking a Particular Method of an Object

- Accessing Properties

Defining Object Handles

To reference objects in Natural programs, object handles have to be defined as follows in the `DEFINE DATA` statement:

```
DEFINE DATA

  level-handle-name [(array-definition)] HANDLE OF OBJECT

  ...

END-DEFINE
```

Example:

```
DEFINE DATA LOCAL
1 #MYOBJ1 HANDLE OF OBJECT
1 #MYOBJ2 (1:5) HANDLE OF OBJECT
END-DEFINE
```

Creating an Instance of a Class

▶ **To create an instance of a class**

- Use the `CREATE OBJECT` statement as described in the *Statements* documentation.

Invoking a Particular Method of an Object

▶ **To invoke a particular method of an object**

- Use the `SEND METHOD` statement as described in the *Statements* documentation.

Accessing Properties

Properties can be accessed using the `ASSIGN` (or `COMPUTE`) statement as follows:

```
ASSIGN operand1.property-name = operand2

ASSIGN operand2 = operand1.property-name
```

Object Handle - *operand1*

operand1 must be defined as an object handle and identifies the object whose property is to be accessed. The object must already exist.

operand2

As *operand2*, you specify an operand whose format must be data transfer-compatible to the format of the property. Please refer to the data transfer compatibility rules for further information.

property-name

The name of a property of the object.

If the property name conforms to Natural identifier syntax, it can be specified as follows

```
create object #o1 of class "Employee"
  #age := #o1.Age
```

If the property name does not conform to Natural identifier syntax, it must be enclosed in angle brackets:

```
create object #o1 of class "Employee"
  #salary := #o1.<<%Salary>>
```

The property name can also be qualified with an interface name. This is necessary if the object has more than one interface containing a property with the same name. In this case, the qualified property name must be enclosed in angle brackets:

```
create object #o1 of class "Employee"
  #age := #o1.<<PersonalData.Age>>
```

Example:

```
define data
  local
  1 #i         (i2)
  1 #o         handle of object
  1 #p         (5) handle of object
  1 #q         (5) handle of object
  1 #salary    (p7.2)
  1 #history   (p7.2/1:10)
  end-define
  * ...
  * Code omitted for brevity.
  * ...
  * Set/Read the Salary property of the object #o.
  #o.Salary := #salary
  #salary := #o.Salary
  * Set/Read the Salary property of
  * the second object of the array #p.
  #p.Salary(2) := #salary
  #salary := #p.Salary(2)
  *
```

```
* Set/Read the SalaryHistory property of the object #o.
#o.SalaryHistory := #history(1:10)
#history(1:10) := #o.SalaryHistory
* Set/Read the SalaryHistory property of
* the second object of the array #p.
#p.SalaryHistory(2) := #history(1:10)
#history(1:10) := #p.SalaryHistory(2)
*
* Set the Salary property of each object in #p to the same value.
#p.Salary(*) := #salary
* Set the SalaryHistory property of each object in #p
* to the same value.
#p.SalaryHistory(*) := #history(1:10)
*
* Set the Salary property of each object in #p to the value
* of the Salary property of the corresponding object in #q.
#p.Salary(*) := #q.Salary(*)
* Set the SalaryHistory property of each object in #p to the value
* of the SalaryHistory property of the corresponding object in #q.
#p.SalaryHistory(*) := #q.SalaryHistory(*)
*
end
```

In order to use arrays of object handles and properties that have arrays as values correctly, it is important to know the following:

A property of an occurrence of an array of object handles is addressed with the following index notation:

```
#p.Salary(2) := #salary
```

A property that has an array as value is always accessed as a whole. Therefore no index notation is necessary with the property name:

```
#o.SalaryHistory := #history(1:10)
```

A property of an occurrence of an array of object handles which has an array as value is therefore addressed as follows:

```
#p.SalaryHistory(2) := #history(1:10)
```