Benchmark study examines results of leading high-level languages

In the science and engineering community, three computer-programming languages, MATLAB, Mathematica and Python, are among the most popular. Called high-level languages, they let researchers focus on solving problems by cloaking the basic, yet necessary, coding that computers require. Each language also has extensions for users to access remote high performance computing systems — without sacrificing their desktop environment and the productivity that comes with it.

But is one any better than the other? Ohio Supercomputer Center researchers are currently evaluating each computing solution against four HPC Challenge benchmarks: STREAM, FFT, Top500 and RandomAccess.

"By testing the benchmarks on an OSC research cluster, we can control the configuration and system load to ensure as objective a comparison as possible. We also examine code complexity and solution time," said Alan Chalker, Ph.D., program director of computational science engineering research applications at OSC. "We'll then conduct a sampling of these test runs on Department of Defense Major Shared Resource Centers supercomputers to validate the OSC-based results."

The underlying computational analysis behind each benchmark offers a unique evaluation of whether a particular solution offers advantages in terms of performance, memory use or code complexity. These results ultimately benefit the work of researchers in all branches of the military, as many use high-level languages. ■

Project lead: Alan Chalker, Ph.D., OSC
Research title: Benchmarking of parallel high-level languages
Funding source: Department of Defense High Performance Computing Modernization Program

Processing the sounds of a battlefield to evaluate targets

The sounds of war, when accurately captured and processed, shed their cacophonous echoes and leave a trail of unique, acoustical fingerprints.

Much like sonar detects and classifies underwater resonance, acoustic signal processing sensors capture sounds in the air. By using an array of sensors, military personnel can collect the distinct auditory signatures of combat vehicles and use that information to identify and track specific targets. This type of network, though, depends on establishing the sensors' locations through triangulation of the equipment. Environmental factors such as wind, hills or air temperature can affect this process, called self-localization.

Establishing the location requires applying a number of different algorithms to the data, which, as the number of environmental factors increase, takes correspondingly more time to process. Researchers at the Ohio Supercomputer Center, in partnership with the Army Research Laboratory, ramped up the analysis phase by refining several parallel processing algorithms. Parallel processing segregates calculations across multiple computer nodes.

"We tested various parallel processing technologies on a sample data set of 63 audio files and found ways to tweak the programs' codes for better, quicker results," said Ashok Krishnamurthy, Ph.D., senior director of research at OSC. "The faster researchers can process the sounds in any given area, the faster military leaders can make critical decisions about their course of action." ■

Project lead: Ashok Krishnamurthy, Ph.D., OSC
Research title: Object detection, localization & tracking using multiple sensors
Funding source: Army Research Laboratory