comprises 50 percent of their grade.

The teams are assigned to reflect a mix of experience in skills, according to Jones. "This more closely resembles the industrial environment, where you work with people of different backgrounds who are not necessarily your friends," Jones said.

Training

The projects relate to an HO-scale model train layout designed by Jones. The layout is composed of switches, a turntable, and several engines and cars, all under remote, digital control. Each team selects its own project, but must adhere to electrical and data standards. The designs must be power aware and each must include a real-time aspect. Teams are to write specifications, determine formal testing objectives, and specify how they are to be evaluated. As in real-world efforts, teams must supply documentation, a formal proposal, and interim reports. Beginning next year, at the end of the semester, teams will present formal poster sessions to judging teams.

The variety of requirements and parameters for the project does not limit the possibilities, according to Jones. "Teams have many options. They can take scenery and figures and make them react in a certain way to specific trains as they pass. They can set a camera in the train yard and create a system to sort trains by color or identity. They can develop a system for a train to react to another train on the track; or a system that generates sound in speakers as it tracks a train. All these projects have a real-time component," he said.

The projects include a fair amount of interfacing to the real world and responding instantly in reasonable ways. "But these are senior computer engineering students," he said. "This is a class to pull together all their skills in a complex project with embedded systems operating in real time."

Where have all the red squirrels gone?

Students in James Armstrong's Design of Systems on a Chip (ECE 5524) class jumped into bio-mathematical computation last fall when they designed hardware accelerators for a "competition between species" model. Until some Americans introduced gray squirrels into parts of England in the early 20th century, red squirrels had been the only species of squirrel in the country. The gray squirrels were larger and bred faster and successfully competed for resources. Within a couple years of overlap in an area, the red squirrels disappeared.

"There is enough data on the red squirrel/grey squirrel competition in England that it is an excellent introduction to computation for biological modeling," Armstrong said. Using an ARM processor and a field programmable gate array (FPGA), student teams were challenged to develop a hardware/software accelerator that could beat a Matlab standard for the model. Students were able to choose their strategy as long as the final system was a partitioned model between software and hardware, running on the ARM ASIC development platform. The teams found challenges ranging from serial transfer bottlenecks to memory storage.

The students enjoyed whole-system design approach. "I enjoyed working with a bunch of different things that all work together," said Brian Marshall.

Patrick La Fratta agreed, saying, "I've had classes on just FPGAs and others on just software. This involved the interaction of both types of components and was challenging and fun."