Heterogeneous Computing – It's Here to Stay, and Your Science Will Depend on It

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Abstract

For the past decade, hundreds or even thousands of talks and papers in the HPC world of scientific computing have introduced their research with a paragraph outlining the pervasive changes taking place in HPC architectures, and the impact that will have on application developers. Those authors were right – there is serious change happening in how we approach HPC unlike anything seen in the past 25 years, driven by power constraints with traditional CPU-based clusters. But if you were to read that corpus of papers, you might still come away feeling that confusion abounds in how to approach the problem. We can hopefully all agree that more powerful HPC enables better science – the ultimate end goal we all seek. This author has yet to see a compelling argument that once we attain a certain level of computing, whether it's exascale, zettascale, or beyond – that as domain scientists we will cease looking beyond the horizon of what we can currently do and feel satisfied as a community that we can peacefully sit back and declare an end to decades of relentless computing progress. While much uncertainty still exists in exactly how the next several decades will play out, this talk will argue that one certainty we can count on is that heterogeneous computing is here to stay, that you must embrace it, and there's no time like the present. In this talk, I will lay out the story of how scientists at Lawrence Livermore National Laboratory came to this conclusion, the difficulties that it entailed, the strategy we have pursued and continue to refine, and some initial results from our GPU-based system Sierra that has convinced us that we're on the right path. I will conclude with some opinions on where HPC is headed in the next decade, and how you as application and algorithm developers can and should begin now to prepare yourself for the inevitable.

References

1. J. R. NEELY. Heterogeneous Computing – It's Here to Stay, and Your Science Will Depend on It. ESCO'18 Keynote Presentation.