



**Corpus Christi, TX  
Pioneers Metro-Wide  
Wi-Fi Mesh Net**

A Case Study



Corpus Christi, TX

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**-Leonard Scott, MIS Unit Manager**

### Introduction

Corpus Christi, Texas, rated one of the nation's top ten digital savvy cities in a Center for Digital Government poll, is innovating its technology infrastructure to boost workforce effectiveness and better serve its citizens.

The city is deploying one of the nation's first carrier-class citywide Wi-Fi mesh networks. It is powered by a joint solution from two companies, the mesh network from Tropos Networks and a mixed-use subscriber management and operations support system (OSS) from Pronto Networks. The network will link water and gas utilities, police, fire and public works departments, and public safety agencies to vital online information while they are in the field.

### History

Discovered by Spanish explorers on the Feast of Corpus Christi in 1519, Corpus Christi is the largest city on the Texas coast and the nation's sixth largest port. More than 247,000 people live within its boundaries, which curve around Corpus Christi Bay.

With a national reputation as a public services leader - the city was honored as one of ten All America cities in 2003 - Corpus Christi employs technology aggressively to enhance the productivity and efficiency of its municipal services. A fiber optic network backbone, installed as part of a centrally managed traffic control system, covers two-thirds of the city. Municipal employees access and share data via an enterprise-wide information system. Citizens and visitors sign onto the city's Internet site, cctexas.com, to pay their utility bills and traffic tickets, apply for jobs, view real-time City Council meetings and airline flight status data, check events calendars, and pinpoint lot-by-lot zoning or right-of-way easements via an interactive Geographic Information System map.

### Business Need

In 2002, Corpus Christi decided to automate meter reading for municipal gas and water services that supply a 147-square-mile area.

"Meter readers often have difficulty accessing a property because of fences or dogs," explained Leonard Scott, MIS unit manager and program manager for the WiFi project. "We average several complaints per day, every day, from customers who believe their utility statements are incorrect. If someone wants to buy a house, there is no easy way to check gas and water usage history."

With automated data collection, gas and water customers can check meter data online and view a property's gas and water consumption history. Instead of monthly meter readings, meters could be read daily, or even more frequently in the case of commercial customers and other large users. Close monitoring of consumption would allow the city to match daily gas usage with gas price fluctuations and better control water flow to reduce system breaks.

### Development Plan

Corpus Christi teamed with Public Technology Inc. (PTI), a national technology research and development membership organization, to work out specifications for the automated meter reading system. The team weighed the pros and cons of two possible implementations:

- Employ the city's already-existing fixed fiber optic network as part of an automatic meter reading (AMR) system
- Equip meter readers with RFID-based mobile equipment and have them drive by properties and capture meter data from a distance.

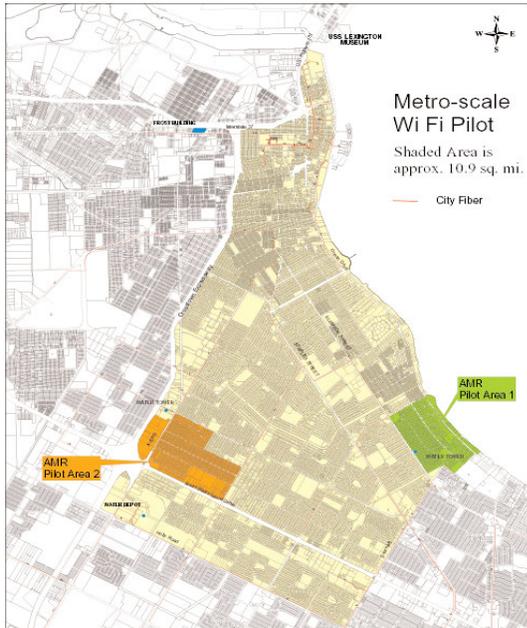


Figure 1: Pilot Plan Area

The mobile solution was slightly less expensive. But it was clear that the fixed network plan would save the city gasoline and manpower, and allow the meters to be read daily or more often, as Corpus Christi planned.

### Challenges

Corpus Christi's existing fiber optic network did not extend to the outlying eastern and western flanks - about a third of the area that the AMR system would need to cover.

The development team issued a Request for Information for a wireless network that would connect the outlying areas with the fixed network.

"Most of the proposals we got back were too expensive and/or did not meet our needs," Scott said, "but the one from Tropos Networks met all of our requirements."

Corpus Christi selected Tropos Networks as the sole-source vendor for a metro-wide Wi-Fi mesh network that would relay gas and water meter data from AMR concentrators to the city's Utilities Business office system. The Tropos 5110 outdoor cells combine the high bandwidth of the 802.11 Wi-Fi standard with cellular technology's extended range. Mounted on a traffic signal pole, they can pick up signals sent from up to a mile away.

The AMR application would use only a portion of the

Wi-Fi mesh network's bandwidth. City departments immediately saw the potential for a host of other services: vehicle equipped laptops for police, fire and other public safety officers; mobile desktops for field supervisors and managers; and anywhere, anytime access for residents and visitors to city resources such as the library, City Hall and museums.

The problem was how to permit broad use of the wireless network and at the same time, restrict the municipal system to authorized users and shield the highly confidential public safety system.

### Solutions

The development team looked at several hardware solutions but none offered the combination of flexibility and security that the city required. Pronto Networks' Metro-Scale Hot Zone solution did.

Pronto's broadband wireless platform supports VLANs that enable the network to be separated for public and private use. Corpus Christi's public safety departments can be on one network, its municipal systems on another, and residents and visitors on yet another, all sharing the same infrastructure.

The city also can set network privileges and control access. Municipal employees can be authenticated by their laptop's MAC address while residents and visitors must supply a username and password.

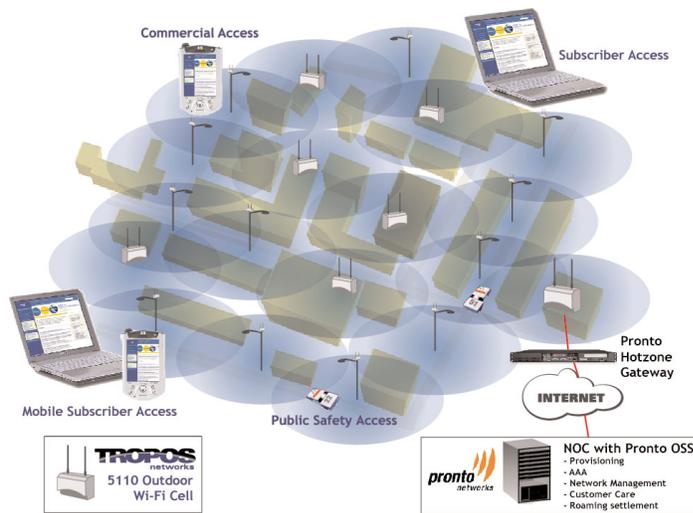
For added security, the Pronto solution provides a SSL-encrypted registration and authentication process and supports corporate VPN clients that allow city employees secure, encrypted access to the municipal information system.

Corpus Christi plans to partner with Internet Service Providers to deliver a host of revenue-generating services over the Wi-Fi network.

Finally, with Pronto, Corpus Christi can custom-tailor the main splash page and offer a walled garden - free unauthenticated access to government, utilities, zoning, and public safety sites. Each network in the system can have its own, distinct splash page as well.

"The Pronto Networks demo knocked everyone off their chairs," Scott said. "It was up and running in a day or so. We were online later that same day. It answered all of our security and networking questions."

Figure 2: Metro-Scale Wi-Fi Network



Pronto's OSS and Hotzone Gateway, combined with Wi-Fi mesh technology from Tropos, are key infrastructure elements in the city-wide pilot deployment.

### Implementation

Corpus Christi is implementing the Wi-Fi mesh network in two phases: A pilot that ends in November 2004, followed by a complete-build out to cover 147 square miles by March 2005.

In the first phase, a Wi-Fi mesh network consisting of 300 Tropos 5110 Wi-Fi cells, plus accompanying Pronto HotZone Gateways and Pronto OSS software, now covers 18.5 square miles of the city. Coverage areas include the downtown and the Convention Center/Arena complex, and two test areas. The city's work crews are installing the cells on traffic signals, street lights, water and radio towers, buildings, wooden poles and other city-owned assets. The average density is 18 cells per square mile.

This month, the city started providing the public with walled garden Internet access throughout the two-square-mile downtown coverage area. In the other test areas, AMR concentrators use the wireless mesh network, as do policemen, firemen, EMS and public works crews, and any other city workers with vehicles equipped for VPN access. When they are in the field, all of the workers can access every application available in their offices. When the entire network is built out, the system will also manage its fleet of 315 public safety vehicles with GPS-based asset and vehicle tracking applications.

Figure 3: Tropos 5110 Wi-Fi Cell



## Results

Local governments across the country are giving Wi-Fi a close look and many are beginning to consider wireless Internet access across areas ranging from downtown hotspot districts to hundreds of square miles.

Corpus Christi's planning partner, PTI, used the Wi-Fi pilot to develop a roadmap that other cities and counties can replicate. The city's experience formed the keystone for the PTI National Summit for Local Governments held in Corpus Christi, October, 2004.

Among the lessons learned: "Whatever you budget for installation and miscellaneous expenses, you will spend half again as much for implementation costs," Scott said. The city set aside \$1 million to purchase Wi-Fi equipment, figuring to save money by having its own traffic signal technicians install the cells. However, the technicians were stretched thin with other duties, which slowed the installation process. Also unforeseen was the need to upgrade traffic controller switches, and install lightning protection devices and weather-proof CAT 5 cabling.

## What Lies Ahead

Corpus Christi's Wi-Fi network opens up endless vistas for economic development and enhanced civic services.

Pronto Networks' standards-based platform allows municipalities to offer additional services such as voice and video on top of the wireless network. Equipping firemen and SWAT teams with locator chips and helmet-mounted wireless video cameras would help incident commanders and field personnel at the scene share knowledge during emergencies.

Securing the safety of the nation's ports is a major national concern. The city's port authority can equip containerized shipments with smart chips and precisely track their location as they travel from truck or train to ship.

Laptop-equipped schoolchildren can do research, check homework assignments and interact with their teachers from home. Their parents can telecommute to their offices downtown, or across the country.

"The Wi-Fi network is the biggest development to come to Corpus Christi, bar none," Scott declared, "and Pronto Networks is the bonding agent that holds it all together. Without Pronto, it would be impossible to manage the mix of public and private networks."



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