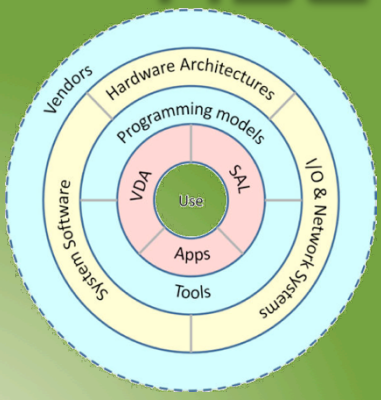
A Monte Carlo Transport mini-App for Exascale Co-Design R&D



Exascale co-design teams require representative applications to guide their R&D. All elements including Use through Vendors will need to utilize these *mini-Apps* to guide development if the final systems are to be of practical use.

One important application domain is ***Monte Carlo radiation transport***, an example of which is the family of codes referred to as MCNP [1]. Monte Carlo (MC) methods are widely used for studying the interaction of radiation with matter in almost every scientific and engineering discipline. These methods are essential to many NNSA missions. Areas of application include radiation shielding, radiography, medical physics, criticality safety, nuclear oil well logging, isotope production, accelerator target design, fission and fusion reactor design, and decontamination and decommissioning of nuclear facilities.

The goal of this effort is to define a neutral-particle (n,g) MC package tailored to solve one or more problems of interest and capable of running on emerging hardware/software paradigms. The *project goals* for the MC mini-App include:

- Clearly defining the *computational* requirements and constraints leaving the *computer* science open [2]
- Developing one or more sample implementations [3]

A Python framework, ***Exa*** [3], is being developed to allow execution of MC algorithmic steps with MPI, Cuda , OpenCL, OpenMP, and/or other paradigms that emerge.

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