

# Information Technology

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CHRIS HILDRETH FOR THE CHRONICLE

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## *Computers Without Cables*

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**A** WEEK BEFORE the spring semester was to begin, Duke University officials had not decided where one entry-level computer-programming class was going to meet. The 32 students needed access to computers and to a network that would let them work together—a tall order on this campus, where most rooms are not wired.

But the man who teaches the course, George D. Stetten, wasn't sweating over such details. His students use portable computers, equipped with devices for wireless networking, that can be used nearly anywhere. The devices, about the size of a television remote control, use the same kind of infrared signals to move data between computers that a channel surfer uses to switch between HBO and MTV.

This wireless network lets students work collaboratively to teach each other the mysteries of computing and programming. They've set up their network in the regular, low-tech classroom that was assigned to the course, as well as in the cafeteria, in automobiles, and even outdoors. "We are a nomadic people," Dr. Stetten says with a laugh.

Connecting computers without cables allows flexibility and, in some cases, can save institutions a great deal of money over installing wires in buildings. Duke officials estimate that equipping a room with electrical outlets and computer wiring costs about \$20,000.

Despite the advantages, few universities use such systems today, largely because the networks generally are much slower or not as reliable as physical networks based on technologies such as Ethernet.

## TEACHING PROGRAMMING

The wireless network at Duke was not originally part of what the university calls its "Paperless Classroom" project, which was envisioned as a new way of teaching computer programming. It is the network, however, that has attracted the most attention.

Two years ago, Dr. Stetten had grown frustrated with the problems of trying to teach computer programming to freshman biomedical-engineering majors in a traditional setting. "You can't even see the students, because they're sitting behind these huge computers," he recalls. "You're up at the blackboard screaming over the sound of 20,000 watts of cooling equipment. Then they go home, and they're afraid to come to the lab across

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campus at night to do work outside of class."

Dr. Stetten, an assistant research professor of biomedical engineering and director of Duke's Visualization and Image Analysis Laboratory, worked with administrators at the university to develop a new way of teaching programming. Students who wanted to take the class were required to purchase portable Apple Macintosh computers, which are small and relatively light. "It gives them 24-hour access, it gives them pride of ownership, it's something that their parents expect them to learn," he says. Apple computers were chosen largely because they have some networking capability built into them.

## 'THICK CONCRETE FLOORS'

The Paperless Classroom project was slated to begin in spring 1994, and most of the 40 students who signed up for it had already purchased their computers before a major stumbling block appeared.

Participants were supposed to meet in Duke's new showcase classroom, with modern desks arranged in tiers. Dr. Stetten recalls meeting with members of the university's physical-plant staff several months before the class was to begin, to discuss installing the necessary network wiring.

"The electricians just came in and laughed at me," he says. "It turned out that this room had thick concrete floors.

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## Some Colleges Are Experimenting With Wireless Computer Networks

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and it would have been really expensive to do this. We just didn't have the money. And so I started madly looking at wireless networks."

Dr. Stetten got a San Jose, Cal., company called Photonics Corporation to donate 60 devices that send and receive data using invisible beams of infrared light. The small boxes, which plug into the

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back of a computer, normally sell for about \$250 each.

The students got the system up and running without a lot of heavy lifting, which was a relief to Dr. Stetten. "A lot of parents were saying, 'This better work,'" he recalls. "On our second lecture, some people were in the back of the room biting their nails. But we just plugged everything in, and within 20 minutes we had a fully functional network."

He uses a software package called "Timbuktu," developed by Farallon Computing Inc. in Alameda, Cal., to let students work together in the classroom. With all the computers linked together, he can take control of any student's computer and project the image from that screen on a much larger screen at the front of the room.

The system has transformed the way computer programming is taught at Duke. "There's a lot of using a computer that's difficult to explain but easy to show," says Dr. Stetten. "Leaning over somebody's shoulder is really where it's at in teaching this stuff, but you can't have 60 people leaning over your shoulder, or lean over 60 dif-

ferent shoulders. And the students are writing programs *together*, because that's the way they'll work in the real world."

The wireless network has proved surprisingly robust, he says. "The only time we ran into a real problem was one time when the university photographers came in, and their flashbulbs overloaded everything."

Students say the system works well. Roxanne N. Landesman, a sophomore majoring in biomedical and electrical engineering, took the course last year. "We used the wireless network all the time, not just in class," she says. "We exchanged homework on it, used it in the library. Sometimes we used it to play games. Once it was so nice we all just went outside to work."

The network proved particularly useful during the final collaborative project, she says. "The project was very difficult, and you really needed to work with everybody to finish it. We could do that anywhere, even in the cafeteria."

### TESTING IN MINNESOTA

Despite the advantages of such a system, few other institutions are using wireless networks. Bruce Brorson, director of continuing education at the University of Minnesota at Crookston, says his institution will start testing a wireless infrared system next month. He has been following closely the progress of Duke's experiment. "We're really still not quite sure the technology is ready for prime time," he says. "It's just too slow, unless you've got a very compelling reason for doing it."

Dr. Stetten acknowledges that wired networks are much faster, but he says he doesn't need quick connections to teach computer programming. "It is definitely slower, but it's not noticeable doing what we're doing."

Researchers hope that infrared-based networks can become much faster soon. Wireless networks that use radio waves are generally speedier but more expensive. It is

also difficult to set up radio-based systems in adjoining rooms, because the signals go through walls and tend to interfere with one another. Infrared signals can be confined within a room.

### 'JUST A PROTOTYPE'

Dr. Stetten says some students would like to take the class but can't afford to buy the computer. "That's a really serious problem. Each student spends about \$2,400. There are some people who have complained about it, and there's nothing I can do about it. All I can say is that someday, these things will cost about as much as a textbook. Until then, this course is still just a prototype."

It is a prototype that he hopes other institutions will emulate. "You learn programming by doing it. You have to experiment with it. I describe programming as a swamp with a bunch of walkways over it, and the trick is to learn how to stay out of the swamp. You don't get that kind of confidence without having done it." ■