Exploiting Partitioned Synchrony to Implement Accurate Failure Detectors

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Abstract

We exploit the concept of partitioned synchrony to show that it is possible to implement accurate failure detectors in a non-synchronous distributed system. To realize that, we introduce the *partitioned synchronous system* (Spa) that is weaker than the conventional synchronous system. Based on some properties we introduce (such as *strong partitioned synchrony*) that must be valid in Spa and a trivially implementable timeliness oracle, we show how to implement a perfect failure detector P in Spa. Moreover, we show that even if *strong partitioned synchrony* is not valid, we are still able to take advantage of the existing synchronous partitions for improving the robustness of applications, by introducing a partially perfect (and accurate) failure detector named xP. We also discuss how applications can benefit from these failure detectors and present some related experimental data. The necessary properties and algorithms for implementing P and xP are presented in the paper, as well as the related correctness proofs.

Keywords: fault tolerance, distributed system models, perfect failure detectors, hybrid distributed systems.