Subject: Re: IDL Object for creating a Singleton
Posted by J.D. Smith on Mon, 22 Jun 1998 07:00:00 GMT
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David Fanning wrote:
>
> Phillip David (pdavid@earthling.net) writes:
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> Cheers,

I think you've both run head-on into the limits of IDL's OO implementation. The foremost among these is the lack of controllable access. All class members are equivalent to "protected" -- visible to a class plus any derived classes. Especially frustrating is the absence of public data members, which requires one to set up GetProperty and SetProperty methods which do *nothing* other than access otherwise "public" data.

Protected class methods, although less frustrating, can limit the amount of cooperative programming possible for large projects (since no mechanism is provided to prevent accidental reliance on internal, and therefore potentially changing, class implementation).

But one must keep in mind that RSI wanted to provide the basic OO functionality, not a totally robust OO environment. I think they did an O.K. job with this. Polymorphism is well-implemented since all methods are "virtual protected", and all objects (read object references) are the equivalent of object pointers in C++ ... there is no such concept as static typing of a method (just as there is no concept of static typing of a variable) in IDL. Encapsulation, though rigid, accomplishes the basics of the principle.

In any case, as to your specific problem, I haven't seen the book you reference, but I'd bet they achieve the "singleton" functionality with a static data member -- a variable which is shared by all instances of the defining class, but only initialized once. There is no comparable functionality in IDL. I believe the only way to implement this *is* with a common block (uhgg ... but remember that XManager, everybody's favorite procedure, is implemented with a bunch of common blocks). The issue is then one of locality and longevity -- we must ensure nothing else alters our common block, and that, after the singleton's life is over, the common block doesn't contain data. The latter is easy enough, the former might be impossible.

I've been tinkering around with various ways to implement this type of structure for a while... unfortunately, you cannot affect what gets returned from Obj_New (more on this later). You could of course achieve the same functionality with other, uglier ways.

An implementation is below. It defines a super-class, Singleton, which is only meant to be inherited from. This class maintains a common block

variable "slist", in which are kept the various singleton objects. Only one list is needed for as many different types of Singleton's you may want, during a session, and, as you kill Singleton objects, the list is cleaned.

********** Singleton Abstract Class -- must be inherited
****

```
pro Singleton::Cleanup
  common Singleton, slist
  if ptr_valid(slist) then begin
    wh=where(NOT obj_isa(*slist, obj_class(self)),cnt)
    if cnt ne n_elements(*slist) then $
     if cnt eq 0 then ptr_free, slist else *slist=(*slist)[wh]
  endif
end

pro Singleton::Init, Object=obj
  common Singleton, slist

  ;; Add this type to our singleton list, if we need to.
  if ptr_valid(slist) then begin
    ;; clean up the list .. removing any danglers
    wh=where(obj_valid(*slist),cnt)
    if cnt eq 0 then begin
      ptr_free,slist
      slist=ptr_new([self])
    endif else begin
      *slist=(*slist)[wh]
      ;; find us on the list
      wh=where(obj_isa(*slist,obj_class(self)),cnt)
      if cnt eq 0 then begin
        *slist=[*slist,self] ;not yet on list -- add us
      endif else begin       ;we are already on the list !
        abort=self
        self=(*slist)[wh[0]]
        obj_destroy,abort
      endelse
    endelse
  endif else slist=ptr_new([self])
  obj=self
  return,1
end

pro Singleton__define
  struct={Singleton, $
          NULL:0b }           ;I am forced to include something in
                              ;this abstract class
end
```

```
 ********************************************************** ***************
```

And a User preferences object based on this ...

```
****************** UsrPref derived Class
*********************************
pro sUsrPref::PrintPrefs
  print,'XSIZE: ',self.Prefs.xsize
  print,'YSIZE: ',self.Prefs.ysize
  print,'CTABL: ',self.Prefs.ctabl

end

pro sUsrPref::SetPrefs, XSIZE=xsize, YSIZE=ysize, CTABL=ctabl
  if n_elements(xsize) ne 0 then self.Prefs.xsize=xsize
  if n_elements(ysize) ne 0 then self.Prefs.ysize=ysize
  if n_elements(ctabl) ne 0 then self.Prefs.ctabl=ctabl
end

pro sUsrPref__define
  struct={USRPREF, $          ;A Structure to hold the preferences
          XSIZE:0, $          ;x size of screen
          YSIZE:0, $          ;y size of screen
          CTABL:0}            ;preferred color table
  class={sUsrPref, $          ;the sUsrPref Class
          INHERITS Singleton,$ ;make it a singleton
          Prefs: {USRPREF}}    ;pointer to user pref structure
end
 ********************************************************** ***************
```

The problems with this are:

1. You have to put some data in the Simpleton class, which really needs no data (since it stores things in the common block). Required data members, egad.

2. You are forced to call the derived class as null=obj_new('sUsrPref',Object=sup), which will always yield a valid object "sup" (the same one each time), but a valid object "null" only once. If "self" were fully by-reference we could skip this awkward keyword. Alas.

3. A heap variable is created and then destroyed when one of this current type is already on the list. This is wasteful and slow. Another possiblity to avoid this is to make a function to use instead of

obj_new, call it singleton()... something like:

```
function singleton, oType, _EXTRA=e
  common Singleton, slist

  if ptr_valid(slist) then begin
    ;; clean up the list .. removing any danglers
    wh=where(obj_valid(*slist),cnt)
    if cnt eq 0 then begin
      ptr_free,slist
      obj=obj_new(oType,_EXTRA=e)
      slist=ptr_new([obj])
    endif else begin
      *slist=(*slist)[wh]
      ;; find us on the list
      wh=where(obj_isa(*slist,oType),cnt)
      if cnt eq 0 then begin
        obj=obj_new(oType,_EXTRA=e)
        *slist=[*slist,obj] ;not yet on list -- add us
      endif else begin       ;we are already on the list !
        obj=(*slist)[wh[0]]
      endelse
    endelse
  endif else begin
    obj=obj_new(oType,_EXTRA=e)
    slist=ptr_new([obj])
  endelse
  return,obj
end
```

This would make Singleton::Init unecessary (could remove it). Now you would simply say:

```
sup=singleton('sUsrPref')
```

To get a new/current instance of the preferences object. However, this is not a perfect replacement for obj_new() because only keyword parameters (through inheritence) are permitted in the initted object.

Anyway, if something better comes to me, I'll let you know.

JD

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Ithaca, NY 14853 |*|

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Posted by davidf on Mon, 22 Jun 1998 07:00:00 GMT
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David
--
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Coyote's Guide to IDL Programming: http://www.dfanning.com/

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> of public data members, which requires one to set up GetProperty and
> SetProperty methods which do *nothing* other than access otherwise
> "public" data.

I had already pretty much figured this out. I wanted to see if other people could come up with a better implementation than my own for this, though. What we really need in this instance is a "class variable" ("static" is the C++ term for it), which is a single variable available to all instances of a class. This variable can be used for such information as a count of the number of objects of this type currently instantiated or, in the case of a singleton, the object reference to the only instance of the class.

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Thanks for that perspective.

> In any case, as to your specific problem, I haven't seen the book you
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> favorite procedure, is implemented with a bunch of common blocks).

<Nice singleton generator code omitted>

I hadn't thought of using a singleton generator, and was instead concerned with the way to generate just a single instance of the singleton class. This is a neat trick that I'll have to remember. Even the C++ example in "Design Patterns" (a truly GREAT book on OO techniques!) had to make the constructor a protected function, and create a class method (i.e., static) that checked whether the static instance variable was initialized. If it was, the variable was returned. If not, the constructor was called by the class variable, and the instance reference updated.

In IDL, there are no such things as either class (static) variables or methods. As a result, I've adopted the following way of handling these things:

For class variables, I define a common block <object>_static which has my static variables inside of it. The only reference to this common block is within my object or other routines found within the same file as my object. Since IDL's object model only works on objects, it cannot use a static method either. As a result, I simply add non-object routines into the same file as my object is defined in, and use these as the structure I want. For this particular project, I defined a file 'GetPreferences.pro', which had the following structure:

---------- Start of sample source code ----------

```
pro Preferences::GetSize



pro Preferences::Init, caller
  if caller NE 'GetPreferences' then begin
    ok = Widget_Message(/Error, $
         'Preference objects can only be created by the GetPreferences routine.')
    return, 0  ; failure
  endif

   ;------------------------------------------------------------ ------------------
  ; I store my preferences in a file.  If they're present, I read them in
when my
  ; preferences object gets initialized.  I'm not including the code for this
  ; because it's not relevant.  However, if the variables XSize and YSize are set
  ; to 0, I call the Device, Get_Screen_Size=sizes to get standard sizes.
   ;------------------------------------------------------------ ------------------
  return, 1 ; success
end

pro Preferences__Define
  struct = {PREFERENCES, XSize=0, YSize=0}
end

function GetPreferences
```

```
   ;------------------------------------------------------------ ------------------
   ; This is a 'static' function for the Preferences class.  Notice that unless
   ; this function is called, the preferences object code is never even compiled
   ; unless it's compiled explicitly.  This prevents the inadvertant call to a
   ; preferences object prior to invoking a GetPreferences routine.  The check
   ; for the proper caller in the init function for the preferences object does
   ; the rest of the protection I can create.  While it's not entirely foolproof
   ; this method does provide substantial protection.
   ;
   ; My main concern here is that this method is not technically a part of the
   ; class, but as JD points out, this may not be possible due to limitations
   ; of the object nature of IDL.
   ;------------------------------------------------------------ ------------------
   common Preferences_Static, preferences
   prefsSize = size(preferences)
   if prefsSize(prefsSize(0)+1) EQ OBJECT then return, preferences
   preferences = Obj_New('Preferences', 'GetPreferences')
   return, preferences
end

---------- end of sample source code -------------
```

What do you think of this as a simpler approach when you just need a single Singleton?

I was hoping for something more elegant than common blocks, but I guess that's what I'll continue to use. Thanks for your inputs. I'll try to continue posting interesting OO ideas as I think of them.

By the way, David, what happened with the Direct Graphics as objects techniques? I never saw more about them, but I haven't had proper newsgroup access for a while.

Phillip
