Impact of Design of Communication Protocols and Choice of Transport Layer on the Power and Energy Consumption of Distributed Programming Models

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Abstract. The amount of energy consumed due to data movement poses a serious threat to the usability of distributed programming models on future systems. Message-passing models like MPI provide the user with explicit interfaces to initiate data-transfers among remote processes. In this work, we establish the notion that from a programmer's standpoint, the controllable factors like the size of the data-payload to be transferred and the number of explicit MPI calls to service such transfers have a direct impact on the pattern of the power-signatures of communication kernels. On a closer look, we further observe that the choice of the transport layer (along with the associated interconnect) and the design of the communication protocol to implement these transfer-routines are responsible for this pattern. This paper discusses these initial initial attempts in performing a fine-grained study on the impact of the power and energy consumption due to data movement in distributed programming models. We hope that results discussed in this work would motivate the design of "power-aware" middleware for use with HPC applications.