[2] D. Decouchant, E. Finn, C. Horn, S. Krakowiak, and M. Riveill, "Experience with implementing and using an object-oriented distributed system," in *Proc. Usenix Workshop on Experiences with Distributed and Multiprocessor Systems*, (Fort Lauderdale), Oct. 1989.

[3] S. Krakowiak, M. Meysembourg, H. N. Van, M. Riveill, C. Roisin, and X. R. de Pina, "Design and implementation of an object-oriented, strongly typed language for distributed applications," *Journal of Object-Oriented Programming*, vol. 3, Sept. 1990.

[4] S. Lacourte, "Exceptions in guide, an object-oriented language for distributed applications," in *Proceedings of ECOOP'91*, (Geneva), July 1991.

[5] V. Normand, "A practical framework for interactive applications in Guide, an object-oriented distributed system," in *Proc. TOOLS'90*, (Paris), June 1990.

[6] R. Balter, D. Decouchant, A. Duda, A. Freyssinet, S. Krakowiak, M. Meysembourg, M. Riveill, C. Roisin, X. R. de Pina, R. Scioville, and Vandôme, "Experience in object-based computation in the Guide operating system," in *Proc. 2nd Workshop on Workstation Operating Systems*, (Asilomar), Sept. 1989.

[7] D. Decouchant, S. Krakowiak, and M. Riveill, "Management of concurrent distributed computation in an object-oriented system," in *Proc. 3rd Workshop on Large Grained Parallelism*, (Pittsburgh), Oct. 1989.

[8] D. Decouchant and A. Duda, "Remote execution and communication in Guide, an object-oriented distributed system," in *Proc. IEEE Workshop on Experimental Distributed Systems*, (Huntsville), Oct. 1990.

[9] D. Decouchant, P. L. Dot, M. Riveill, C. Roisin, and X. R. de Pina, "A synchronization mechanism for an object-oriented distributed system," in *Proc. 11 th Int. Conf. on Distributed Computing Systems (ICDCS)*, (Arlington, TX), May 1991.

[10] D. Decouchant, E. Paire, and M. Riveill, "Efficient implementation of low-level synchronization primitives in the Unix-based Guide kernel," in *Proc. Europeean Unix Users Group (EUUG) Autumn Conference*, (Vienna), Oct. 1989.

[11] F. Boyer, J. Cayuela, P. Chevalier, A. Freyssinet, and D. Hagimont, "Supporting an object-oriented distributed system: experience with Unix, Chorus and Mach," in *Proc. Symposium on Experience with Distributed and Multiprocessor Systems*, (Atlanta), Mar. 1991.

- the definition of a persistent object model which includes the notion of separate types and classes, with simple inheritance (at the current stage)
- the definition of a computational model based on multi-threaded "jobs" distributed on network nodes.

Guide is designed as a set of distributed services, which may be viewed as the upper layers of a distributed operating system. It provides location transparency of network resources to the application layer. It is a convenient tool for developing transparently distributed applications that use persistent data. The intended application domain is cooperative processing (e.g. document management). Guide is still a research prototype, with the deficiencies that may be expected at this stage (lack of support and robustness)

Description

Guide uses persistent objects, i.e. the object's lifetime is not related to the execution of programs, but the object is in existence as long as at least one other persistent object refers to it. Objects encapsulate a set of data and a set of procedures. A *type* describes the behavior shared by all objects of that type. A *class* defines a specific implementation of a type. Classes are used to generate instances.

The Guide language supports this object model. It is a strongly typed language with conformity, single inheritance and persistent objects. There is support for concurrency, genericity and exceptions. See description in [3]. The exception model is described in [4]. Support for interactive applications is described in [5].

Objects are only accessible through typed variables which are used to invoke operations on objects. At run time, these variables are associated with unique identifiers which are used to name and to locate the objects.

The computational model is based on jobs and activities. A *job* is a multiprocess virtual machine which provides an arbitrary number of sequential threads of control, called *activities* ([6], [7]). The object invocation mechanism is described in [8]. Jobs and activities are transparently distributed. Activities communicate through shared objects, which include a synchronization mechanism ([9], [10]).

Failure handling and security issues are not discussed due to the current status of the project.

Status

Version 1.5 of Guide currently runs on top of Unix[1] on the following machines: Sun-3/60 and 3/80, Sun-4, Sun-i386, Bull DPX1000 and DPX-2, DEC Decstation3100. It uses shared memory and sockets.

There are no current plans to distribute it outside the Comandos project. Version 2 is under design and is expected to run on Mach, later on Chorus. Preliminary work on the microkernel implementations is reported in [11].

Report Availability

The technical reports of the project are available by anonymous FTP from imag.fr [129.88.32.1], under the pub/GUIDE/doc directory. The current list in the file LIST in that directory.

References

[1] R. Balter, J. Bernadat, D. Decouchant, A. Duda, A. Freyssinet, S. Krakowiak, M. Meysembourg, P. L. Dot, H. N. Van, E. Paire, M. Riveill, C. Roisin, X. R. de Pina, R. Scioville, and G. Vandôme, "Architecture and implementation of Guide, an object-oriented distributed system." to appear in Computing Systems, Apr. 1991.

[1] Unix is a trademark of AT&T Bell Laboratories.

Guide

(Grenoble Universities Integrated Distributed Environment)

Bull-IMAG

Personnel

Principal investigators	Roland Balter (Bull)
	Sacha Krakowiak (IMAG)
Faculty and researchers	D. Decouchant
	A. Duda
	C. Roisin
	X. Rousset de Pina
	M. Santana
Bull staff	J. Bernadat
	J. Cayuela
	A. Freyssinet
	S. Lacourte
	M. Riveill
	G. Vandôme
Graduate students	F. Boyer
	P.-Y. Chevalier
	D. Hagimont
	H. Jamrozik
	V. Normand

Contacts

Roland Balter (Bull)
Bull-IMAG
2 avenue de Vignate
F-38610 Gières
France

Internet: balter@imag.fr

Sacha Krakowiak (IMAG)
Bull-IMAG
2 avenue de Vignate
F-38610 Gières
France

Internet: krakowiak@imag.fr

Project Description

Guide (Grenoble Universities Integrated Distributed Environment) is an object-oriented distributed operating system for local area networks [1]. It embodies the object-oriented architecture defined in the COMANDOS Esprit Project (Construction and Management of Distributed Open Systems) [2]. Guide is a joint project of Bull and the IMAG Research Institute (Universities of Grenoble), which have created the Bull-IMAG joint Research Laboratory.

The main design decisions are: