

Bugs: Black Ice on the Road to Exascale

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As we inexorably march toward increasing the volume of scientific results delivered per watt, worries about the quality and reproducibility of these results has become a first order concern. Of the various classes of "bugs" that portend slowdown, we clearly must rein in those caused by loose specification as well as widely prevalent misunderstandings about concurrency primitives such as fences and memory consistency models. We must also avoid bugs stemming from inadequate testing by developing methods that enhance code coverage, such as symbolic execution and active testing. Runtime monitoring methods are also essential, considering that the cognitive distance from a failure to its manifestation can be very high. Clearly, research is also needed to rein in on silicon variability and bit-flips. Floating-point accuracy estimation methods are also of paramount importance. Following the maxim of controlling the easily controllables first, this talk will attempt to portray bug classes, their severity, and imminent actionability, citing specific examples from the speaker's research group.