Charm++: on the road to Exascale

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The Charm++ parallel programming language and its adaptive runtime system is highly portable and will soon achieve a sustained petaflop of application performance on the upcoming Blue Waters system. This talk will discuss the Charm++ programming model, how it applies to a diverse set of modern parallel systems, and its benefits for complex, dynamic and multi-module applications. To simplify parallel programming further, we are developing a multi-paradigm approach that leverages compositionality supported by Charm++ RTS, and includes development of new "incomplete" languages (Multiphase Shared Arrays, Charisma). We are exploring the hypothesis that compiler support can improve productivity in non-traditional ways. Additionally, we are investigating how increased levels of dynamic adaptivity via collaborative reconfiguration of both the runtime and the application can improve performance with minimal programmer effort.