

*External Research Digital Inclusion Program*

## Low-Cost Networking Solution Holds Promise for Rural Latin America

*Computers and communications technology can play an important role in improving people's economic prospects in all kinds of settings—even in communities that still rely on time-honored methods of manual production. A team of academic researchers in Uruguay is developing an innovative system to bring low-cost networking to rural enterprises so they can streamline their business processes and improve efficiency and communication.*

It can be hard to imagine how computers and networking might benefit people like the weavers and hand-knitters of the Cooperativa Artesanal Totoral Fray Marcos (CATFRAY) artisans' cooperative in southern Uruguay. But like small enterprises everywhere, including those that rely on traditional manual skills, the cooperative needs to track inventory, keep financial records up to date, record sales, and communicate within their organization and with customers—processes that are time-consuming and inefficient when done without any automation or communications technologies.

For the 30-some CATFRAY members, who live in two villages 43 miles (70 kilometers) apart, these processes have been cumbersome and have limited their business prospects because the region has only basic communications links. The value of the richly colored and extraordinarily beautiful wool sweaters, scarves and other items that the artisans produce would be immediately recognized in urban markets in Latin America and overseas, but the challenge is to connect with those markets.

A team of computer scientists at Universidad de la República (UdelaR) in Montevideo, Uruguay, has set out to create a solution that brings affordable wireless networking to rural businesses such as CATFRAY. With support from the Microsoft



*Totoral del Sauce, one of the two southern Uruguayan towns where researchers are field-testing a low-cost wireless networking system.*

### Fast Facts

**Project:** Wireless Ambient Networks for Rural Environments

**Project Principals:**

Professors Eduardo Grampin and Leonardo Vidal, Universidad de la República

**Partner:**

Cooperativa Artesanal Totoral Fray Marcos (CATFRAY)

**Web Site:**

<http://www.fing.edu.uy/inco/proyectos/wan/>

**Profile:**

A team of researchers in Uruguay is implementing a low-cost wireless networking solution designed for remote areas with minimal communications infrastructure. The system is being field-tested at an artisans' cooperative in southern Uruguay.

### Digital Inclusion Program

The Microsoft Research Digital Inclusion Program provided US\$1.2 million in research funding in 2006 to empower academic researchers worldwide to tackle technological challenges that could positively affect health, education and socioeconomic conditions. The 17 recipients, selected from among 162 proposals from 34 countries, received technology resources as well as project funding.

The Digital Inclusion Program is administered by the External Research group within Microsoft Research and is part of the group's ongoing commitment to investing deeply in innovative research. The External Research group collaborates with the world's foremost researchers in academia, industry and government to move research in new directions across nearly every field of computer science, engineering and general science.

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Research Digital Inclusion Program, the researchers are field-testing a wireless network architecture, a mobile computing infrastructure and custom business applications created for the cooperative, whose members are mostly women.

Led by UdelaR professors Eduardo Grampin and Leonardo Vidal, the research team designed the prototype system to work over a wireless Internet connection, but they plan to make the system usable over any form of connectivity because of the diverse patchwork of communications technologies in use in Uruguay. This type of solution is known as “ambient networking” because it allows connectivity over any existing networking infrastructures and accommodates diverse protocols for data transmission.

The researchers hope their system will serve as a model that can be applied throughout Latin America and in rural settings throughout the world.

*Grampin notes that digital inclusion initiatives for the developed world must take into account geography, population density and other factors, which is why no single rural connectivity solution can apply to all situations.*

The CATFRAY artisans work from home or from a cooperative office in one of the towns—Totoral del Sauce or Fray Marcos. Before the project began, the Totoral del Sauce office had one donated computer and an ADSL Internet connection, but the Fray Marcos office had neither. None of the artisans had computer access at home. While cellular phones are becoming more common in the area, most communication has continued to be in person, with CATFRAY members traveling between the offices by bus.

The prototype system tackles some difficult networking challenges because of the lack of mature networking infrastructures in the area. It includes two wireless clients in each office plus a central server, and it uses a mesh networking architecture, in which all network nodes, including mobile devices, are connected to each other. This means that the failure of one node or a service disruption—a common occurrence in rural areas—will not halt network traffic. The system software is also designed so that most network issues are resolved automatically, without the need for user intervention or technical support.

The research team, which also includes professors Javier Baliosian and Raquel Abella and graduate students Jorge Visca and Martin Giachino, rolled out the initial implementation in June and July of 2007. The setup phase included installing wireless routers, wireless antennas and cable,

as well as ensuring power supplies. Since that time, the researchers have been monitoring the amount of network traffic and the CATFRAY members’ ability to use the system, as well as making refinements such as weatherproofing. Design and software adjustments are ongoing and will include the addition of security features.

Since the project began, the Uruguayan government has launched an initiative to supply laptop computers to all students and teachers in public schools and to build the supporting infrastructure for network connectivity. “We are trying to align our objectives with this much bigger project,” says Grampin. “We think that we can share some of that infrastructure.” The research team also hopes that funding from local governments or other sources can help make larger deployments of the system possible.

Grampin notes that digital inclusion initiatives for the developing world must take into account geography, population density, cultural practices and other factors, which is why no single rural connectivity solution can apply to all situations. “Uruguay is a small country with a small population,” he says, “so most of the time the solutions for places like India or Pakistan are not adaptable to our situation. Basically, we should think about solutions for each place, even though we use the same technology.” He attributes the initial success of this project to the strong working relationship with the CATFRAY artisans and particularly its now-retired founder, Norma Carugno, a respected leader in the women’s cooperative movement in Uruguay.

Grampin hopes that his team’s project can contribute valuable insights to the field of low-cost wireless networking. “The technology itself is not a novelty, but this application is quite new,” he says of the project. “This is interesting not only for the community but for us as researchers. We are creating a live laboratory.”