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Grid makes laptops sing

(Source: international science grid this week)

The Laptop Orchestra of Louisiana was on tour last month, and they did it with the help of grid technology.

A laptop orchestra uses ordinary laptops as instruments and sound sources to perform pieces composed for this unusual form of performance.

"The laptops in a laptop orchestras are generally thought of as 'meta-instruments' which can perform whatever kind of virtual instrument (software) with whatever kind of virtual control (user-interface)," explained Stephen David Beck, the director of the AVATAR Initiative in Digital Media at the Center for Computation and Technology at Louisiana State University.

Each musical composition consists of a unique combination of software code, middleware, and physical user interface such as a keyboard, trackpad, or joystick. The code is usually written in a higher-level language specific to music. The middleware is employed for low-level sound generation and interface control.

Each music composition must be performed from a traditional score, a controlled improvisation, or some other process chosen by the composer.

"Some of our compositions give every laptop the same virtual instrument. Others give a unique virtual instrument to each machine. And others mix and match," Beck said. "It depends on the composer's intent."

One of the central challenges a laptop orchestra faces is to create an enriched experience for the audience. Most laptop orchestras have adopted hemisphere speakers, which you can see in the picture above, so that each individual laptop's output is loud enough to be heard, yet remains local to that laptop, just as with any musical instrument. Beyond that, each ensemble finds different ways to ensure that the audiences have a good time.

"We think very hard about this, as we are very concerned about the 'performative' nature of our work," Beck said. "Audiences expect a physical relationship between what we do on stage and the sounds that we create. If we ignore this fundamental premise, it's hard for audiences to accept what we are doing as musically 'valid.'"

As with any traditional musical group, the performers that make up the LOL have defined roles and responsibilities. Unlike traditional musicians, they can play a different instrument during different compositions, and interface with their instruments via a variety of interfaces. They are also more than simply performers; each also contributes to the orchestra as composers and computer scientists.

LOL was first inspired by similar ensembles based at Princeton and Stanford Universities. It is both a research and performance ensemble which aims to explore the process of collaborative musical creativity as it interfaces with real-time computer technology.

The most computationally intensive piece the LOL performs, Quartet for Colors by Yemin Oh, uses laptop webcams to record fluorescent rings "played" by each performer. The color and motion of the ring is reinterpreted as sound, and video from each laptop is transmitted to the central node, combined, and projected on a screen behind the performers. To perform the piece, they need access to a wired network of at least 1 Gbps.

In the past, distributing the appropriate scripts and software for each musical piece to each laptop has been a headache.

"Software was distributed either by sneaker net (thumb drives), downloaded from a server, or by using ssh across the local network," Beck explained. "Specific configurations for each piece had to be dealt with on individual computers, unless the composer had created a script to automate part or all of that process. Pieces were launched 'by hand' on each individual laptop."

Now GRENDL, which stands for Grid-Enabled Deployment for Laptop Orchestras, is poised to change all of that. GRENDL leverages the Simple API for Grid Applications (SAGA) framework to handle a lot of that work.

"The genesis of the idea came as we were preparing for our first concert last year," Beck said. "All of these issues came directly to the fore, as we needed a way to quickly prepare laptops and launch applications for new pieces during the concert."

Beck raised their issues with Shantenu Jha, an LSU CCT researcher who is known for his expertise in grid technologies. Jha introduced Beck to SAGA.

"That's when I began to think of LOs as grids, and using SAGA began to make sense," Beck added.

Beck, Sharath Maddineni, and Chris Branton collaborated to create GRENDL, with a helping hand from Jha and Brygg Ullmer.

The software is still in a pre-beta phase. In fact, the LOL has not finished "GRENDL-izing" all of its own music. But once Beck and his colleagues have added some error-catching handlers for user feedback, they plan to release GRENDL for public use.

"That said, we have had a lot of interest from colleagues and I expect there will be significant adoption," Beck said.

Find out more about the LOL at their blog.

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