

# A Note on Distributed Computing

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## **Introduction by Jim Waldo**

Unlike the majority of the technical reports produced by Sun Microsystems Laboratories, "A Note on Distributed Computing" does not report on the results of a project. Instead, this technical report sets the context for the problem being addressed by the Large-Scale Distributed Systems group, made up of the authors. This group had the goal of investigating how to create applications that could scale up to millions of machines on a network — a network size that was unheard of at the time.

When the report was written, the goal of most distributed computing infrastructure projects, such as the Object Management Groups (OMG), Common Object Request Broker Architecture (CORBA), was to simplify the production of distributed systems by making the programming of such systems look like the programming of non-distributed systems. The infrastructure, it was thought, could be built to remove all of the differences between references to a remote service and references to a local service. This paper argues that all such attempts are doomed to failure and can, at best, enable the development of systems that are fragile, prone to unavoidable errors, and restricted in scale. In particular, we argued that distributed infrastructures must present a model of partial failure to the programmer, since only at the application level can such failure be dealt with; must deal with concurrency issues, rather than leaving them to the infrastructure; and must at the application level realize what parts of the program are local and what parts are at least potentially remote.

Within the Large-Scale Distributed Systems group, the paper became the foundation for a program of research that attempted to find simple mechanisms for the building of distributed systems without attempting to mask the distinctions at the programming model level between local and remote interactions. Part of the model that was adopted was to build systems that were simplified by being centered around a single language. A direct result of this work was the invention (by Ann Wollrath) of the Remote Method Invocation system (RMI) that has become a standard part of the Java™ platform. The paper also formed the basis of a design philosophy that led to the Jini™ Networking technology, in which many of the techniques and programming models first explored in the Large-Scale Distributed Systems project have found commercial use.

While originally written to set the context for a particular research group, the paper has had considerably broader impact than originally imagined. It has been widely cited, and has been reprinted in Vitek and Tschudin (eds), *Mobile Object Systems* (Springer, 1996) and Waldo, et. al., *The Jini Specification* (Addison Wesley, 2001). Indeed, the conclusions of the paper have become part of the accepted wisdom in the distributed computing community.