DECLARATION OF QUINTIN LEW

EXHIBIT 14

ClariNews Hot News Special Edition

Arcwave Introduces ARCXtend Wireless Plant Extension Solution for Cable MSOs

Story from Arcwave via BizWire
Monday, 15-Sep-2003 6:10PM PDT

CAMPBELL, Calif.--(BUSINESS WIRE)--Sept. 15, 2003--

ARCXtend(TM) solution enables cable MSOs to expand beyond residential

markets into $100B small and medium-sized business market

Arcwave, Inc. today announced availability of the industry's first wireless solution purpose-built to enable Cable MSOs to profitably expand high speed data service beyond the limits of their cable plant and reach Small and Medium-sized Business (SMB) customers in their franchise areas. With their extensive fiber networks and advanced IP service capability, Cable MSOs are ideally positioned to target the 8 million plus domestic SMBs and garner a significant share of the $100B they spend annually on voice and data services. While an estimated 90% of these SMBs are within a few miles of cable operator's network, today operators are finding that many cannot be connected because of cost, right of way, or timing issues. With the introduction of ARCXtend Cable MSOs can now provide service to almost any SMB customer without the hassle, delay, and of laying new cable.

"Wireless access technology offers the potential for cable MSOs to significantly increase their penetration of the commercial voice and data services market," said Lindsay Schroth, an analyst for the Yankee Group's Broadband Access Technologies research and consulting practice. "With the introduction of ARCXtend, Arcwave has made it possible for Cable MSOs to deploy and manage a last mile wireless solution without a major capital or operating investment. Because ARCXtend leverages existing network and support infrastructure, initial capital cost is kept low providing a financial model that enables cable MSOs to continue to grow their revenue base even in tight capital markets."

"ARCXtend will enable us to satisfy the tremendous demand for high speed data service in our franchise area," said Tim Lenz, head of technical operations for USA Media, a current user of the ARCXtend solution. "Before ARCXtend we had to turn away commercial business because they were beyond the reach of our network. Arcwave's solution will helps us reach these customers without additional network build-out, and enable us to profitably deliver broadband service to these customers."

ARCXtend transparently carries DOCSIS channels over high reliability wireless links. When an aerial or trenched drop is not an option, a strand mounted ARCXtend AX1255 Network Hub can be deployed by cable technicians in a matter of hours to meet immediate service demand. An ARCXtend Network Hub can also be deployed on a utility pole or other structure to provide wide area coverage to lucrative commercial districts such as office parks, campuses, or municipal complexes. In either configuration, customer access is provided by a standard cable modem connected to an ARCXtend AX3155 CPE installed at the customer site. The ARCXtend AX1255 Network Hub uses cable-industry technology and communications protocols, including SNMP, enabling direct integration with existing network infrastructure and network management systems. ARCXtend is also fully compatible with existing customer support and provisioning tools.

About Arcwave

Arcwave is a leading developer and provider of affordable licensed and un-licensed band broadband wireless access solutions that enable widespread deployment of broadband services.

U.S. Corporate Headquarters:

Arcwave Inc.

910 Campisi Way, Suite 1C

Campbell, CA 95008

www.arcwaveinc.com

Tel: 408-558-2300

Fax: 408-558-2302

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ARCWAVE
THE STANDARD IN WIRELESS

Press Releases

Arcwave Introduces ARCXtend™ Wireless Plant Extension Solution for Cal

ARCXtend solution enables cable MSOs to expand beyond residential mari $100B small and medium-sized business market

CAMPBELL, Calif., September 15, 2003 — Arcwave, Inc. today announced availab industry's first wireless solution purpose-built to enable Cable MSOs to profitably exp speed data service beyond the limits of their cable plant and reach Small and Medium Business (SMB) customers in their franchise areas. With their extensive fiber network advanced IP service capability, Cable MSOs are ideally positioned to target the 8 milli domestic SMBs and garner a significant share of the $100B they spend annually on v data services. While an estimated 90% of these SMBs are within a few miles of cable network, today operators are finding that many cannot be connected because of cost way, or timing issues. With the introduction of ARCXtend Cable MSOs can now provid almost any SMB customer without the hassle, delay, and of laying new cable.

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About Arcwave

Arcwave is the leading developer and provider of wireless plant extension solutions for tl industry. Arcwave's products enable domestic and international multiple system operatc leverage the latest wireless technologies to extend the reach of their existing services ar service offerings within their current plant and operating infrastructure. The company hi technology and experience in the wireless industry combined with a unique understandir business model. Arcwave's solutions are designed for "plug and play" deployment and le existing and future technologies, such as Wireless DOCSIS (Data Over Cable Service Int(Specification), 802.11, 802.16d, and 802.16e. Arcwave customers consist of leading MS one of the top five national cable operators in the U.S. The company is funded by Mayfi(Associates, Lucent Venture Partners and SBV Venture Partners.

U.S. Corporate Headquarters:	**Arcwave Contacts:**
Arcwave Inc. 910 Campisi Way, Suite 1C Campbell, Ca 95008 www.arcwaveinc.com Tel: 408-558-2300 Fax: 408-558-2302	David Fonkalsrud K/F Communications, Inc. (415) 255-6506 dave@kfcomm.com Julie Karbo K/F Communications, Inc. (415) 255-6505 julie@kfcomm.com

DECLARATION OF QUINTIN LEW

EXHIBIT 15

Lew Decl. - Exhibit 15

Type in your question here: search in: About XO Find

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XO® Network

Network Details

Core OC-192 IP Backbone

The core of the XO backbone network is a mesh of OC-192 circuits, connecting XO Peering POPs and XO Data Centers. The XO OC-192 IP backbone runs completely across its own Inter-city facilities. Using a mesh of physically diverse OC-192 circuits, this backbone interconnects our five data centers with multiple high-capacity peering interconnections. Additionally, XO offers Dedicated Internet Access (DIA), DSL and Dial customers enhanced Internet connectivity by connecting each DIA market to the OC-192 backbone with dual OC-12c SONET-protected circuits*. This network design delivers maximum end-to-end throughput as well as high levels of protection and redundancy.

Our OC-192 backbone utilizes an advanced IP design, ensuring scalability as well as the ability to offer advanced future IP services plus the added benefit of no single IP point of failure past the customers' access port.

And since the XO OC-192 backbone and market connections run end-to-end across XO facilities, XO can quickly resolve any problems that may occur without any delays; this eliminates many of the common failure points found in older network designs.

Peering Infrastructure

As one of the few fully peered, facilities-based Tier 1 network backbone providers in the U.S., XO has substantial private peering arrangements in many metropolitan areas at speeds of up to OC-12. As a Tier 1 Internet provider, XO is constantly improving its peering infrastructure to benefit our customers. Those advantages include:

- Multiple and geographically redundant dedicated connections to other Tier 1 Internet backbones. Dedicated and private connections mean traffic crosses the XO backbone and the peering partner's backbone only. Customers benefit because data packets to and from the peering networks reach their end destination quickly and with lower risk of loss.
- XO peering relationships are monitored and maintained 24x7.
- Quality control of the XO network because we don't have to rely on other networks for Internet connectivity.

Connectivity from Internet Access POPs to the backbone

XO currently offers Dedicated Internet Access connections via 36 Metro POPs in 31 markets and DSL connections in 45 markets. All DIA markets are connected to the closest OC-192 IP Core Node; dual uplinks are provided from each Metro market into the closest Inter-city core node at speeds from OC-3c (155 Mbps) to OC-48c (2.4 Gbps)

Contact XO

Sales

Call toll-free 1.866.963.9696

Contact us online

Support

Call toll-free 1.888.575.6398

Contact us online

Manage your account online

What's Hot

- America's Network Names Best Internet Access Provider
- Boardwatch Ranks Second in Backbone Performance
- XO Provides Broadband Services Using Upgraded Nationwide OC-192 IP Backbone Network

Network Diagnostic Tools

Examine connectivity, path, and route information in XO Data Network. Use Network Diagnostic Tools

View XO IP Assets Map

- Normal View - 800 x 600 (100 KB)
- Large View - 1600x1200 (215 KB)

Metro Fiber Connectivity

Metro Area Networks (MANs) allow XO to control customer traffic and ensure an efficient data transfer to the Inter-city network. metro-area networks are composed of enough metro fiber-optic cable to circle the globe more than 45 times -- 1.16 million metro fiber miles throughout 40 major US cities, including the largest 30 cities in the United States.

Unlike non-facilities based providers or long-haul providers, XO, with its MANs, has access to the end customer. The MANs enable XO to offer such dynamic products as Ethernet and SONET services that carry data faster and more efficiently than our competition. that carry data faster and more efficiently than our competition.

Wireless Spectrum

XO owns the largest footprint of U.S. fixed wireless spectrum, which covers 95% of the population in the top 30 U.S. cities. The frequency of the spectrum is 27 GHz-32 GHz and allows XO to offer broadband access services using Local-to-Multipoint Distribution System (LMDS) technology. This enables XO to bypass the Regional Bell Operating Companies (RBOCs) and provide direct access to our end customers.

View XO Market and Fixed Wireless Spectrum Map

- Normal View - 800x600 (100 KB)
- Large View - 1600x1200 (215 KB)

The Intercity Fiber Network

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XO has deployed an OC-192 (10 Gbps) network using Dense Wavelength Division Multiplexing (DWDM) routing technology. This Inter-city network spans 16,000 route miles across the continental United States. The extensive reach of the XO fiber network affords XO the unprecedented ability to manage customer data from the point of access to the point of termination. Owning such a vast network facility gives XO the power to:

- scale immediately to meet customer demand
- quickly respond to network issues and
- control prices charged to customers.

See Also:

- Network Diagnostic Tools
  Examine connectivity, path, and route information in XO Data Network
- XO Factsheet
- XO Product Portfolio

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10-K 1 d10k.htm FORM 10-K

UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549

FORM 10-K

☒ **ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the fiscal year ended December 31, 2003

OR

☐ **TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the transition period from _____ to _____

Commission file number 1-04721

SPRINT CORPORATION

(Exact name of registrant as specified in its charter)

KANSAS (State or other jurisdiction of incorporation or organization)	**48-0457967** (IRS Employer Identification No.)
P.O. Box 7997, Shawnee Mission, Kansas (Address of principal executive offices)	**66207-0997** (Zip Code)
Registrant's telephone number, including area code	**(913) 624-3000**

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Name of each exchange on which registered
FON Common Stock, Series 1, $2.00 par value, and FON Group Rights	New York Stock Exchange
PCS Common Stock, Series 1, $1.00 par value, and PCS Group Rights	New York Stock Exchange
Guarantees of Sprint Capital Corporation 6.875% Notes due 2028	New York Stock Exchange
Corporate Units	New York Stock Exchange

Securities registered pursuant to Section 12(g) of the Act: None

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file these reports), and (2) has been subject to these filing requirements for the past 90 days. Yes __X__ No _____

Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K is not contained herein, and will not be contained, to the best of registrant's knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K. ☐

Indicate by check mark whether the registrant is an accelerated filer (as defined in Rule 12b-2 of the Act) Yes__X__ No _____

Aggregate market value of voting and non-voting common equity held by non-affiliates at June 30, 2003, was $18,863,514,730.

COMMON SHARES OUTSTANDING AT FEBRUARY 27, 2004:

FON COMMON STOCK	**906,584,815**
PCS COMMON STOCK	
Series 1	**851,849,701**
Series 2	**184,745,330**

Documents incorporated by reference.

Registrant's definitive proxy statement filed under Regulation 14A promulgated by the Securities and Exchange

Commission under the Securities Exchange Act of 1934, which definitive proxy statement is to be filed within 120 days after the end of Registrant's fiscal year ended December 31, 2003, is incorporated by reference in Part III hereof.

SECURITIES AND EXCHANGE COMMISSION
ANNUAL REPORT ON FORM 10-K

Sprint Corporation

Part I

Item 1. Business

The Corporation

Sprint Corporation, incorporated in 1938 under the laws of Kansas, is mainly a holding company, with its operations primarily conducted in its subsidiaries. Unless the context otherwise requires, references to "Sprint," "we," "us," and "our" mean Sprint Corporation and its subsidiaries.

Sprint is a global communications company and a leader in integrating long-distance, local service, and wireless communications. Sprint is also one of the largest carriers of Internet traffic using its tier one Internet Protocol network, which provides connectivity to any point on the Internet either through its own network or via direct connections with other backbone providers. Sprint is the nation's third-largest provider of long distance services based on revenues, and operates nationwide, all-digital long distance and tier one Internet Protocol networks using fiber-optic and electronic technology. Sprint currently serves approximately 7.9 million access lines in its franchise territories in 18 states, and we provide local service using our facilities, leased facilities or unbundled network elements provided by other carriers in 36 states and the District of Columbia. Sprint is selling into the cable telephony market through arrangements with cable companies that resell Sprint long distance service and use Sprint back office systems and network assets in support of their local telephone service provided over cable facilities. Sprint also operates a 100% digital personal communications service, or PCS, wireless network with licenses to provide service to the entire United States population, including Puerto Rico and the U.S. Virgin Islands, using a single frequency band and a single technology. The PCS Group, together with third party affiliates, operates PCS systems in over 300 metropolitan markets, including the 100 largest U.S. metropolitan areas. The PCS Group's service, including third party affiliates, reaches a quarter billion people. The PCS Group, combined with our wholesale and affiliate partners, served more than 20 million customers at the end of 2003.

Sprint operates in an industry that has been and continues to be subject to consolidation and dynamic change. Therefore, Sprint routinely reassesses its business strategies. In light of events and specific changes in telecommunications, including bankruptcies, over-capacity and the current economic environment, Sprint continues to assess the implications on its operations. Any such assessment may impact the valuation of its long-lived assets. As part of its overall business strategy, Sprint regularly evaluates opportunities to expand and complement its operations and may at any time be discussing or negotiating a transaction that, if consummated, could have a material effect on its business, financial condition, liquidity or results of operations.

In the 2002 third quarter, Sprint reached a definitive agreement to sell its directory publishing business to R.H. Donnelley for $2.23 billion in cash. The sale closed on January 3, 2003.

In November 1998, Sprint's shareholders approved the allocation of all of Sprint's assets and liabilities into two groups, the FON Group and the PCS Group, as well as the creation of the FON stock and the PCS stock. FON common stock and PCS common stock are intended to reflect the financial results and economic value of the FON and PCS Groups. However, they are classes of common stock of Sprint, not of the group they are intended to track.

The FON Group is comprised of the global markets division, the local division and other businesses consisting primarily of wholesale distribution of telecommunications products. The PCS Group includes Sprint's wireless PCS operations.

On February 28, 2004, Sprint's board of directors decided to recombine the tracking stocks and return to a single common stock. As a result, each share of the PCS common stock will convert automatically into 0.50 shares of FON common stock on April 23, 2004. The FON stock will represent the only outstanding common stock of Sprint. After the recombination, Sprint will continue to present consolidated financial information, but will not include group level information. The recombination will not impact Sprint's current presentation of all required segment information.

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XO Tests Fixed Wireless Broadband Access

Posted on: 01/19/2004

PRINT

XO Communications, Inc. one of the nation's leading providers of broadband telecommunications services, today announces successful trials of its fixed wireless broadband access to dozens of customers in San Diego and Irvine, Calif. The company says the trials mean it could significantly reduce "last mile" costs for its business customers and propel XO into the last mile market for carrier customers.

XO used Using local multipoint distribution system (LMDS) technology to testt fixed wireless access with burstable bandwidth capabilities from 1 Mbps up to 20-plus Mbps. The company says XO Fixed Wireless Access provides businesses and carriers with a cost-effective, high-speed access solution to deliver all types of data and voice services including Internet connectivity, Ethernet, and VoIP services.

"These trials could be a very meaningful breakthrough for XO, in that XO can reduce "last mile" costs, XO can become even more price competitive than it is today for business customers. Additionally, this will allow XO to compete in the multi-billion dollar "last mile market" for carrier customers that now use the local RBOC," says Carl Grivner, CEO of XO Communications. Grivner adds there will be more trials before a national rollout can be undertaken.

This fixed wireless technology works by connecting the end user through fixed wireless access to PoPs on the XO metro fiber network, thus eliminating the need for the RBOCs' last mile infrastructure. With direct access to businesses and carriers, the widespread deployment of this wireless technology can significantly reduce the multi-millions of dollars in access charge payments that XO makes each year to the RBOCs. This third generation fixed wireless broadband access, in conjunction with XO's long haul, IP and metro fiber network,

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06/08/2005

CompTIA Forms Advisory Council for Resellers

PPL Launches T1 for Small Businesses

06/07/2005

CloseCall to Use CommPartners for VoIP

VoX Chooses Global Crossing VoIP Services

VoiceLog Creates Offer for Dictaphone Users

XML

also allows XO to offer a wide range of metro, national and global connectivity solutions.

The company claims its fixed wireless access has significant advantages over incumbents' wireline based access solutions including faster provisioning of Internet and Ethernet services and offers as much as three times more bandwidth for the cost of a traditional dedicated T1 circuit.

XO is the licensee of the largest U.S footprint of fixed wireless spectrum, covering 95 percent of the population in the top 30 U.S. cities.

WISP Directory

Welcome to the WISP Directory

A global directory of wireless Internet Service Providers and WISP industry- related websites provided by **WISP Centric**.

WISP Classifieds :: Start a WISP :: WISP Centric

Home

Main Menu

- Home
- Choosing a WISP
- Browse the Directory
- Search the Directory
- Add or Edit Your Listing
- Upgrade Your Listing
- Recommend Our Site
- Contact Us
- Weekly Newsletters
- Terms & Policies
- About Us
- Advertise With Us

Login Form

Username

Password

Remember me

Login

Forgotten your password?
No account yet? Create one

Latest Listings

PCS Internet Services
Xtratyme Nederlands

Features:

Start a WISP Knowledge Base - Are you interested in starting a wireless ISP but don't know where to start? Do you need help writing your business plan and could use some samples?

Random Listing

VOCAL Technologies, Ltd.

Directory Stats

There are 545 listings and 89 categories in the Directory today.
Directory last updated: 2005-06-08 16:39:42

Welcome to the WISP Directory

If you would like to add your **no-charge** basic wireless ISP (or "WISP") listing to the Directory, simply register on our site, login, browse to the category(ies) where you would like to be listed and submit your listing(s). We will review it within 24 hours.

In addition, you're more than welcome to **submit an image** (such as your logo) in JPG or PNG format (sorry, GIF format is not supported).

Or, if you're prefer, feel free to upgrade your listing to "featured" status which allows it to be placed at the top of the category in a special format to help it stand out.

In addition, WISP subscribers and end-users may submit reviews about their provider's service. They may also recommend a listing to a colleague via an interactive form.

Click on the following map to select the continent you wish to find service on or browse the Directory's base categories. If you are a WISP and are searching for service companies, i.e. associations, bandwidth providers, distributors, manufacturers, etc., please visit the "Services & Business Operations" category.

You may also use our advanced search form to search for a WISP's name, by zip code, by area code, etc.

Xtratyme Nederlands
Brand X Networks
Brand X Networks
Show more...

FEEDBURNER

WISP Centric Newsfeed
Daily wireless ISP industry news & information.

- **Comprehensive North American Airport Wi-Fi Guide**
- **WiMax Faces Scattered Spectrum Challenges**
- **BellSouth's Not-New, Not-WiMax Trial Is Also Not-Naked DSL**
- **US WiMax Looks to 2006**
- **FCC Chairman will stop at nothing to 'level the playing field'**
- **More on Motorola's BPL**
- **New spectrum on its way?**
- **Third UWB protocol "can co-exist"**
- **VOIP Tops Data for Metro WiFi**
- **BelAir Unwires Galt**

FEEDBURNER

Start a WISP feed

- **What applications do you use to run your WISP?**
  What free and $$ applications do you use to help monitor and run your WISP?...
- **Site survey with Netstumbler**
  Hi everybody, trying 2 see APs in my area with a laptop runnin XP, NL 2511...
- **Tranzeo Sector Pics and Question**
  I have my sector setup almost done but I thought I better ask before I install,...
- **How much fade margin?**
  At 2.4 G. when links are established, how much fade margin is usually used?If I remember...
- **two sets of sectors**
  I heard superdog mentioning putting two sets (3x120*) of 2.4 sectors on one tower; one set...

Weekly Newsletter Subscription

From the WISP Centric Group - highlights industry news, "Start a WISP" articles, tidbits, advice and suggestions, etc.

Name
E-mail
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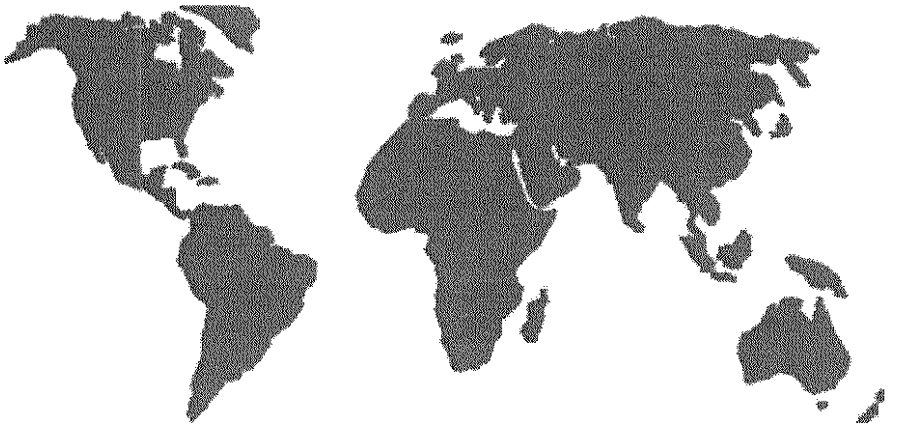
Unsubscribe
Go!

Featured Partners

American Alliance of Service Providers



Please don't hesitate to contact us with any questions, suggestions, etc. you might have.

Thanks for visiting!

- **WISPCentric.com** - a comprehensive global website organized in categories that contains links to:
  - Categorized articles and content submissions specifically related to the Wireless Internet Service Provider industry from various sources around the 'Net.
  - Newsfeeds from other WISP-related sites.Global Initiatives Wiki
  - Industry Events Calendar
  - Much more...
- **Start A Wisp.com** - a comprehensive resource for both new and established WISPs:
  - Provides content in a categorized and organized format including: business operations, network configuration, marketing & promotion and much more. Users may expand and offer additional input within each article, offering a collaborative and informative environment.
  - Image/Sample Network Drawing Gallery.
- **WISPClassifieds.com** - a listing of categorized private seller ads:
  - *No charge to submit an ad.*

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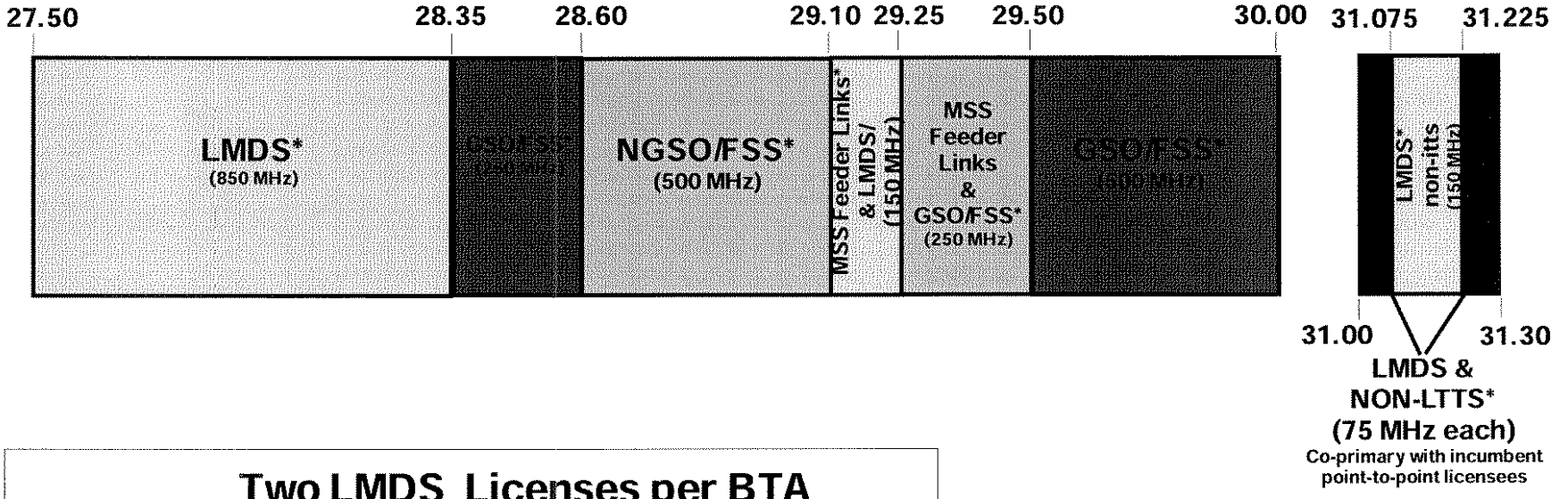
EXHIBIT 16

LMDS Band Allocation
(Local Multipoint Distribution Service)

28 & 31 GHz Band Plan



Two LMDS Licenses per BTA

Block A - 1150 MHz:
27,500-28,350 MHz
29,100-29,250 MHz
31,075-31,225 MHz

Block B - 150 MHz:
31,000-31,075 MHz
31,225-31,300 MHz

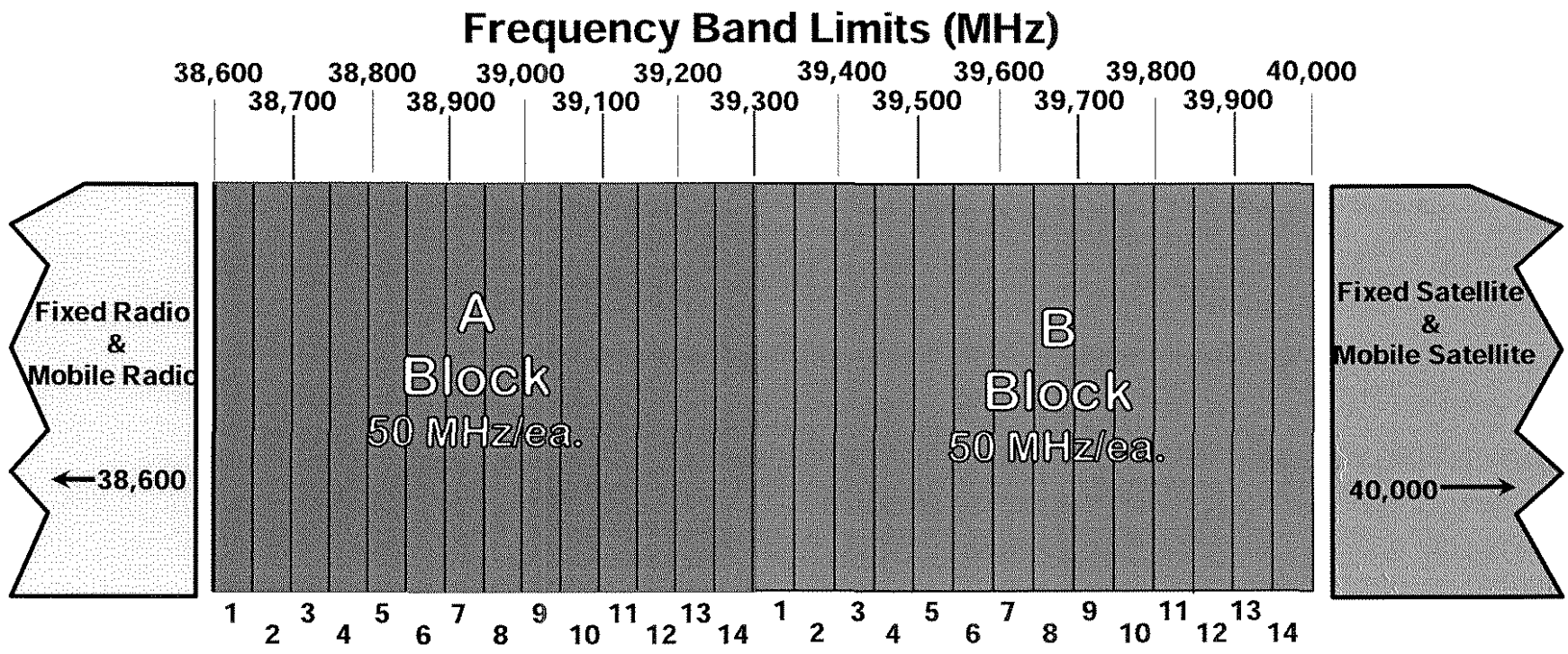
Legend

"*" - Primary Service
FSS - Fixed Satellite Service
GSO - Geostationary Orbit
NON-LTTS - Non-Local Television Transmission Service
MSS - Mobile Satellite Service
NGSO - Non-Geostationary Orbit

39 GHz Band Allocation

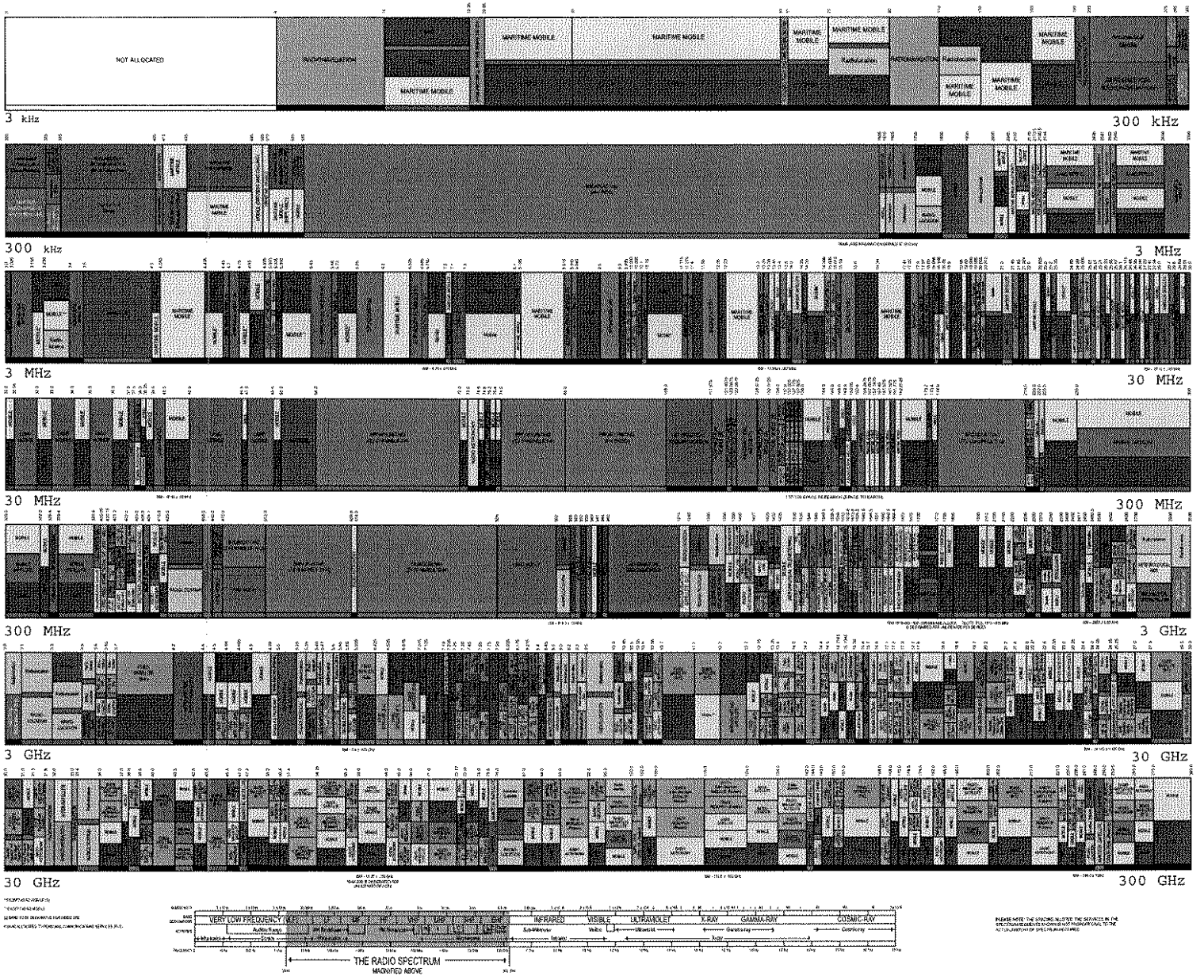
auctions

39 GHz



UNITED STATES FREQUENCY ALLOCATIONS

THE RADIO SPECTRUM



RADIO SERVICES COLOR LEGEND

- AERONAUTICAL MOBILE
- AERONAUTICAL MOBILE SATELLITE
- AERONAUTICAL RADIONAVIGATION
- AMATEUR
- AMATEUR SATELLITE
- BROADCASTING
- BROADCASTING SATELLITE
- EARTH EXPLORATION SATELLITE
- FIXED
- FIXED SATELLITE
- INTER-SATELLITE
- LAND MOBILE
- LAND MOBILE SATELLITE
- MARITIME MOBILE
- MARITIME MOBILE SATELLITE
- MARITIME RADIONAVIGATION
- METEOROLOGICAL AIDS
- METEOROLOGICAL SATELLITE
- MOBILE
- MOBILE SATELLITE
- RADIO ASTRONOMY
- RADIODETERMINATION SATELLITE
- RADIOLOCATION
- RADIOLOCATION SATELLITE
- RADIONAVIGATION
- RADIONAVIGATION SATELLITE
- SPACE OPERATION
- SPACE RESEARCH
- STANDARD FREQUENCY AND TIME SIGNAL
- STANDARD FREQUENCY AND TIME SIGNAL SATELLITE

ACTIVITY CODE

- GOVERNMENT EXCLUSIVE
- GOVERNMENT/NON-GOVERNMENT SHARED
- NON-GOVERNMENT EXCLUSIVE

ALLOCATION USAGE DESIGNATION

SERVICE	EXAMPLE	DESCRIPTION
Primary	FIXED	Capital Letters
Secondary	Mobile	1st Capital with lower case letters
Permitted	BROADCASTING	Capital Letters between oblique strokes

U.S. DEPARTMENT OF COMMERCE
National Telecommunications and Information Administration
Office of Spectrum Management
March 1998

BEAR STEARNS

Equity Research

JUNE 2004

U.S. Wireline/Wireless Services

Wireless Broadband: The Impact of 802 Technology

A Joint Study by Bear Stearns and TMNG

- **THIS REPORT ANALYZES WIRELESS BROADBAND'S POTENTIAL IMPACT ON THE TELECOM INDUSTRY.** In a joint study, The Management Network Group (TMNG) and Bear Stearns interviewed representatives of more than 25 organizations that are actively engaged in the wireless broadband market, including radio, chipset, and device manufacturers, established and upstart service providers, and financial institutions with investments in wireless broadband. We addressed the development of next-generation wireless broadband technologies, including WiMAX (802.16) and Mobile-FI (802.20), and their potential impact on wireline and wireless carriers. We believe this report provides a comprehensive overview of fixed, portable, and mobile services using these technologies.

- **KEY CONCLUSIONS.** The study has led us to four conclusions: 1) fixed wireless broadband service should not dislodge or disrupt existing broadband service in urban and suburban areas, but could be attractive in less competitive areas, e.g., rural geographies; 2) portable service will likely be dominated by WiFi due to its early lead, low cost, and value proposition for users; 3) mobile service presents the greatest opportunity for WiMAX and Mobile-FI and could replace traditional broadband, but this application will take longer to develop and will likely require licensed spectrum, potentially limiting how carriers deploy the service; and 4) backhaul and campus opportunities exist, but simply represent a new product suite to complement existing wireline and wireless solutions.

- **IMPACT TO SERVICE PROVIDERS.** We believe that potential winners include rural companies looking to expand their broadband reach, IXCs seeking to reduce their dependence on incumbent networks, and wireless companies with licensed spectrum who can complement their current 2.5/3G buildouts. Near term, we do not expect these technologies to be disruptive to existing telecom providers, but we think they offer enough potential to warrant careful monitoring.

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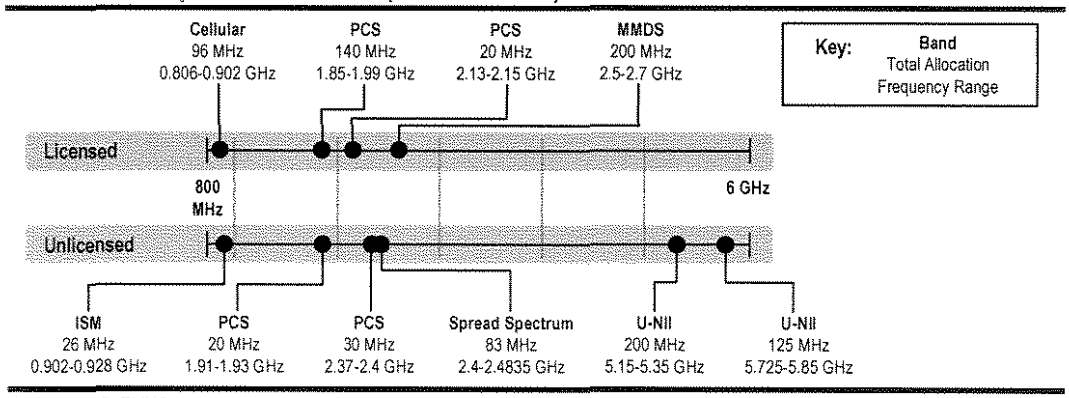
- **Installation** of service for customers requires careful engineering. This process is highly manual and expensive, comparing unfavorably to the automated self-install procedures being enacted by most cable and DSL providers.
- **Inter-carrier agreements** between WISPs allow for actionable spectrum sharing, but only in cases where operators are willing or able to work in good faith. Large-scale deployment would complicate these arrangements exponentially.
- **Scarce resources** such as free spectrum will necessarily disappear as profit opportunities materialize. This is the so-called "tragedy of the commons," which has led regulators worldwide to issue spectrum licenses for wide-area applications.

Turning our attention, therefore, toward licensed spectrum, the MMDS bands seem the most likely candidates in the United States. Cellular and PCS spectrum is already in short supply, at least in major markets, and the likelihood of a mobile carrier dedicating this spectrum to a fixed application seems low. Sprint and Nextel are the major owners of U.S. MMDS spectrum today.

Exhibit 22. U.S. Spectrum Allocations (800MHz to 6GHz)



Source: FCC; TMNG.

What About Additional Spectrum Allocation?

While this alternative has received some attention recently and is being actively pursued by Intel and others, it is a distant solution, given the strength of various lobbying groups who would oppose such measures. The lobbying against additional unlicensed spectrum would most likely be led by broadcasters (who are likely to be displaced or dispossessed of existing spectrum), wireless carriers (who paid for their spectrum), and wireline players (who stand to lose from market entry by any new players). This, combined with the inherent slowness of the regulatory process, makes new spectrum allocations, licensed or unlicensed, unlikely over the short to mid-term.

Outside the U.S., spectrum availability must be assessed on a regional or national basis. It is very difficult to generalize, owing to differences in the frequency range, number of licenses, block size, and timing of spectrum allocations from individual regulators. The nature of license holders also varies significantly, with incumbent cellular or fixed line operators often facing restrictions. Nonetheless, efforts toward global harmonization of wireless broadband spectrum allocations are under way. Our

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TOWERSTREAM: FCC RULING TO STRENGTHEN DEMAND FOR WIRELESS BROADBAND ALTERNATIVES

Middletown, R.I.---December 17, 2004---On Wednesday, December 15, the Federal Communications Commission (FCC) ruled that Incumbent Local Exchange Carriers (ILECs) such as Verizon and SBC are no longer required to subsidize their competition, the Competitive Local Exchange Carriers (CLECs) in high-density metropolitan areas. It is widely recognized that the FCC ruling will empower ILECs to raise prices on T-1 and DS3 loops in dense urban environments.

The only way to avoid the impending rise in prices is to bypass the ILEC's wires altogether. TowerStream, which provides business-class wireless Internet access to over 700 businesses in five major metropolitan areas, and other broadband fixed wireless providers, currently represent the only alternative for businesses to completely sever ties with the phone company for their telecommunications needs, keeping prices low. Over the past 4 years, businesses have been replacing their T-1 and DS3 Internet access with TowerStream's guaranteed wireless service.

"The FCC ruling casts uncertainty over the CLEC industry for months and perhaps years to come," said Jeff Thompson, President and COO of TowerStream. "Subsidies have been steadily declining, and have now reached the point where ILECs will have no constraints to raise their T-1 prices in dense urban areas. TowerStream's urban business model has successfully demonstrated that it is possible to provide facilities-based competition without reliance on the incumbent's facilities. Most businesses don't realize that there is a cheaper, faster, more reliable alternative to their phone company's service that is available right now."

Towerstream provides T1 up to 100 Mbps connections to businesses in New York, Chicago, Los Angeles, Boston and Newport/Providence. TowerStream fully supports VoIP, allowing customers to bypass the phone companies for both their Internet and phone solutions.

About TowerStream

TowerStream is a leading fixed wireless broadband provider in the U.S. Founded in 2000, the company serves major U.S. markets including New York City, Los Angeles, Chicago, the greater Boston, Providence and Newport, R.I. areas, and is aggressively expanding coverage throughout the country. The company is the first carrier selected to join the WiMAX Forum to assist leading vendors such as Intel, Alvarion, Fujitsu, Aperto Networks and Proxim in establishing industry compliance with international broadband wireless access standards and cross-vendor interoperability. For more information on TowerStream, please visit their website at: http://www.towerstream.com/.

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- Reliability—Only TowerStream provides True Separate Egress for true redundancy. All your wires are dead by one backhoe swipe or switch failure. TowerStream comes to you from a Ring in the Sky. It is backhoe proof, weather-proof and outage-proof.
- Price—DS3 and T3 are arbitrary Telco denominations representing through-put of 45 Mbps (Million bits per second). TowerStream offers 100 Mbps for $5000 per month, including Internet Access—with no other charges like a local loop charge. 1000 Mbps prices are available.
- Price—Check around and you will see that we offer the throughput of more than 2 DS3s for less than the price of 1 DS3. We do not pass along a local loop charge to you, because we do not have to buy one from the phone company.
- Quick Installation—TowerStream is already located at the highest points above your city, and can connect to your business location up to 30 miles away. We can generally build this type of link in two weeks.
- VOIP will work on a large scale over this type of connection and save your company thousands per month. VOIP can offer a total phone company bypass or the only real phone company back-up. Ask our representatives about companies we recommend on this scale.

TowerStream is in its 5th year. Our sole focus is providing large Wireless connections. We have won major clients and awards and have emerged as a profitable company that focuses on customer satisfaction. We do not complicate our business, diluting our energy and expertise with numerous product lines. We are experts in installing and servicing Business-Quality Wireless Broadband. Please search around our site and feel free to contact us. Or simply call with any questions: (866) 848-5848.

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Providing WiMAX Fixed-Wireless Internet Access & IP Network Design

Technology

The MetroTap 802.16a WiMAX System

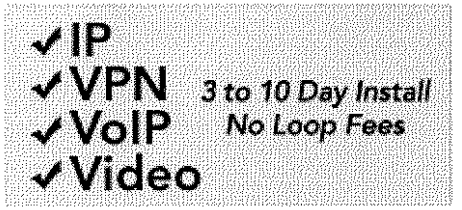
MetroTap is a revolution in fixed wireless 802.16a WiMAX connectivity. Never before has a wireless system had so much customer reach, network capacity and failsafe redundancy. Tapping into the core of a city's fiber-optic network, MetroTap uses diverse multi-carrier fiber-optic routes located within a fully redundant facility, forming the root of its network access. From there, MetroTap utilizes redundant FCC licensed OC-12 backhaul radios to create its own "wireless fiber ring" in the sky, extending the power of its root network connectivity to strategic distribution points located on high-rise rooftops throughout a city's greater urban areas. Using industry breakthrough, next-generation point-to-multipoint radios deployed on these rooftops, MetroTap will provide unprecedented Non-Line-of-Site broadband Internet access to over 90% of the city's establishments. With redundant service agreements enabling 99.999% network availability and broadband burst speeds up to 144 Mbps per redundant client, MetroTap will bring the power of fiber-optic connectivity to customers without the physical and financial burdens related to fiber. Through its cost efficient network design and the power of extensive coverage area per distribution point, AirTap will be able to offer its customers a 30 to 60 percent savings over its competitors, attracting current fiber customers as well as those establishments unable to justify the steep costs of fiber connectivity. Additionally, MetroTap can be utilized worldwide, from increasing the integrity of national security to quickly deploying a solid wireless IP infrastructure in the rebuilding of Iraq.

Previous Wireless Failures

Previous attempts to complete the metropolitan end-mile wirelessly have had limited success. Ventures such as Teligent, WinStar and Advanced Radio Telecom raised funds and partially constructed metropolitan area networks with LMDS licensed equipment but found their terminal downfall directly related to the frequencies in which they operated. The LMDS frequency spectrum was auctioned off in the mid-to-late 1990's by the FCC for millions of dollars per city coverage area. These expensive licenses provide some protection for service providers. However, they are located so high up the frequency chart that point-to-multipoint service coverage is extremely limited in range. The only solution to overcoming such limited coverage areas was to mass deploy metropolitan areas with dozens of cost prohibitive network distribution points. The costs of the carrier-class wireless equipment and FCC licenses elevated initial cash outlay and recurring operating expenses to the point where these wireless providers could not effectively compete with traditional wired carriers.

Current Wireless Successes

The majority of current successful wireless ventures are serving the Internet bandwidth needs of residential and small-to-medium sized businesses located in tier two and three markets. These WISPs (Wireless Internet Service Providers) tend to be smaller start-up operations and deliver wireless Internet access using the unlicensed ISM (Industrial, Science, Medical) 2.4



Redundant - Scalable - Available - Affordable

"Considering how to implement last-mile wireless networks... After the Sept. 11 tragedy LMTWG needed to establish an alternative network. 'In many cases companies thought they had network diversity, but they had carrier diversity. They were all using the same network.'"
December 16, 2002 - John Gilbert, CFO of the Rudin Organization; Chairman Lower Manhattan Telecommunications Working Group (LMTWG)

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GHz frequencies. For the past four years, equipment costs for these operators have continuously dropped, multiplying profit margins in the residential and small enterprise markets. This recipe for success using inexpensive gear to provide cheap Internet access in non-competitive environments has had a somewhat deterrent effect on current WISP's from venturing into the larger enterprise market space. This is why AirTap has developed its 802.16a WiMAX metropolitan area network system, MetroTap.

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Fixed Wireless Business

TowerStream: Getting It Right The Second Time

We take a closer look at TowerStream, the fixed-wireless service provider building a pre-WiMax cloud over major metropolitan areas to growing success.

by Gerry Blackwell
of Wi-Fi Planet
[October 26, 2004]

Email this article to a colleague

A few years ago, fixed wireless access providers like WinStar and Teligent famously flopped after investing millions in Local Multipoint Distribution Services (LMDS) in major population centers so they could offer high-speed network connectivity mainly to small and medium-size enterprises.

Now TowerStream Corp., the first service provider member of the WiMAX Forum, which recently announced its planned entry into the Los Angeles market, appears to be following in their footsteps—albeit with a few telling differences.

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For one thing, TowerStream is using much lower-cost and more readily available pre-standard 802.16 infrastructure equipment from Aperto Networks and Alvarion, which operates in the license-exempt 5GHz band. One of the reasons LMDS providers failed is that they had to pony up for expensive spectrum licenses and then buy infrastructure equipment at premium prices in a not very competitive market.

When TowerStream launched four years ago, memories of the LMDS debacle were still fresh.

"We really wanted to learn from everybody else's mistakes," says president and COO Jeff Thompson, one of the co-founders. "We knew we didn't want to keep replicating old telecom models as we could see others doing. We wanted it to be scalable and reliable and we wanted to make a lot of money."

Sure. Easy.

TowerStream isn't there quite yet, but it has taken some significant strides. It first launched service in Boston and Providence R.I., its home base, in 2002. By earlier this year, it was in three major markets, including New York City.

It charges $500 a month for T-1 equivalent service with a standard service level agreement (SLA) guaranteeing 99.99 percent up time. It can also provide a 100-Mbps service for enterprise customers, using infrastructure equipment from DragonWave. In June 2003 it moved into the concrete canyons of Manhattan.

"That roll-out went very well. We got a lot of experience and learned a lot about opening new markets, about expanding the company, about how to make a roll-out better and how to give customers what they want. It was magnificent," says Thompson, who is nothing if not enthusiastic. (We're guessing this is code for, 'It was a mammoth challenge that we somehow got through.')

ISP Glossary

Chicago came next, in March of this year. The company's short-term goal is to be in 10 top markets. However, the ten are not necessarily the ten biggest, Thompson notes. "It's not purely population. We're looking at markets, visiting each one to see which are best for TowerStream." Its current pace is two new markets a year. "We'll hopefully be there [in 10 markets] by the end of 2006, but we don't have a stick in the ground [that says it has to be by then]," he says.

The company hopes to be up and running in Los Angeles, its fourth major market, by end of Q1 2005. "We had a great response from a lot of businesses in LA when we announced we were coming," he says.

TowerStream is avoiding one mistake of the LMDS pioneers—it's not relying on windfall venture capital financing to fund its roll-out. The money market is different today in any case: the tens of millions available to WinStar et al just aren't there today. TowerStream's costs are also lower, as noted, so capital requirements aren't as onerous. Still, the company's "self-funded, organic growth model," as Thompson terms it, is one reason it's not moving faster. He is acutely aware that the right timing is critical.

"If we go too fast," he says, "we could end up like our predecessors, but if we do it too slow, we'll miss opportunities."

The organic growth model depends on getting markets up and running and generating significant revenues that the company can then plough back into opening more new markets.

"We're still a relatively small company," Thompson says, "but we're starting to grow now. We have over 700 customers today and that will quickly approach 1,000 now that those markets [Boston/Providence, NYC, Chicago] are starting to ramp up." Last year it doubled revenues while only adding four new employees, bringing the total to 33. "When you can double revenue and only add four new staff, that's incredible," he says.

Go to page two: **A wireless ring above the city >**

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The world according to AT&T

Ma Bell is not amused: Services over IP is the way of the future for telecom giant

Reality Check, By Ephraim Schwartz
November 19, 2004

During the past decade, AT&T has been jettisoning divisions faster than a heavyweight fighter sheds pounds trying to get back in shape for a shot at the title: NCR in '94; Bell Labs in '96; AT&T Cable, AT&T Wireless in '01; Excite@Home, Small Business Hosting accounts in '02. Earlier this year, it announced plans to stop pursuing residential and long-distance voice customers altogether.

I met with Hossein Eslambolchi — CIO, CTO, and president of global networking technology services at AT&T — over a light dinner to discuss AT&T's IT strategy for the next decade. In a word, that strategy comes down to services. Not voice services, or even VoIP, but SoIP (services over IP). Eslambolchi told me emphatically, just short of pointing his fork at me, that AT&T is no longer a voice company. It is a data company.

The stats, albeit from AT&T, appear to back up that claim. Its IP network handles 1,700TB of data per day, while its public switched network handles 450TB per day. SoIP includes IP security, application hosting, managed network services, and multimedia, including HD-TV over IP and radio over IP.

Here's one example of what a company can do when it handles that much data on a daily basis.

Stochastic analysis, a form of statistical probability that looks at past behavior patterns to identify and predict future behavior, depends on sampling. The larger the samples, the closer to 100 percent accuracy in identifying a reoccurring pattern at a very early stage.

AT&T has a security service called Internet Protect. It uses stochastic processing and an

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TECH WATCH
Apple risks user disaffection in sw
There seem to be something the Apple forgetting as they try to rationalize wh the switch to Intel. Yes, every develop explained that the transition is no big

algorithm called Smart Sampling to extract information — rather than just data — on 17TB of data daily, looking for patterns that indicate a virus or DoS attacks. Eslambolchi told me AT&T identified the SQL Slammer attack on the network three weeks before it hit in large scale.

Eslambochi went a step farther to say that Internet Protect is getting so accurate that companies will soon be able to eliminate on-site firewalls.

"With that much data, stochastic becomes near foolproof," Eslambolchi said.

AT&T is also moving aggressively on other technology fronts. It spends $8.5 billion annually in fees to the ILECs (Incumbent Local Exchange Carriers) for last-mile connection to business customers. You might say Ma Bell is not amused.

To dramatically reduce those connection costs, AT&T will use WiMax, mesh networks, and other broadband wireless technologies as a battering ram to bring down the walls of those greedy ILECs.

In 12 to 18 months, AT&T will run trials in two undisclosed cities to use WiMax for the last-mile connection to customers. AT&T has identified approximately 245,000 buildings within the United States that house business customers. AT&T is directly connected to 7,000 of those. WiMax in particular will be a way to connect to the next 100,000, Eslambolchi said.

With the largest IP network in the world, Eslambochi also said computing power will take place; not at the end points or at the edge, but within the network. It is all about policy-based computing, which allows policies or rules to travel with the data in the network so that decisions can be made simultaneous with generation of data.

This is the world according to Eslambolchi. Worth watching, don't you think?

Ephraim Schwartz is an editor at large at *InfoWorld*.

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