Researchers from MIT—including more than a dozen members of the Lincoln Laboratory Supercomputing Center (LLSC)—aim to speed up the process of monitoring, diagnosing, and fixing problems with multi-billion-dollar supercomputers. They plan to utilize Unity, a 3D game engine, to visualize the hardware.

Supercomputers are an extremely complex collection of hardware, as they operate with thousands of interconnected systems. However, there can be bottlenecks within the system that can result in reduced performance, as well as lost time while diagnosing those bottlenecks.

The average supercomputer has many components in the system. Each part of the system is called a node, and each node contains a specific set of hardware components. As a basic explanation, some nodes are designed for storing data while other nodes are for computing. The compute nodes typically contain processors and main system memory.

Engineers continuously test the machine during the installation process, encountering problems along the way. There could be storage, processor, and even networking problems in the system, and diagnosing the root cause can be difficult with such large-scale systems. For example, the upcoming Frontier supercomputer should have around 100 racks containing tens of nodes each, resulting in thousands of nodes to diagnose and monitor.

To help streamline these types of efforts, researchers from the Laboratory and MIT have developed a new technology to visualize node monitoring, offering real-time system reporting in the Unity 3D game engine found in many video games. Called the MM3D, it is a part of Data Center Infrastructure Management (DCIM) tools developed by the MIT SuperCloud division.

“The combination of supercomputing analytics and 3D gaming visualization enables real-time processing and visual data display of massive amounts of information that humans can process quickly with little training,” said Dr. Jeremy Kepner, Laboratory Fellow, LLSC, while summarizing a paper that the researchers recently published to nonprofit arXiv. “Our system fully utilizes the capabilities of modern 3D gaming environments to create novel representations of computing hardware, which intuitively represent the physical attributes of the supercomputer while displaying real-time alerts and component utilization.”

This means that this 3D engine can display component utilization and any alerts from the system in real time. For instance, if an alert pops up, a specific node could be overheating, and the system administrator would be alerted instantly in the 3D engine application.
While this is not a commercial application yet, this academic project could represent a step forward in the supercomputer monitoring department that helps ease system administration. Given that academic institutions share their work with other entities, it may be only a matter of time before we see a similar solution in the wild.

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The above figure shows in-game views (from top to bottom) of the Hewlett Packard Enterprise EcoPod, node layout, and a display that provides situational awareness of high performance computing components in real time.