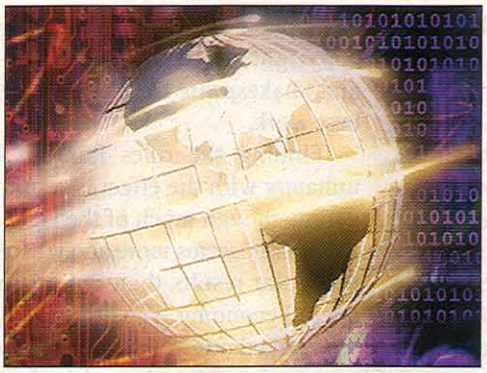

Municipal Wireless Networks Open New Access and Old Debates

Greg Goth

Around the world, ever-increasing numbers of government agencies are either deploying 802.11 wireless networks for public and administrative uses or studying how to do so. However, the booming popularity of municipal wireless networks has also amplified an ongoing public policy dispute, especially in the US.

Esme Vos, founder of muniwireless.com, an Amsterdam-based clearinghouse of information on municipal wireless deployments and issues, says interest in the topic has grown substantially in the past year. In June 2004, she had just over 650 subscribers for her weekly newsletter on municipal wireless. By March 2005, that number had increased to 1,700.

In the same time, the number of public-sector wireless networks also increased globally from 80 to 110. Vos says 12 networks are in the planning stages, most notably in Philadelphia and Taipei, whose networks should span most, if not all, their respective areas.

Supporters of municipal wireless networks say they're a vital solution to many locations' last-mile broadband problems. Such locations either can't get broadband because they're too far from providers' physical facilities or because the services are too costly for area residents. Relatively economical to deploy, municipal networks offer broadband capabilities to businesses, residents, and tourists, serving as a vital economic engine. Moreover, by deploying such networks, both commercial vendors and academic researchers can learn much about technological issues such as optimum antenna deployment and dynamic management of large wireless layouts.

But current providers, who depend on broadband revenue to make up for declining income in the voice market, see these networks as a threat. In the US, incumbent telecommunications providers are attempting to block public-sector broadband networks of any kind by influencing state legislatures to pass laws banning them. Supporters of such legislation say it's meant to short-circuit municipal networks that have unfair financial advantages in what should be a free market. Network supporters, however, say the incumbent providers didn't invest in last-mile networks quickly enough to ensure economic competitiveness. In low-income neighborhoods in large cities and in rural areas, for example, the pure market approach doesn't provide sufficient incentive for incumbents to offer broadband or for consumers to pay the incumbents' prices.

If Not Now, When?

Vos, an intellectual-property attorney specializing in telecom issues, says that the European telecommunications market has opened up, similar to the breakup of AT&T in the US, resulting in lower prices and improved service. The European Union has continued to compel the former state-owned incumbents to open their facilities to other providers, resulting in last-mile broadband that, for the most part, is more plentiful and cheaper than in the US.

Asian broadband networks have also outstripped those available to US consumers, and Frank Caruso, information technology director for the Borough of Kutztown, Pennsylvania, says representatives of Korean and Japanese firms have visited the town to inspect its municipally owned fiber network (www.kutztownboro.org/Misc PDFs/Folder Inserts.pdf) and brainstorm on how to further leverage the massive investments their nations' governments have made in broadband infrastructure. Caruso says the success of these public–private efforts shouldn't be lost on the US domestic market.

However, Link Hoewing, assistant vice president of technology planning for Verizon, which serves customers in 29 states, upholds the industry's argument against municipal networks.

"The concern in a lot of cases is, number one, they're trying to fund [the networks] with taxpayer dollars, and in many cases that's just an unfair competitive thing," Hoewing says.

More importantly, he says, there are ways to deploy such networks in partnerships that avoid spending tax dollars and still let companies do it on a contractual basis. In many instances, the network is open after it's built, and private companies can come in and run the services as well.

SBC spokesman Marty Richter echoes Hoewing's concerns about public-sector financing.

"The investment and losses are sub-

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chair of the IETF. Carpenter is an IBM Distinguished Engineer and former chair of the Internet Architecture Board. In addition to the IETF, he will chair the Internet Engineering Steering Group, which manages the Internet standards process.

An interview with Carpenter about his views of the IETF and his leadership goals is online at www.isoc.org/standards/carpenter.shtml.

The **UK** announced **a seven-point plan** in April that aims to make the nation one of the most digitally connected on earth. **Patricia Hewitt**, the UK's secretary of state for trade and industry, said that the new programs will **reduce the digital divide** and "transform the UK from a poor relation to a digitally rich nation in just a few years." Among the plans are universal online access for local public services, a national PC and laptop leasing program for students, and the expansion of broadband service access.

The UK Department of Trade and Industry's digital strategy report is available at www.dti.gov.uk/industries/telecoms/pdf/digital_strategy.pdf.

The **International Corporation for Assigned Names and Numbers** approved two **new top-level domains** at its April meeting in Argentina. Reflecting a move toward narrower content parameters, ICANN approved **.jobs** and **.travel**, which will be operated by Employ Media and Tralliance, respectively. The .travel handover to Tralliance generated some controversy; some critics claim the organization's handling of the matter once again casts doubt on the transparency and openness of ICANN procedures.

The ICANN announcement is at www.icann.org/announcements/announcement-08apr05.htm.

An overview of the .travel contro-

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easy compared to laying optical fiber. However, widening wireless networks' reach to include an area up to a city the size of Philadelphia, for instance, is sending researchers into the field to experiment with factors such as antenna placement and security protocols.

One such network is a project run jointly by researchers from Rice University and Technology for All (TFA; www.techforall.org), a nonprofit corporation bringing technology resources to low-income neighborhoods in Houston, Texas. They launched a Wi-Fi mesh network in February 2005 (www.techforall.org/tfa_wireless.html).

The network, which cost US$26,000 to deploy, consists of one wired entry point, 12 meshboxes, 12 omnidirectional antennas, two directional antennas, and one Ethernet bridge per home over a two-square-mile area (http://www-old.ece.rice.edu/networks/TFA.pdf). Although the network is capable of access speeds up to 11 Mbits per second, its designers opted for slower speeds per customer, due to traffic-management and tiered-pricing objectives. Initially, TFA will provide speeds of 1 Mbit per sec and 512 Kbits per sec at monthly charges approximately half that of comparable cable and DSL connections. TFA will offer a free 128-Kbit entry-level service to residents.

Edward Knightly, associate professor of electrical and computer engineering at Rice, says the network could yield useful information, not just for its own designers, but also for anyone interested in deploying wireless networks.

"I've made a course project out of this network because my students, both graduate and undergraduate, were so interested," Knightly says. "One of the problems they're looking at is antenna placement. They drive around the neighborhood with an antenna on a pickup truck, take measurements between existing stationary antennas, and correlate those with detailed maps that have features such as building size, foliage between antennas, and so on. In the end, we hope we'll have software tools others can use by inputting a generic city map, and it can tell you antenna properties and placement strategy."

Knightly says he and his designers have to ensure 1.5-Mbps access to the commercial customers TFA needs to maintain a viable business model.

"That's also driving our deployment. When we place a node, the very edges will get 1.5 Mbps. It's not going to be 1.5 anywhere within the neighborhood, but we want to make sure the key business hotspots get 1.5. Otherwise, we're targeting a minimum of 256 Kbits per second anywhere." To achieve that goal, Knightly says, they've designed the network mesh for four hops or less to any node from the network gateway.

Ironically, Texas lawmakers are considering a bill that would kill municipal networks, and Knightly says the law could have a chilling effect, not just on commercial deployments, but also on research like his.

Security and Access Concerns

Perhaps the security implications of having thousands of users online at once will be the biggest stumbling block to attracting lucrative commercial customers to municipal wireless networks. Close on its heels will be allowing access to devices configured with static IP addresses or corporate virtual private network (VPN) software – configurations that are often incompatible with the dynamic-addressing scheme of many hotspot-type networks.

Nigel Ballard, director of wireless at Matrix Networks (www.matrixnetworks.com/) in Portland, Oregon, is also on a city-commissioned committee planning a wireless network, and he finds the security issue vexing.

"If you have a residential wireless router in your home and you put WEP [Wireless Encryption Protocol] on it, that's fine," Ballard says. "You're passing so little traffic through that access point, somebody would have to park outside your home for a day and a half

sidized by taxpayers, or by ratepayers through cross-subsidization from city utilities or departments," Richter says. "Municipalities must divert scarce funds from other priorities – roads, sewers, law enforcement – to cover them. And even where government-owned networks succeed, they force consumers who do not use high-speed Internet access to subsidize those who do.

"Municipalities can adopt best-practice rights-of-way [ROW] management policies to encourage broadband deployment by private companies – things like authorizing providers to use ROW for broadband infrastructure, limiting ROW fees to cost-based fees, and establishing simplified permitting and approval."

One municipal network advocate says the incumbents' concerns about public-sector financing are smoke screens for hesitation to invest in places where the number or type of customers doesn't meet corporate dictates.

"Municipalities across the country are saying it's not a question of selling entertainment to the public, it's a question of economic survival," says attorney Jim Baller, founder of the Baller Herbst law firm, which specializes in public-communications policy. "It's a matter of attracting and retaining businesses and jobs, providing for educational and occupational opportunity, homeland security, and environmental protection – myriad issues that contribute to a high quality of life – and they feel they've got to take matters in their own hands. In virtually every project I've been involved in [during] the last decade – and I've been involved in most of the leading projects – at one point or another, every single project involved an effort by the municipality to go to the incumbents and try to work together."

The incumbents, Baller says, have responded in one of three ways: they flatly refuse to work with the public sector, they express interest and don't follow through, or they want to dictate conditions "so one-sided and limited in scope, they're not workable for anybody."

Kutztown IT director Caruso says the borough's efforts to partner with incumbent providers to build a fiber network were originally ignored or rebuffed. The borough went ahead and built its fiber network in 2002, financing it via taxable bonds. Caruso says it plans to expand to wireless services for existing subscribers soon.

Baller says the number of proposed antimunicipal network bills has increased, from four to six in prior years to 11 this year. Interestingly enough, West Virginia introduced legislation specifically authorizing public-sector broadband networks in late March 2005. Within a week of its introduction, vigorous lobbying by incumbent providers considerably weakened its sweeping authorizations for public networks.

The patchwork of state laws has aroused the ire of former US Federal Communications Commission chair Reed Hundt. In a paper for the Stanford Institute for Economic Policy Research that was released in March 2005, Hundt called for Congress to override any state prohibitions (http://siepr.stanford.edu/papers/pdf/04-07.pdf).

"Congress should pass a law declaring that communities should have the ability to use their funds in a way that they see fit," Hunt wrote with coauthor Gregory Rosston. "The government should make it clear that if citizens decide to operate their own co-op or municipally owned franchise to provide broadband services on a wireless, wireline, or hybrid basis, they can legally do so. It is astounding to think that government instead may bar citizens from coming together to buy common communications capability."

Technological Lessons

The widespread popularity of 802.11 networks in many public surroundings, such as hotspots in cafes and airports, has made theoretical deployment of municipal wireless networks relatively

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The **Open Source Initiative (OSI) board** adopted new approval and classification systems for **open-source licenses** at its April meeting in San Francisco. Calling license proliferation "a significant barrier to open-source deployment," OSI said that approved licenses must be nonduplicative, clear and understandable, and reusable. They will also be classifying approved licenses as preferred, approved, or deprecated.

More information is available at www.opensource.org/docs/policy/licenseproliferation.php.

The **Electronic Frontier Foundation (EFF)** announced its 14th annual **Pioneer Awards** in April, honoring three individuals for advancing the causes of human rights and civil liberties in the high technology area. The honorees are **Patrick Ball,** a human-rights activist and director of the Human Rights Data Analysis Group at the nonprofit Benetech (www.benetech.org); **Edward Felton**, author of the "Freedom-to-Tinker" blog (www.freedom-to-tinker.com) and a Princeton University professor whose work focuses on security and technology law and policy; and **Mitch Kapor**, president of the Open Source Applications Foundation (www.osafoundation.org), founder of Lotus Development, and cofounder of EFF.

Further information on the honorees is available at www.eff.org/news/archives/2005_04.php#003496.

April also marked the release of the EFF's "**How to Blog Safely (About Work or Anything Else)**." The guide gives practical and technical advice for keeping blogs anonymous, as well as a guide to legal protections from employer punishments related to blog postings.

The free guide is available at www.eff.org/Privacy/Anonymity/blog-anonymously.php.

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to get enough useful packets to crack the key. But on a public hotspot, that AP [access point] on top of that light pole is passing one hell of a lot of traffic. You may be able to get sufficient interesting packets in 20 minutes from that AP to crack the key, and then you're in the network."

In addition, Ballard says, trying any kind of a key-management scheme on such a wide-open public network is highly implausible.

However, a dynamic network management gateway might provide some sort of operator assurance. Ballard manages wireless networks for hotels in 35 states, and says highly intelligent gateway devices work well in such high-traffic areas. Matrix uses Nomadix gateways, which let network engineers assign dynamic IP addresses and VPN routing, as well as dynamically monitor port usage.

"If you open more than 40 virtual ports, you're doing one of three things," Ballard says. "One, you've got a virus on your laptop [that] is trying to open thousands of ports to spam the world. Two, you're running Kazaa or one of those Grokster programs that will suck the life out of the T-1. Or, three, you're running one of those multiuser games and trying to connect to servers all around the world. Any of those three things can effectively suck the life out of a network, and I will block you automatically."

Whether such dynamic management can scale to the size of a citywide network is an open question. However, advocates say that the need to address such questions supports their contention that more networks, run by many different types of organizations, will be a boon for all.

Rice's Knightly says all options for broadband infrastructure should be left open – that way, public and private sectors and commercial and research engineers could all benefit from mutual investment and resource sharing.

"I've been trying to advocate to the telecommunications industry that projects like this will only increase demand for broadband and increase the size of the pie," he says. "All the bandwidth we generate in our network needs to be backhauled, so I hope they'll see this as an opportunity for them as well. This is bandwidth demand that just wouldn't exist otherwise, and they'd want to do additional applications such as voice over IP as well. But in the meantime, that's not the way they see it. They see it as a competition."

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versy is available from ICANN watcher Edward Hasbrouck at www.hasbrouck.org/icann.

The **Internet Society** is accepting nominations from ISOC members for its 2005 **Jonathan B. Postel Service Award** through 20 May. The award honors individuals who've displayed leadership and made a substantial technical and service contribution to the data communications community.

Details are available at www.isoc.org/awards/#details.