

12 Concurrency

12.8 Explorations

- 12.49 Find out how message passing is implemented in some locally available concurrent language or library. Does this system provide no-wait send, synchronization send, remote-invocation send, or some related hybrid? If you wanted to emulate the other options using the one available, how expensive would emulation be, in terms of low-level operations performed by the underlying system? How would this overhead compare to what could be achieved on the same underlying system by a language or library that provided an optimized implementation of the other varieties of send?
- 12.50 MPI provides extensive facilities for *collective communication*, in which there are more than two communicating parties. Examples include *multicast*, in which a message is sent simultaneously to a group of recipients; *scatter*, in which elements of an array-structured message are sent, one each, to a group of recipients; *gather*, in which an array-structured message is created, at the sole recipient, from elements provided by a group of senders; *all-to-all*, in which participants provide one element each of an array-structured message that is received by all; and *reduction*, in which messages from a group of senders are combined, using a commutative operator, into a result that is received by one or all. Learn more about both the semantics and the implementation of collective communication. What opportunities does it provide for optimizations that are difficult to implement at the application level?
- 12.51 Language designers and concurrency experts have argued for more than 30 years over whether shared memory or message passing is a more appealing programming model. The argument is to a large extent subjective—and hence not subject to definitive settlement—but it includes substantive

issues of fault containment, implementation efficiency, hardware requirements, and algorithmic expressiveness as well. Do a literature search on “shared memory versus message passing.” How many papers do you find? Read a sampling of these and summarize their arguments. Do you find any of the positions particularly convincing?