

CINECA Seminar
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E4S and the TAU Performance System for highly-parallel application profiling on heterogeneous machines

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Abstract

The DOE Exascale Computing Project (ECP) Software Technology focus area is developing an HPC software ecosystem that will enable the efficient and performant execution of exascale applications. Through the Extreme-scale Scientific Software Stack (E4S) [<https://e4s.io>], it is developing a comprehensive and coherent software stack that will enable application developers to productively write highly parallel applications that can portably target diverse exascale architectures. E4S provides both source builds through the Spack platform and a set of containers that feature a broad collection of HPC and AI/ML software packages that target GPUs from three vendors (Intel, AMD, and NVIDIA). E4S exists to accelerate the development, deployment, and use of HPC software, lowering the barriers for HPC and AI/ML users. It provides container images, build manifests, and turn-key, from-source builds of popular HPC software packages developed as Software Development Kits (SDKs). This effort includes a broad range of areas including programming models and runtimes (MPICH, Kokkos, RAJA, OpenMPI), development tools (TAU, PAPI), math libraries (PETSc, Trilinos), data and visualization tools (Adios, HDF5, Paraview), and compilers (LLVM), all available through the Spack package manager.

The talk will highlight tools such as the TAU Performance System(R) [<http://tau.uoregon.edu>] and its support of IBM Power 9 and x86_64 systems with support for instrumentation of applications such as Quantum Espresso (QE) running on CINECA's state-of-the-art hardware platforms. It will show how TAU can transparently instrument the application with no change to the binary to support both profiling and tracing modes of measurements. TAU supports I/O, communication, and memory footprint profiling as well as support for a large number of HPC runtimes including MPI, Kokkos, pthread, OpenCL, oneAPI DPC++ (Level Zero), OpenACC, ROCm, and CUDA. E4S includes these runtimes and features base and full featured Docker and Singularity container images and support for cloud platforms including AWS. The talk will highlight TAU's use in the EuroHPC ADMIRE project [<https://admire-eurohpc.eu>]. It will describe how TAU and E4S are installed on CINECA's systems and will show the users how they can create custom containers starting with the base GPU images provided by E4S.

Bio

Sameer Shende serves as a Research Associate Professor and the Director of the Performance Research Laboratory at the University of Oregon and the President and Director of ParaTools, Inc. (USA) and ParaTools, SAS (France). He serves as the lead developer of the Extreme-scale Scientific Software Stack (E4S), TAU Performance System, Program Database Toolkit (PDT), and HPC Linux. His research interests include scientific software stacks, performance instrumentation, compiler optimizations, measurement, and analysis tools for HPC. He leads the SDK project for the Exascale Computing Project (ECP), in the Programming Models and Runtime (PMR) area. He served as the General Co-Chair for ICPP 2021 and is serving as the the vice chair for technical papers for SC22.

He received his [B.Tech.](#) in Electrical Engineering from IIT Bombay in 1991, and his M.S. and Ph.D. in Computer and Information Science from the University of Oregon in 1996 and 2001 respectively.

