How to Share a Bag of Tasks Optimally in a Heterogeneous Cluster — Three Models, Three Answers

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In the world of sequential computers, the abstract RAM model enables one to design provably efficient algorithms for a broad range of actual architectures and a broad range of workloads. In the world of multiprocessors, the abstract BSP model serves a similar function. No analogue of the RAM and BSP models is known for modern computing platforms such as clusters of workstations—especially heterogeneous ones, whose constituent workstations may differ in computational power—and the various modalities of Internet-based computing. In this talk, we present circumstantial evidence that no such single algorithmic model can exist for heterogeneous clusters. We describe three quite similar computational problems related to computing a large collection of mutually independent tasks on a cluster. (Two of the problems can be shown formally to be equivalent.) Despite their similarities, the three problems require drastically different algorithmic approaches if one wants provably optimal solutions.

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