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**The World of Objects**

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**Distributed**

**Objects**

**BY ROGER SESSIONS**

et's try a quick psychological test. I'll put forth a word, and I want you to say the first word



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that comes to mind. Are you ready? Here's the word: SOM. Most likely, this word elicited one of three reactions: perplexity,- a better object model, or a

better C++.

SOM technology was first intro­ duced with OS/2 2.0. The first-ever arti­ cle about SOM appeared in the 1992

winter issue of *OS/2 Developer* (p.107),

written by Nurcan Coskun and myself. Over the following three years, SOM

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was imbued with a variety of new fea­

tures, including one that should have guaranteed it a place in the annals of software history.

This critical feature added to SOM

2.0 was the ability to distribute objects. SOM was the first serious commercial implementation of the Object Manage­ ment Group's COREA model, which defined an industry standard architec­ ture for distributing objects.

The fact that so few people think of object distribution when they hear the word SOM, is a sad testimony to IBM's marketing ability or lack thereof. IBM has consistently failed to realize the importance of object distribution and has given a muddled story of what

SOM is all about. '

This reality is SOM's gloomy past. Fortunately, there is some bright news on the horizon. The upcoming release of SOM has been redesigned, with object distribution as the focal point of the release. If IBM can figure out how to market this capability, with half the aplomb that Sun has shown toward marketing Java (a big "if"), we might have a real winner.

In this column, let's introduce writ­

ing distributed objects with SOM. All of

**44 05/2 M A G A *Z* I N E** A P R I l 1 9 9 6

**Figure 1: Distributed SOM architecture.**

the code examples work with the cur­ rent 2.1 release. To simplify the exam­ ples and concepts, we'll use the C lan­ guage bindings for SOM.

**Distributed**

**object applications** Distributed object technology is impor­ tant, because it's the most natural mech­ anism we have for doing distributed pro­ grai!]llling. If we are object-oriented pro­ grammers, then we already know about combining behavior and data into little packages that we call objects. With object distribution, we now have the ability to take these little packages and move them to other processes.

From the program's point of view, no difference exists between using local or remote objects. Iil either case, we'll have an object. That object contains state or data. We interact with the object through well-defined method invocations. Because the state of an object is only of internal concern to the object, we don't care where that state actually resides. Our code works fine, as long as the invoked methods can find the right target object, regardless of

**Figure 2:tbistributed SOM architecture as seen by' client.**



whether that object lives in our address space or in another.

It's similar to the concept of remote procedure calls (RPC), which

is probably the most widely recog­ nized paradigm for distributed pro­ gramming. However, procedure calls can only be distributed when proce­ dures have been carefully designed with distribution in mind. Objects are naturally encapsulated, so any well-



**The World of Objects**

designed object is a good candidate for being a unit of distribution. Besides, object-oriented programming has a host of advantages over proce­ dural programming.

Any business that organizes its activ­ ities over a network of computers is a natural for distributred object technol­ ogy, especially if these businesses are also under pressure to rapidly respond to changes in the marketplace. Prime examples include banks, insurance companies, and retail outlets, among many others.

**Basic SOM definitions**

Let's take a closer technical look at this technology. We start by looking at some distributed SOM definitions. Dis­ tributed SOMis often referred to as DSOM, but in SOM 3.0 the distinction between SOM and DSOM will likely be de-emphasized.

Object: An object is just that, an object; it knows how to respond to method invocations. If it's a dog object,

say Snoopy, it knows how to respond to the bark method.

Proxy: A proxy looks similar to a tra­ ditional object, but is just a front for an object. It responds to the same meth­ ods as traditional objects, but does so by forwarding the invocation to some actual object. If it's a dog-proxy object, say the Snoopy-proxy, it implements bark by interacting with SOM to for­ ward the bark invocation to the actual Snoopy object. From the client's per­ spective, the Snoopy-proxy appears to actually be Snoopy. Only SOM knows the difference.

Server Process: All objects live in

some process running on some machine. The process in which the actual Snoopy lives is called the server process for Snoopy, or sometimes just the Snoopy Server.

Client Process: All method invoca­

tions originate from some process. The process, from which a particular bark invocation originates, is considered the client process for that particular method invocation. Ma­

ny different client pro-



cesses can be invoking methods on a given Snoopy.

Object References: A proxy can be

turned into an object reference, which can be used to create a new proxy. The new proxy will then be a front for the same object as the original proxy. For example, if we create an object refer­ ence from Snoopy-Proxy and then gen­ erate a new proxy from that object ref­ erence, say Snoopy-proxy2, both Snoo­ py-proxy and Snoopy-proxy2 will pass their method calls through to the same object, namely, Snoopy. Object refer­ ences take the physical form of a stan­ dard C/C++ string.

Object Request Broker (ORBs):The

ORB is an underlying distribution mechanism used to pass information between proxies and objects. It's not visible to the client or object code.

SOMD\_OBJECTMGR: SOMD\_Ob­ jectMgr is a global object available to any distributed SOM process. This glob­ al object knows how to, among other things, instantiate objects remotely, cre­ ate object references from proxies, and create proxies from object references.



**05/2 M A G A Z I N E** A P R I l l 9 9 6 45

**The Wo ld olObjects**



The architectural relationship between these components is shown in Figure 1. We have a lot of flexibility in configuring client and server processes. For example, they could both be run­ ning in a single machine, they could be on two separate OS/2 boxes, or the client could be running on an OS/2 box and the server on an MVS, AIX, or AS/

400 box-a configuration particularly likely when the objects must interact with corporate databases.

The architecture, as seen by the client, is much simpler. Clients don't see proxies, ORBs, Servers, or remote machines. From the client perspective, the architecture is as shown in Figure 2.

**Sample code**

Let's look at one of our standard dogs. The dog definition, *dog.idl,* is:

#include <somobj.idl>

string bark();

void setBark(

in string newBark);

implementation {

string myBark;

dllname = "dog.dll";

};

},.

This example defines a dog that responds to two methods: bark, which returns a string containing the dog's bark, and setBark, which is used to tell the dog what its bark is.

The C code implementing these

methods is shown in Listing 1. Notice that nothing exists in the dog imple­ mentation that knows whether or not the dog is going to be distributed.

The first will instantiate a Snoopy object, the second will tell Snoopy what his bark is, and the third will ask Snoopy

to bark. These three different programs are running in three different processes, and the Snoopy object is in a fourth.

In Listing 2, Line 1 includes the dis­

tributed SOM header file. Line 12 ini­ tializes the distributed SOM run time. Line 14 asks the MD\_ ObjectMgrto in­ stantiate a new remote object by typing "dog." Although the client believes a "dog" has been returned, what has actually been returned is a proxy to the remotely instantiated dog. Line 16 cre­ ates an object reference for Snoopy. Line 17 to19 opens a file by the name of *id.dat* and writes into it

Snoopy's object reference.



Line 21 tells SOMD\_ObjectMgr that the proxy is no longer needed. Lines 23 and 24 close down the system.

When the program completes, this client process is no longer active. How­ ever, a remote server process is still run­ ning, which contains a live Snoopy object that is ready to accept method invocations.

In Listing 3, Snoopy is told what his bark is in Program 2. With Listing 3, many of these lines are obvious by com­ parison to Program 1. Lines 15 to 17 open the *id.datfile* and read in the object reference. Using shared files is the stan­ dard SOM 2.1 out-of-the-box mecha­ nism for sharing object references. SOM

3.0 is expected to introduce a naming service, which will allow processes to share object references via well-known names. It's not difficult to implement a naming-type service using SOM 2.1, but it does require some advanced SOM pro­ gramming knowledge.

Line 19 asks the SOMD\_ObjectMgr to create a proxy from the object refer­ ence. Line 21 tells Snoopy his bark. Of course, it's actually the Snoopy-proxy that is told, and this proxy passes the information on to the actual Snoopy. Line 23 to 25 releases the proxy and cleans up.

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**46 05/2 M A G A *Z* I N E** A P R ll 1 9 9 6

**The World of Objects**

Most of the remote-specific code has to deal with either creating or freeing object proxies. This code is expected to be simplified in SOM 3.0 through a mechanism described as local/remote transparency, meaning that the same client code will work for both local and remote objects. Again, programming techniques are available for local/re­ mote transparency even in SOM 2.1, but they require advanced program­ ming abilities.

When Program 2 starts, it starts as a new client process, independent of the client process from which Program 1 ran. When this program completes, it then exits. The server process contain­ ing Snoopy, who now thinks his bark is "Woof Woof," is still running.

The program in Listing 4 is very similar to Program 2 (Listing 3). The only significant difference is line 20, which asks Snoopy (actually the Snoopy-proxy) to bark. The result of this program, which demonstrates how the Snoopy Server has evolved its state as the three different client processes have come and gone, looks

like the following:

Snoopy says Woof Woof.

**Reflection**

We have looked at a simple example that was meant to demonstrate the manipulation of remote objects.Similar mechanisms can be used for highly complex objects representing, say, store inventory, customers, or bank accounts.

The main difficulty in programming remote objects has to do with the proxy. As we discussed, this difficulty can be ameliorated using advanced program­ ming techniques and is expected to be simplified in 3.0, although the code shown here will still work.

Distributed object technology allows flexible, sophisticated, and dis­ tributed applications to be built quick­ ly. With the rapid growth of the Inter­ net, the demand for highly interactive distributed applications is expected to grow rapidly. SOM, with its ubiquitous presence on the IBM product line and beyond, is well positioned to be the major contender in this field.

To date, IBM has been unfocused in the object field as new products come in from every direction with no obvi­ ous coordinated overall strategy. Even within the SOM products line, there appear to be multiple directions. If SOM is to be successful, IBM must get focused. It needs to realize that it can't do everything. IBM has great technolo­ gy for doing object distribution. Object distribution is an important field. Now is the time for IBM to turn its technical strengths into marketing triumphs.[i1'fiJ

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22

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