Rexx Objects

Dipping a toe in the object pool

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An altogether too common statement:

- “these needs arise from *trying not to use the oo features of oorexx* since i'm creating a way for some users who know no programming language to use *the minimal features* of rexx.”
  - Recent comment on the REXXLA mailing list (emphasis added)

This frequently results in rejecting the easiest solution

- The discussion from the previous statement ended up as a discussion of whether interpret or value() provided the better solution.
  - did not meet *the minimal features of rexx* goal
  - ooRexx solution would have been much smaller and easier for the target users to understand

Goals of Object Rexx Features

- Features were added with an eye toward providing easier ways to solve problems that users frequently asked about.
  - Mike Cowlishaw's “top ten” list.
  - Object orientation in many cases was the solution, not the end goal of the design.

Typical Questions

- How do I pass/return a stem to/from a procedure
- How do I expose a variable without having to expose through all call levels
- How do I drop a sub-stem
- How do I copy a sub-stem
- How do I reuse more of my code
- How do I get stem.0 to be automatically set
- How do I implement callbacks within my program

A simple example

```
emp.i.name = “Rick McGuire”
emp.i.location = “Sandy Hook”
....
call print_employees
....
print_employees:
procedure expose emp. empcount
do i = 1 to empcount
....
end
```

Common problems with using the classic approach

- The “accidental simple variable” problem.
- Writing code to deal with multiple collections.
- The external function variable scope.
- The embedded “.” problem
- Some problem solutions require use of interpret or value().

But wait...

- Structured data...
- A series of functions that operate on that data....

SOUNDS LIKE AN OBJECT TO ME!

What is an object?

?????????

Object-oriented programming is easy as...

Polymorphism

Inheritance

Encapsulation

A sample object

```
c 'SET ALT 0 0'
c 'SET DISPLAY' On On
c 'SET SCOPE DISPLAY'

c 'BOTTOM'          /* GOTOP */
c 'EXTRACT/FLSCREEN/'
if flscreen.1<1 then Signal AtTop
c 'TOP'
c 'EXTRACT/FLSCREEN/'
do while (flscreen.1<1)
   c 'DOWN 1'
   c 'EXTRACT/FLSCREEN/'
end
```

Another sample object

```
start = 5
length = 5
data = 'Flying pigs have wings'
parse var data x1 =(start) x2 +(length) x3
```

Encapsulation

- “Keep your paws off my data...”
- Internal data is hidden (“Encapsulated”)
- Manipulations are only via an interface that the object defines

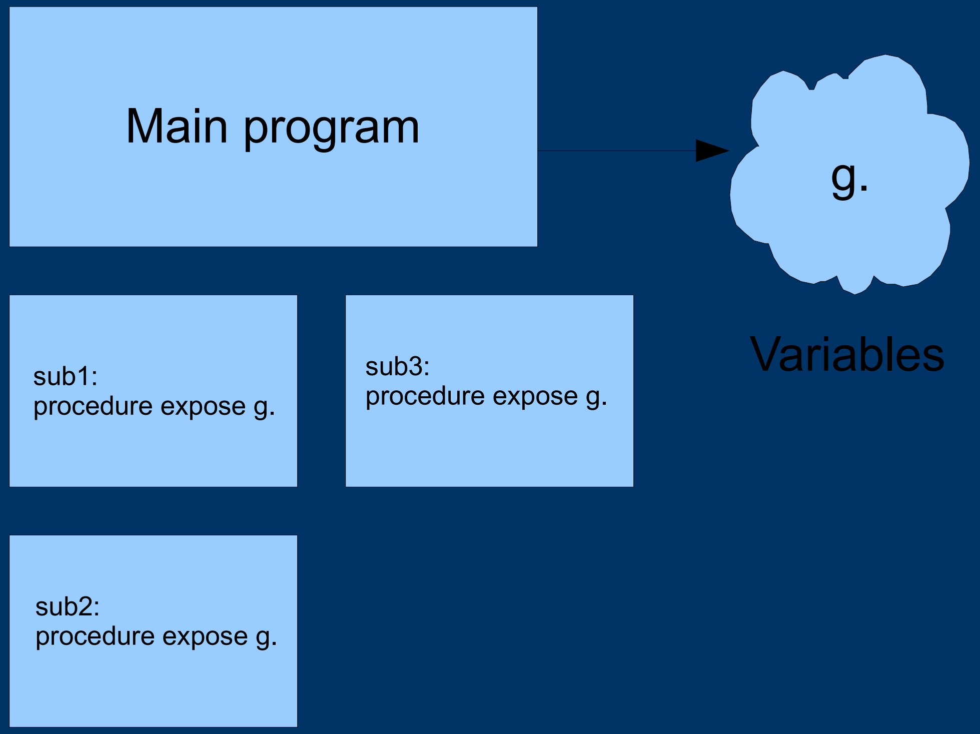
How do you write such a program in Rexx?

- Very difficult
  - Variable scoping rules require passing around of “globals”
  - Everything is open, everything is exposed
  - Great care must be taken for naming variables, procedures, etc., because all one shared namespace.

What is a Rexx object?

- An object is a bundle of Rexx variables (“instance variables”)
- PLUS a “trusted” set of code that's allowed to directly access those variables (“methods”)
- Methods may be invoked by “outsiders”
- You can have many instances of an object active at one time.

A Classic Rexx program



Main program

g.

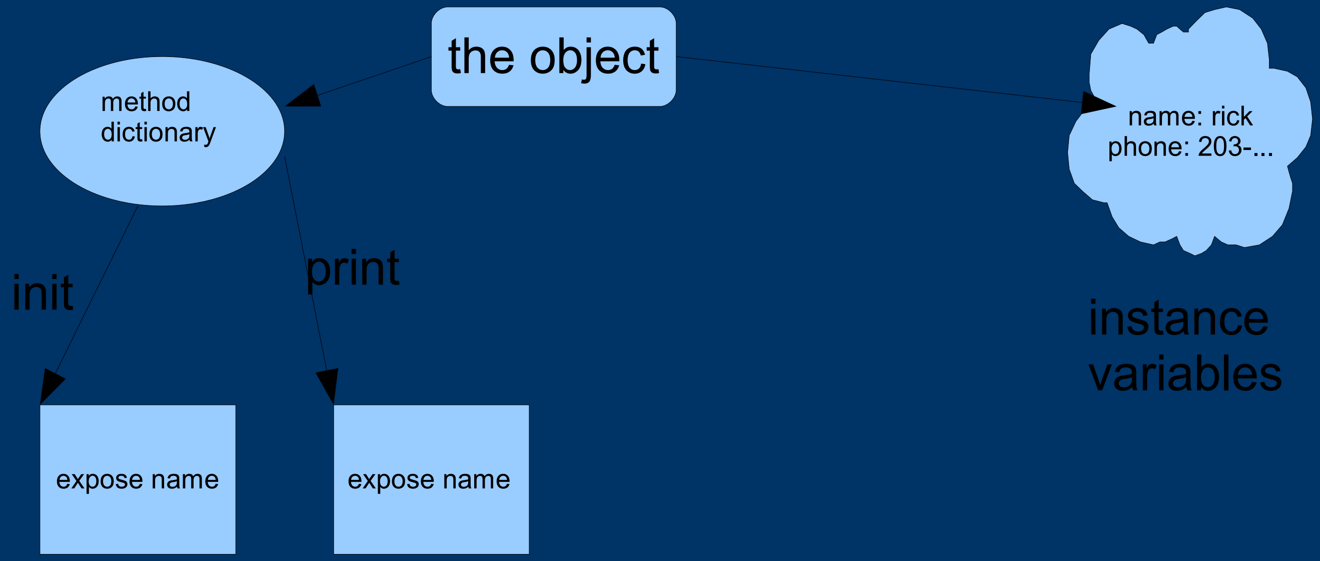
Variables

sub1:
procedure expose g.

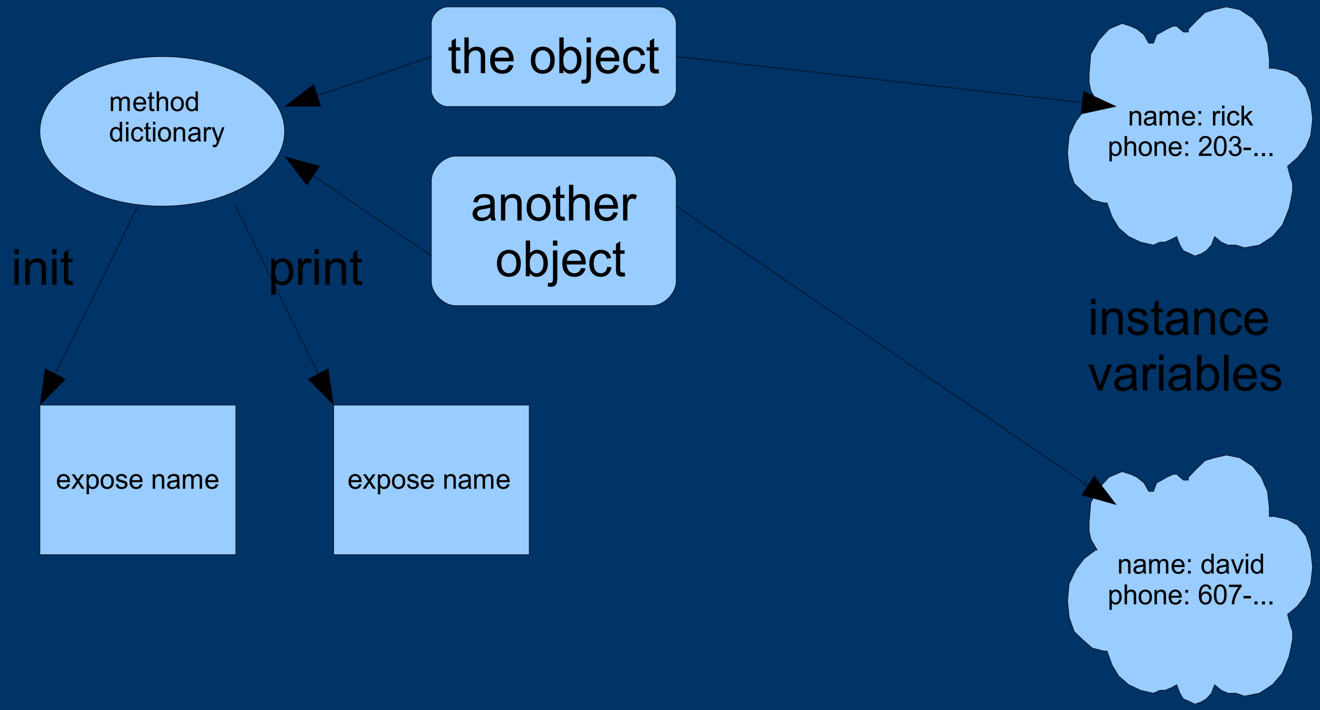
sub3:
procedure expose g.

sub2:
procedure expose g.

The Object picture



A multiplicity of objects



A simple Rexx object

```
::class employee public
::method init
  expose name location
  use strict arg name, location
::method name attribute
::method location attribute
::method print
  say self~string
::method string
  expose name location
  return name “at” location
```

Creating an object

- Objects are created by sending a “new” method to a “Class” object

```
a = .employee~new(“Rick”, “Sandy Hook”)
```

- The class object allocates space, plugs in the method dictionary, and calls “INIT” to finish up construction.

Calling methods

- You call methods by “twiddling” the object

```
a~print
```

Creating your own objects

- Objects are created by making a Class object factory, and defining methods associated with the class

```
::class employee
::method init
expose name address
use strict arg name, address
::method name attribute
```

The Parser...

- A real example...an object based version of the PARSE instruction

If it looks like a duck...

- ...and quacks like a duck, it's probably a duck.

Is this an XEDIT macro?

- ...or a KEDIT macro, or a THE macro?

```
c 'SET ALT 0 0'
c 'SET DISPLAY' On On
c 'SET SCOPE DISPLAY'

c 'BOTTOM'          /* GOTOP */
c 'EXTRACT/FLSCREEN/'
if flscreen.1<1 then Signal AtTop
c 'TOP'
c 'EXTRACT/FLSCREEN/'
do while (flscreen.1<1)
   c 'DOWN 1'
   c 'EXTRACT/FLSCREEN/'
end
```

Polymorphism

- “many bodies”
- In ooRexx terms, it means an object responds to the message you send it.

Pipes

- How can all of these stages work together?

```
'PIPE (name LIST2SRC)',
'| <' fn 'listing *', /* Read the LISTING file */
'| mctoasa', /* Machine carriage ctl => ASA */
'| frlabel - LOC', /* Discard to start of program */
'| drop 1', /* Drop that '- LOC' line too */
'| tolabel - POS.ID', /* Keep only up to relocation */
'| tolabel -SYMBOL', /* dictionary or cross-ref */
'| tolabel 0THE FOLLOWING STATEMENTS', /* or diagnostics */
'| outside /1/ 2', /* Drop 1st 2 lines on each pg */
'| nlocate 5-7 /IEV/', /* Discard error messages */
'| nlocate 41 /+/', /* Discard macro expansions */
'| nlocate 40 / /', /* Discard blank lines */'| nlocate 5-7 /IEV/', /* Discard error messages */
'| nlocate 41 /+/', /* Discard macro expansions */
'| nlocate 40 / /', /* Discard blank lines */
'| specs 42.80 1', /* Pick out source "card" */
'| >' fn 'assemble a fixed' /* Write new source (RECFM F) */
```

DO OVER

- How can DO OVER iterate over
    - An array
    - A stem
    - A stream?
- It really only understands arrays, but it sends a “MAKEARRAY” message to the object to get one.
- Any object can provide a MAKEARRAY method and work with DO OVER.

Never write this program again

```
select
    when type = 1 then call printEmployee
    when type = 2 then call printManager
    when type = 3 then call printExecutive
    when type = 4 then call printContractor
end
```

...do this instead

```
anEmployee~print
```

The TreeTable

- The tree table is polymorphic with the ooRexx Directory class
- A totally new implementation
  - Can be used interchangeably with directory objects

Standing on the shoulders of giants...

- One of the major benefits of O-O programming is code reuse
  - Don't copy the code and modify...
  - Use the original directly and extend and override.

Inheritance

- When you create a class, you can start by "subclassing" an existing class.
- You "inherit" the methods and data of the existing class...
- ...and add some of your own.

Why inherit?

- Extend existing function
- Alter/extend the behavior of an existing class to meet your requirements
- Complete the implementation of an abstract concept (inherit from a “framework”)
- Another means of achieving polymorphism

Enhancing the function

- Add additional capability to an existing class
  - Q: How hard would it be to add regular expression support to the PARSE instruction yourself?
  - Q: How hard would it be to add regular expression support to the Parser sample yourself?

The enhanced parser

- Same base parser, but additional function added

Getting a little SELFish

- In any ooRexx method, the variable SELF will point to the object you use to invoke the method
  - This allows you to invoke “subroutines” using your own context:

```
::method string
return self~name “living at” self~address
```

Before, after, and in between

- When you subclass, you can override methods of the superclass, but still use those methods

```
::method string
return “This is my version of” self~string:super
```

Making callbacks

- Some classes define empty methods and allow you to fill in the blanks:

```
::class myparser subclass xmlparser
::method start_element
use arg chunk
call charout , '<'chunk~tag
if chunk~attr <> .nil then do f over chunk~attr
   call charout , ' 'f'="'self~textxlate(chunk~attr[f])'"'
   end
say '>'
return

::method end_element
use arg chunk
say '</'chunk~tag'>'
return

::method passthrough
use arg chunk
say '<'chunk~text'>'
return
```

All we are saying, is give peace a chance...

- Allow the ooRexx language to help you with what you're already trying to do!
- Using ooRexx features doesn't require a complete reshaping of your mind set...
  - immediately rejecting these features frequently means you're working too hard!

Object-oriented programming is easy as...

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