A Pattern Language for High-Performance Computing Resilience

Achievement: Developed a pattern language that describes the fundamental nature of the task of building resilience solutions for high-performance computing systems and their applications.

Significance and Impact:
In order to construct effective and efficient resilience solutions for future extreme-scale HPC systems, a range of techniques will be necessary. The resilience design patterns only describe the essence of the solutions without providing guidelines on combining the various patterns. The pattern language provides clear instructions for grasping the entire collection of resilience design patterns and to create solutions that are based on a variety of pattern combinations.

Research Details:
• Pattern language defines the ordering of critical considerations and design decisions during the selection of patterns from the catalog.
• Highlights the relationships between patterns in the catalog

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Publications:

Overview:
Practical resilience solutions consist of one or more patterns that together support detection, containment and mitigation of specific types of faults. Therefore, establishing pattern interrelations is a key step in the direction of using the patterns to develop new resilience solutions, as well as to improve existing solutions to meet the requirements of future generations of HPC systems. In the design pattern specification, the patterns are organized in a layered hierarchy to establish a classification scheme for the patterns that highlights the primary relationships between the patterns in terms of their capabilities, type of events they handle, etc. However, to provide hardware and software designers with a systematic approach to develop resilience solutions, a more formal pattern language. The pattern language for resilience design patterns expands upon the initial design spaces framework (illustrated in Figure 1), to progressively refine the relationships between the patterns and optimizes the overall solution.