Tower Market Report
4th Annual Market Survey Results
Trends and Forecasts

Infrastructure, regulatory and financial information for the antenna-sit

ABOVE GROUND LEVEL

agl ™
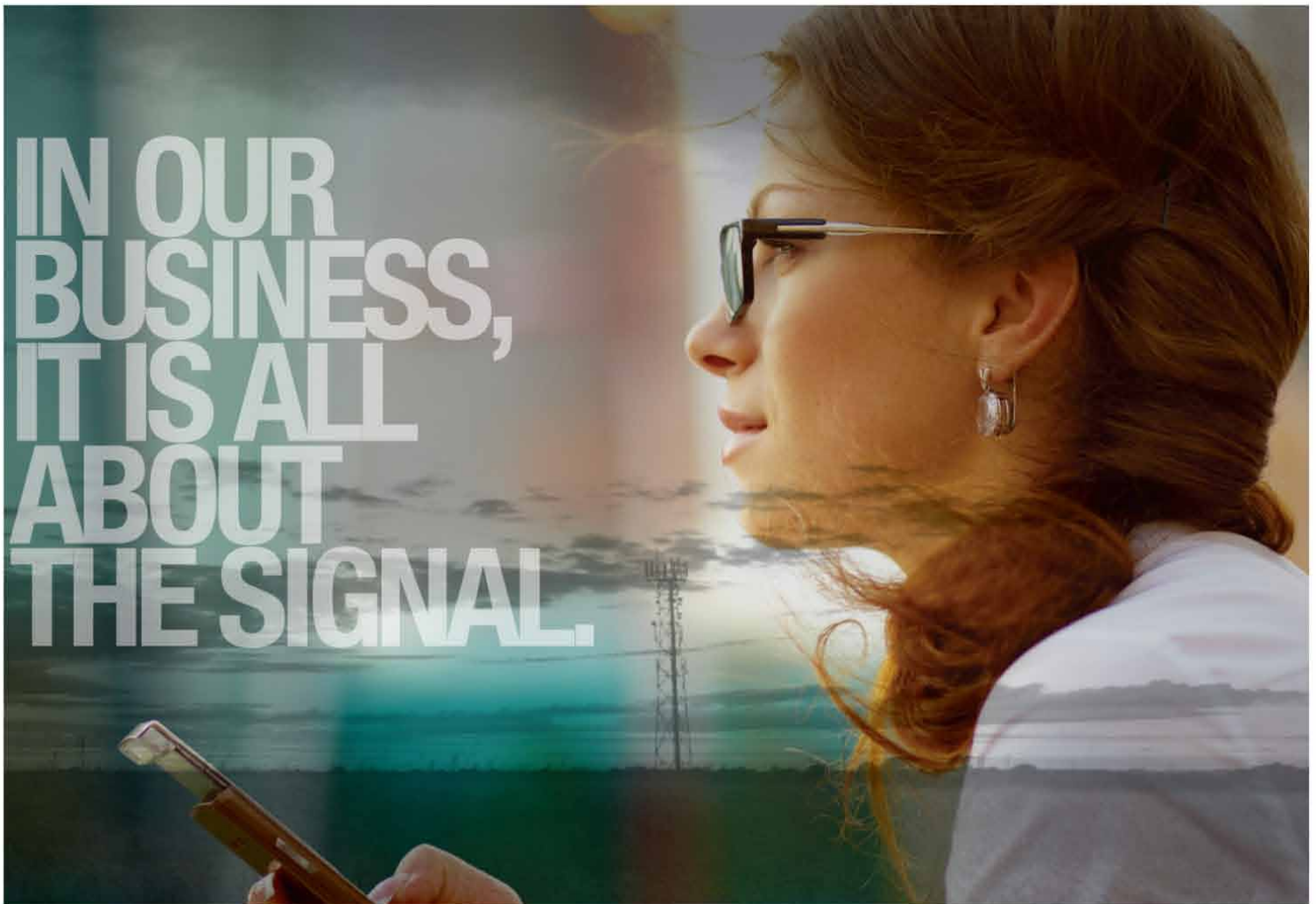
DAS and Small Cells Magazine

Enterprise-level BYOD/X

Spectrum Conditioning for DAS

Unified Communications

Advances in Wireless

OSHA Inspections

Supreme Court Upholds Shot Clock

Site and Tower Information Modeling

Antenna Alignment

agl-mag.com   A BIBY PUBLISHING, LLC PUBLICATION

September 2013

Tower Market Report
4th Annual Market Survey Results
Trends and Forecasts

Infrastructure, regulatory and financial information for the antenna-sit
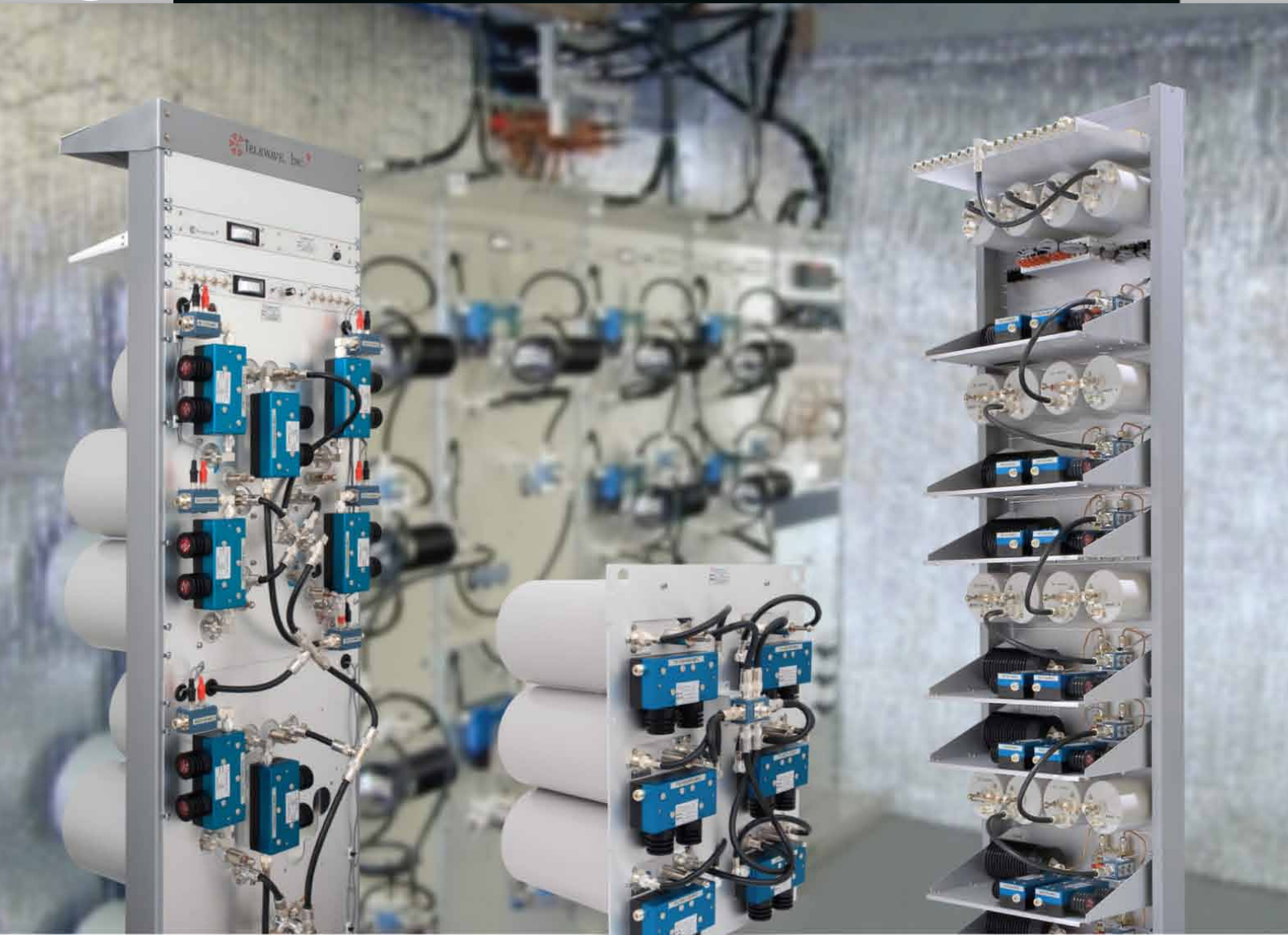
ABOVE GROUND LEVEL

agl ™

DAS and Small Cells Magazine

Enterprise-level BYOD/X

Spectrum Conditioning for DAS

Unified Communications

Advances in Wireless

OSHA Inspections

Supreme Court Upholds Shot Clock

Site and Tower Information Modeling

Antenna Alignment

agl-mag.com   A BIBY PUBLISHING, LLC PUBLICATION

September 2013

September 2013   **Vol. 10, No. 8**   contents

52

Tower Market Report

Features

DAS and Small Cells Magazine

Departments

Interested in advertising with *AGL*'s magazine, website or e-newsletters or sponsoring *AGL*'s Regional Conference? For information, contact *www.agl-mag.com/advertise* for information.

on the cover

The moon rises behind a TowerCo tower in Haverhill, Fla., near the Atlantic coast, in an image captured in November 2011.

Photo by Don Bishop.

editorial comment

Dumont Telephone

Art Director Scott Dolash photographed the *AGL* Tower of the Month (page 52). The image shows a tower in Parkersburg, Iowa, owned by Dumont Telephone. Founded in 1901 as the Ingham Township Mutual Telephone, the company provides wireless telecommunications service in Butler County, Iowa, with five towers.

"We have our own cellular network," Roger Kregel, the company's general manager, told *AGL*. "We're affiliated with iWireless, which is a T-Mobile USA partner." Iowa Wireless Services, doing business as iWireless, is a partnership between T-Mobile and Iowa Network Services. Dumont Telephone customers using cell phones outside the company's home network area receive service from T-Mobile, but still pay their bill to Dumont Telephone.

"Surviving in an environment with large players is increasingly difficult," Kregel said. "With the regulations we now have, it is difficult to keep customers happy while making enough money to invest in network upgrades."

Kregel said that historically, rural telephone companies derived much of their revenue by charging other telephone companies for access to their landline networks. "They paid by the minute to run traffic over the network," he said. "Today, not as many people use long-distance landline service." Rural telephone companies are paid for long-distance calls that terminate in their service areas.

"Verizon is using our network for broadband access," Kregel said. But he pointed out that entities that provide content to users via the World Wide Web over the Internet do not pay for such use. "Providers such as Google, Yahoo! and

Netflix use our network, but we're not getting paid for the use," he said.

What Kregel said reminded me that cable TV companies used to rely entirely on subscriber fees for revenue, but increasingly they are charging fees to originators of content for carriage. In August, a dispute over fees led cable TV provider Time Warner to black out CBS-originated programs on the TW cable systems in several cities, leaving 3.2 million cable subscribers without access to CBS programs via cable.

It seems far-fetched to think that website operators might pay telephone companies to use their broadband networks, but Dumont Telephone could use the money. Although the company has been able to offer high-speed Internet to every subscriber who wanted it, and although Dumont Telephone upgraded all cable TV service to digital and extended fiber to the homes of most subscribers, it faces a financial challenge when it comes to upgrading its cellular service to 4G. "My board is talking about that right now," Kregel said.

Dumont Telephone has an eight-member board of directors and eight employees.

And now you know more than usual about the company with the *AGL* Tower of the Month.

NATE Chairwoman Pat Cipov

Selected by the organization's board of directors, Pat Cipov has become the first woman to head the National Association of Tower Erectors. She is president of Cipov Enterprises, a tower construction and maintenance company with 10 employees. Watch for *AGL*'s interview with Cipov in the October issue.

Cipov takes the top volunteer leadership position in NATE at a time when fatalities stemming from injuries sustained while working on towers are on the rise.

We wish Cipov the best in helping NATE extend training to all tower workers and fall protection awareness to everyone in the industry, including carriers, tower owners and general contractors. ∎

By Don Bishop, Executive Editor
dbishop@agl-mag.com

Towers That Mean Business

The art and science of tower management

publisher's note

Never Stop Learning

Working in Vermont during the past year or so has been such fun. And I still can't believe I'm just back from England and France where I went for a little R&R with the family. Talk about telecom sticker shock! Taking a CDMA phone from the United States to the United Kingdom had a number of really unpleasant financial options and data rates that would suggest a mortgage may be necessary just to afford regularly checking your email. Forget the kids being able to FaceTime any friends, or trying to keep your Facebook community up to date. Sorry "friends," I can't afford for you to watch this vacation in near real time.

Being a natural cheapskate, I checked out the prepaid options, both in the United States and then with what I might be able to buy once I landed. The options all looked so unattractive financially, with pretty high rates to call the United States and about a $45 minimum commitment with very little or no data. So, with a heavy heart and an unlocked GSM phone in hand, I set my sights on Heathrow and trusted I would figure something out when I landed.

The airport offered few options, however. I closed my eyes and walked into the first convenience store I could find near a tube station. The gentlemen behind the counter were enjoying their consultative roles and led me toward a Lycamoble SIM, which I acquired for £5, and with a minimum of £10 (about $15) to get a little data. I was supposed to have 400 minutes of UK calling and some hard-to-understand rate against my £10 for U.S. calling and unlimited data for a month. Not a bad deal it appeared.

At least I got a UK phone number out

Photograph courtesy of mikefosterphotography.com

of the deal. My minutes quickly disappeared, although I only placed a couple of phone calls in the UK. However, the data remained. I was unable to get any customer service help, and I immediately tossed the idea of traditional GSM phone calls out the window and scrambled to find a good VoIP client for Android. I did, and I was quickly able to configure a U.S. local phone number and set up a UK local SIP line for a couple of bucks. US SIP DID to UK SIP DID and presto! Essentially free calling! Well, OK, pretty cheap, but the true enjoyment was in hacking the system. Truth be told, I received few phone calls, and called few people; however, the point is: *I could have, if I had wanted to!*

Global Tower Partners

All happy hour events at PCIA are courtesy of Global Tower Partners!

OK, I don't know that, and if I was going to be invited to one, I'm likely off the list already. So, I'm officially bummed to not have any major scoop on the proposed sale of GTP. It was no surprise really that the only major, non-publically traded tower company is up for sale. I can't really think of a better time for it to happen. The market is becoming a little mature; most of the organic growth is gone in the site acquisition, construction market. The big bucks are now from the modifications and from all of the carriers trying to deploy the same LTE network to out-market the other carriers. "The tower industry is hereby matured," is what I say. The siting market has plenty of life left in it, but I'm taking this as a sign that the traditional tower development model has run its course, at least here in the United States.

As for our friends at GTP: job well done. There is still a lot to happen between here and there, like the buyer ac-

tually coming forward. By the time you read about it in *The Wall Street Journal*, you know the deal is actually already pretty much done. So who will it be? The usual suspects? American Tower? Crown Castle International? It's probably too big of a deal for SBA Communications, I would imagine, given what limited understanding I have of the financial world, but I guess you never know. Old friends in Florida may soon be friends again. It might be interesting to see another non-U.S. company take a leading role in the industry. I would imagine, though, that the buyer will be American Tower.

Vermont

I'm still lighting up poles and having a great time with the small-cell base station project in Vermont. We're heading toward a completed deployment and looking at what to do next. Strangely enough, things have worked out almost as planned. In my 48 years, I've become convinced that nothing works out exactly as planned, so survival and something close to planned is success in my book. I'm hereby declaring (for the second time in this column) success.

Next up: Vertical markets? Low-population areas? High-population areas? Updating the DAS model? I'm not sure, but we've really had a great time learning the details of on-pole deployment and I have really enjoyed the new-to-me experience of the network operations side of the house. Never stop learning. Never stop having fun. When you do, hang it up. Until then, be in touch. ∎

By Rich Biby, Publisher
rbiby@agl-mag.com

ON AIR 🔑 Access™

FIND ▸ APPLY ▸ TRACK

Your Fully Integrated Site Collocation Experience

Find
sites that meet
your objectives

Apply
for collocations and
modifications online

Track
projects and
important milestones

americantower.com/onairaccess

AMERICAN TOWER®

buyers guide

Quick-Guide to Engineering Companies

As a supplement to *AGL*'s January Buyers Guide, a list of engineering companies offers more detail to help you choose a vendor for your next project. Each service is coded numerically according to the legend below. Where shown, logos and company descriptions were provided by and paid for by each company.

1. Architectural
2. Electrical
3. Electromagnetic compatiblity
4. Environmental
5. Geotechnical
6. Power systems
7. Regulatory compliance
8. RF propagation
9. RF safety
10. RF systems design
11. Site design
12. Structural

4G Unwired
325 Fifth Ave., Suite 100
Indialantic, FL 32903
Scott Robinson
scott.robinson@4gunwired.com
(321) 726-4183
www.4gunwired.com
Services: 8, 10
Other: LTE, UMTS, CDMA and GSM design, microwave network engineering
Company description:
4G Unwired (4G) is an RF consulting firm that specializes in wireless system design services for Tier 2 and Tier 4 cellular carriers in the United States and the Caribbean. 4G Unwired also provides RF engineering services for system integrators, tower companies and infrastructure vendors. The company also offers 700-MHz and MW design services with deliverables in Google Earth.

Advantage Engineers
7070 Samuel Morse Drive, Suite 150
Columbia, MD 21046
Cynthia Stuber
cstuber@advantageengineers.com
(443) 367-0003
www.advantageengineers.com
Services: 1, 4, 5, 6, 7, 11, 12

Company description:
Advantage Engineers provides innovative solutions for complex telecommunications engineering challenges. The company specializes in wireless site design for cellular, microwave, public safety radio and DAS for in-building and wide-area applications. Comprised of more than 120 professionals and five offices, Advantage Engineers serves government and private clients in the Mid-Atlantic region.
See ad on page 74

AFL
170 Ridgeview Center Drive
Duncan, SC 29334
Dennis Beck
dennis.beck@aflglobal.com
(615) 591-0098
www.aflglobal.com
Services: 6, 11, 12
Other: detailed engineering specs related to telco equipment
Company description:
AFL provides installation, material furnish, detailed engineering, construction and maintenance solutions allowing wireless communications companies to maintain satisfied customers by offering ever-increasing bandwidth, technology and service performance. AFL plans, designs, implements and maintains communication networks for service providers, working in all communications markets offering network, cell site and enterprise solutions.

AM Coordination Services
P.O. Box 6065
Martinsburg, WV 25402
Butch McBride
amcoordination@aol.com
(304) 264-5941
www.amcoordination.com
Services: AM broadcast measurements, tower detuning, MININEC modeling
Company description:
AM Coordination Services provides pre- and post-construction field-strength measurements, tower detuning, repair of all manufacturers' detuning systems, proximity measurements to determine whether a tower is reradiating broadcast signals, and MININEC modeling. AM Coordination also provides intermodulation studies and MPE studies.

AW Solutions
300 Crown Oak Centre Drive
Longwood, FL 32750

Cost effective
RF Safety in the palm of your hands

✓ **Pinpoint and monitor active and idle antennas**
✓ **Single button, easy operation**
✓ **Loud audio warning in case of overexposure**
✓ **Frequency coverage 380 MHz - 2.7GHz**
✓ **Wide level indicator range, 5% to 250%**

The fieldSENSE personal RF monitor is designed specifically for the mobile industry. It's a cost effective solution ideal for all personnel working in the vicinity of transmitting cellular antennas.

Certified to IEC 61000-6-4, IEC 6100-6-2, IEC 60950-1

Measures in accordance with ICNIRP (1998)
FCC (NCRP) OET65 (1997)
Canada Safety Code 6 (2009)
IEEE C95.1 (2005)

Calibration Certified by ACRBR

field:SENSE

250%
160%
100%
65%
40%
15%
5%

380MHz - 2.7GHz

field:SENSE
Personal RF Monitor

fieldsense.com

buyers guide

1. Architectural
2. Electrical
3. Electromagnetic compatiblity
4. Environmental
5. Geotechnical
6. Power systems
7. Regulatory compliance
8. RF propagation
9. RF safety
10. RF systems design
11. Site design
12. Structural

James Partridge
james.partridge@awsolutionsinc.com
(407) 260-0231 ext. 101
www.awsolutionsinc.com
Services: 1, 2, 4, 5, 6, 7, 11, 12
Other: site audits, surveys, OSP, iDAS, oDAS, EF&I
Company description:
AW Solutions is licensed throughout the United States, Canada and the Caribbean providing turnkey site infrastructure development and build-to-suit services to the wireless (towers and DAS), wireline and fiber industries. Services include project management, site evaluations and audits, site acquisition and land planning, engineering design and analysis, regulatory, construction management, construction, and warehousing and logistics.

Black & Veatch
10950 Grandview
Overland Park, KS 66210
Patrick Lien
lienp@bv.com
(407) 401-4706
www.bv.com
Services: 1, 2, 4, 6, 7, 10, 11, 12
See ad on page 59

CALTROP Telecom

Caltrop Telecom
9337 Milliken Ave.
Rancho Cucamonga, CA 91730
Mani Kontokanis
mani@caltrop.com
(916) 203-6750
www.caltrop.com
Services: 1, 2, 6, 11, 12
Company description:
Caltrop Telecom provides professional civil, structural and electrical engineering services to the wireless communications industry. Its multidisciplinary team of professionals applies a wide range of experience to provide a streamlined approach to workflow management that generates significant cost

savings through reduced deployment time and cost. Caltrop Telecom has branch offices throughout the United States.

EHRESMANN ENGINEERING INC.

Ehresmann Engineering
4400 W. 31st St.
Yankton, SD 57078
Eric Heine
e.heine@ehresmannengineering.com
(605) 665-7532
www.ehresmannengineering.com
Service: 12
Company description:
Ehresmann Engineering has been performing tower structural analysis since 1983. The company's engineering staff has over 100 years of tower engineering experience. Ehresmann Engineering has performed thousands of analyses on numerous types and heights of towers and various current and past tower manufacturers. Rely on its experience for your next project.

Environmentex consulting

Environmentex
6060 N. Central Expressway, Suite 560
Dallas, TX 75206
Brian McCallister
brian@environmentex.com
(214) 793-7317
www.environmentex.com
Services: 4, 5
Company description:
Environmentex offers fast turnaround and solid dependable reporting. The company's seasoned professionals have a tremendous depth of experience in environmental due diligence and compliance for the tower industry. Environmentex engineers, biologists, archeologists and historians have performed thousands of Phase I, NEPA, SHPO and geotechnical studies across the United States and are experts in addressing FCC NEPA regulatory issues fast and within budget constraints.

FULLERTON ENGINEERING·DESIGN

Fullerton Engineering Consultants
9600 West Bryn Mawr Ave., Suite 200
Rosemont, IL 60018
Frank Di Vito
fdivito@fullertonengineering.com
(847) 292-0200
www.fullertonengineering.com
Services: 1, 11, 12
Company description:
Fullerton provides superior design and innovative engineering solutions for wireless service providers nationwide. The company's field-proven expertise and thorough knowledge of wireless network technologies is reflected in its services. Through responsive customer service, a solid commitment to quality and the professionalism of its staff, Fullerton Engineering continuously enables its clients to exceed their customers' expectations.

Hatfield & Dawson Consulting Engineers
9500 Greenwood Ave. North
Seattle, WA 98103
Ben Dawson
dawson@hatdaw.com
(206) 783-9151
www.hatdaw.com
Services: 3, 8, 9, 11
Company description:
Hatfield & Dawson provides RF engineering services to clients throughout the United States and worldwide. Uniquely, the firm has decades of experience in RF engineering for land mobile and public safety communications users as well as broadcasting clients and therefore has unequalled experience in solving inter-service compatibility problems.

AT&T Towers

Expansive needs call for an expanded portfolio.

With greater, wider demand for anytime, anywhere wireless coverage, our expanded portfolio, featuring AT&T Neutral Host DAS, tower and rooftop coverage, offers you more ways to meet the challenges you face. And with end-to-end support from our specialist, we make the entire process quick and easy.

Visit att.com/towers to get started.

buyers guide

Henkels & McCoy
985 Jolly Road
Blue Bell, PA 19422
Bob Dundon
bdundon@henkels.com
(215) 283-7764

www.henkels.com
Services: 2, 6, 10, 11, 12
Company description:
Henkels & McCoy has helped customers deal with their changing communications infrastructure needs from source to end user since 1923. The company performs work for telephone companies, carriers, wireless providers, government agencies, utilities, educational institutions and the private sector on projects of every scale. With wireless ca-

pabilities that span 4G rollouts and complex DAS installations to structural analysis and tower modifications, Henkels & McCoy wireless network solutions incorporate safety, quality, on-time performance, and effective program and cost management.

Huber+Suhner
19 Thompson Drive
Essex Jct., VT 05452
Dick Schmidt
dick.schmidt@hubersuhner.com
(630) 816-4021
www.wireless-infrastructure.com
Services: 10, 11
Company description:
The Huber+Suhner group is a leading global supplier of components and systems for electrical and optical connectivity. The company's customers in wireless communication appreciate that Huber+Suhner is a specialist with detailed knowledge of practical applications. Huber+Suhner offers expertise in radio frequency, fiber optics and low frequency all under one roof, thus providing a unique basis for continual innovation that is focused on the FttA, PttA and RF needs of its customers all over the world.
See ads on pages 18 and 95

Infinigy Engineering
2255 Sewell Mill Road, Suite 130
Marietta, GA 30062
Joe Dean
jdean@infinigy.com
(770) 883-3007
www.infinigy.com
Services: 1, 4, 5, 11, 12
Company description:
Infinigy Engineering is an integrated technical services company that delivers design-driven, turnkey solutions to the wireless communication industry. The company's mission is to focus on its clients' business objectives to deliver high-quality, cost-effective wireless solutions that exceed expectations.

buyers guide

IVI

IVI Telecom Services
55 W. Red Oak Lane
White Plains, NY 10604
Adrian Berezowsky
telecom@ivi-intl.com
(914) 694-9600
www.ivi-telecom.com

Service: 4
Other: regulatory compliance
Company description:
IVI Telecom Services offers a wide spectrum of environmental services for nationwide telecommunications infrastructure development ranging from environmental site assessments to FCC/NEPA screenings and Section 106 consultations. IVI understands customers' program and schedule constraints and uses its expertise to realize customer

goals in a cost-effective and timely manner.

MartinEnviro
Martin Environmental Solutions Inc

Martin Environmental Solutions
8823 San Jose Blvd., Suite 103
Jacksonville, FL 32217
Thomas Martin
tmartin@martinenviro.com
(904) 737-1034
www.martinenviro.com
Services: 4, 7
Company description:
Martin Environmental Solutions (MartinEnviro) is a diversified, nationwide environmental services company specializing in the telecommunications field and offering integrated environmental and health and safety consulting including due diligence (Phase I, II and III assessments), full NEPA compliance consulting with IBAs and migratory bird surveys, and complete environmental project management.

MORRISON HERSHFIELD

Morrison Hershfield
1455 Lincoln Parkway, Suite 500
Atlanta, Georgia 30346
Shylesh Moras
telecom@morrisonhershfield.com
(770) 379-8500
www.morrisonhershfield.com
Services: 1, 4, 5, 11, 12
Company description:
With over 60 years of experience working with all types of towers, Morrison Hershfield has the technical depth and resources that are required. The company's wide range of tower engineering, environmental and site design services, combined with its geographic coverage, ensures that Morrison Hershfield will always be a single source for all of its customers' engineering needs.

PM&A

P. Marshall and Associates (PM&A)
30 Mansell Court, Suite 103
Roswell, GA 30076
Greg Hazlehurst
ghazlehurst@pmass.com

buyers guide

(678) 280-2325
www.pmass.com
Services: 1, 2, 11, 12
Company description:
PM&A is an award-winning, multidiscipline engineering and site development company that has enjoyed rapid growth while still maintaining a family-style corporate culture. PM&A's highly tuned and experienced teams can help make its customers' next project a success. PM&A resources run

deep, and the company has worked in over 40 states.

SSC
9900 W. 109th St., Suite 300
Overland Park, KS 66210

David Blaha
dblaha@ssc.us.com
(913) 438.7700
www.ssc.us.com
Services: 1, 2, 4, 5, 7-12
Company description:
SSC is a leading provider of services to the telecommunications, development and construction industries. The company's range of in-house services and abilities makes it uniquely capable of handling all aspects of the most challenging projects. SSC strives hard to serve its clients, solve their problems, and communicate effectively.

Tectonic Engineering & Surveying Consultants
70 Pleasant Hill Road, P.O. Box 37
Mountainville, NY 10953
Richard P. Kummerle
rpkummerle@tectonicengineering.com
(800) 829-6531
www.tectonicengineering.com
Services: 4, 5, 11, 12
Other: site management and acquisition, surveying, construction inspection and materials testing
Company description:
Tectonic Engineering & Surveying Consultants provides a full spectrum of site acquisition, A/E professional services and program management. Tectonics' staff of 475 is located throughout regional and project offices nationally, providing site acquisition, permitting, zoning, due diligence, NEPA/SHPO, Phase I, civil, structural and geotechnical engineering and tower analysis.
See ad on page 72

Tempest Telecom Solutions
136 West Canon Perdido, Suite 100
Santa Barbara, CA 93101
Elda Rudd
erudd@tempesttelecom.com
(805) 879-4829
www.tempestdas.com
Services: DAS and small-cell turnkey design, installation and project management.

buyers guide

V-Comm
2540 U.S. Highway 130, Suite 101
Cranbury, NJ 08512
Dominic Villecco
dominic.villecco@vcomm-eng.com
(609) 655-1200
www.vcomm-eng.com
Services: 3, 6, 7, 8, 9, 10, 11

Company description:
V-Comm is a leading provider of integrated network engineering, radio-frequency engineering and business services, with offices in New Jersey and Pennsylvania. V-Comm delivers the needed expertise and cost-effective solutions to wireless operators and public safety agencies. V-Comm also provides design and build services for in-building, in-tunnel and other wireless telecommunications networks.

W-T Communications Design Group
2675 Pratum Ave.
Hoffman Estates, IL 60192
Dave Guillen
david.guillen@wtengineering.com
(224) 293-6333
www.wtengineering.com
Services: 1, 2, 11, 12

Company description:
W-T Communication Design Group is a full-service engineering company serving the wireless industry since 1996. The company performs structurals, CDs, ZDs, tower modification and augmentation designs, site ground audits and tower-top audits with internal climbers. W-T Communication Design Group also provides construction management services for large rollouts and single-site deployments. The company is licensed in all 50 states.

Waterford Consultants
P.O. Box 2090
Ashburn, VA 20146
Tom Ferguson
sales@waterfordconsultants.com
(703) 592-1022
www.waterfordconsultants.com
Services: 8, 10

Company description:
Waterford Consultants is a professional services organization with unmatched expertise in delivering FCC regulatory compliance, RF propagation and design, and site development services to the wireless, telecommunications and broadcast industries. Waterford's nationwide team of field and operational personnel seamlessly reaches from coast to coast, ensuring clients' project budgets and schedules are maintained — as its slogan says — from "Start to Signal."

Do Higher Interest Rates Lead To Lower Tower Valuations?

Tower Valuations Remained Strong During The First Half of 2013.

Thanks to the strong fundamentals of wireless and towers, the availability of low-cost debt, a limited supply of towers for sale and a large pool of tower buyers, valuations for tower assets during the first half of 2013 were at all-time highs. Given the rush by many sellers to complete transactions prior to the end of 2012, a supply-demand imbalance developed (many well-financed tower buyers and few assets for sale) in early 2013, leading to a further increase in tower valuations.

What Does The Rest of 2013 Hold For Tower Owners and Tower Valuations?

Media Venture Partners ("MVP") believes the single most likely risk factor that could impact tower valuations in the near-term is rising interest rates. Although there are other risk factors such as wireless consolidation or a slowdown of network builds by the carriers, a low-interest rate environment has helped fuel the attractive prices paid by both public and private tower buyers. Despite treasury notes and mortgage rates increasing slightly over the last several months, MVP believes tower companies with long-term, low-cost debt facilities will be able to continue to offer similar prices for tower assets in the foreseeable future. Continued hikes in interest rates in the U.S. even greater than the increase of nearly 1% since May, however, could result in a drop in tower values by tower buyers.

What Are Your Best Options? *What Are Your Towers Worth?*

Contact MVP for a confidential discussion about your towers. No hyperbole and no scare tactics. Simply a straightforward perspective from a professional and experienced intermediary in the tower industry. We've been representing tower owners for nearly 16 years and we'll continue to be a trusted advisor for tower owners for many years to come.

Select 2012 and 2013 transactions:

AMERICAN TOWER®
has bought the broadcast facility at the John Hancock Center, Chicago

Milestone
has sold 21 towers in Virginia to
CROWN CASTLE

PEGASUS TOWERS
has sold certain tower assets to
SBA

has sold one broadcast tower in Massachusetts to
K TOWERS

CAPITAL
has sold certain tower assets to
GRAIN

Since 1997, MVP has completed more than 120 tower and 80 wireless and spectrum transactions with an aggregate value of more than $2 billion. The firm's professional staff offers strategic counsel and financial advisory services related to M&A, private equity and debt capital placements, financial restructurings, valuations and appraisals.

MVP
MEDIA VENTURE PARTNERS
Telecom • Media • Technology

For a confidential discussion or more information, Call 415.391.4877 or visit www.mediaventurepartners.com

San Francisco | Boulder | Kansas City | Boston

Securities and Advisory Services are offered through Financial Telesis Inc., Member SIPC/FINRA.

guest opinion

Advances in Wireless Technology Enhance Site Design and Deployment

By Stephen Banks
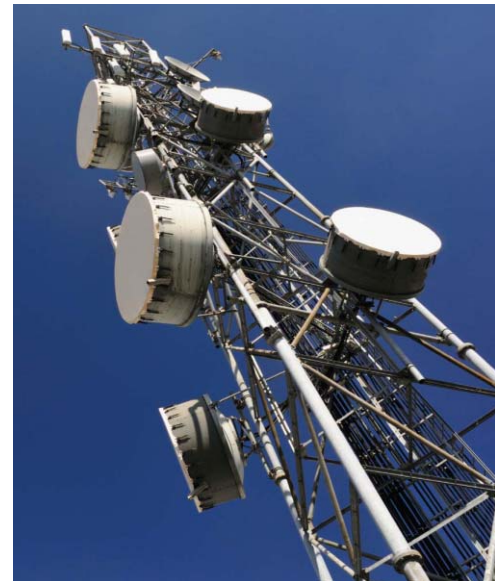
In recent years, national wireless carriers have been racing to keep up with the public's voracious appetite for data.

Despite advancements in technology that provide the public with more bandwidth and increased data transfer speeds, the ensuing consumption quickly exhausts the increased capacity. As users, we have a seemingly insatiable hunger for streaming media and ubiquitous, reliable, high-speed wireless data networks. Carriers have responded with colossal nationwide projects to upgrade existing infrastructure to 3G and, more recently, 4G LTE coverage.

In designing these projects, one need remains the same — *speed*. While on-air speed to market is critically important, it cannot be achieved at the cost of quality. The integrity of the initial engineering design survey and the data obtained during those few hours on site — whether in sun, rain or snow — are the foundation of the engineering design and drawings that ultimately land in the hands of the person building the site.

Technology advances to keep pace

The telecommunications industry is a vibrant environment for engineers. Although many things have changed during my 15 years in the industry, on-air, speed-to-market timelines have remained a driving force in successful engineering project management. Having experienced the design and deployment of totally new carrier networks

from the ground up, as well as technology enhancements and overlays of existing sites in both Europe and the United States, I've had a unique opportunity to see a variety of engineering site design scenarios and challenges.

Although I don't consider myself to be old, my first professional engineering experience in telecom site design was completed with equipment and tools that now are considered to be archaic by many. My younger colleagues at KMB laugh when I recall using measuring wheels, steel tapes and, yes, a pencil and paper.

Field notes were gathered from site to site, transferred back to the office and then incorporated into a site design package the following day. From there, they were submitted to the engineering department to develop the design and drawing packages for real estate negotiation and, ultimately, construction drawings. Even as recently as three years ago, this basic approach was still the industry standard.

But like all things telecom related, three years is now a generation. Recent improvements in survey tools have changed the site design process. The tape and wheel, for example, have been replaced with a handheld laser accurate to ±0.04 inches over 650 feet, thus improving both the accuracy and speed of field design surveys. The tablet computer now enables the field engineer to sketch sites as soft-copy PDFs or

even within AutoCAD in the field. The advancement of wireless connectivity and cloud computing of tablets allows the field engineer to transfer complete site design packages to the engineering department within minutes of walking the site. These technology improvements and real-time information and data transfers have decreased the margin of human error, data loss and the boundaries of the business day to make productivity skyrocket.

Another unique aspect of these changes in wireless technology is illustrated in our own consumption of the technology we engineer to support the ecosystem. As new wireless devices come to market, the user demand and data usage levels will only increase and further stretch the capacity of existing networks. For example, at KMB we are using the wireless data available to our tablet PC devices in the field to aid our engineers in designing both new wireless sites and 4G LTE overlays throughout the nation.

Once a field design visit is completed and saved to the cloud, the office-based team is immediately notified, the data is downloaded to the network, submitted for QC review and then to engineering. In this fast-paced era of near-instant communication, we are both the engineers and consumers of the technology, and we are a key link in the wireless deployment chain to bring this improved wireless technology to the public.

guest opinion

In an industry in which wireless technology solutions constantly evolve, the question remains: Are engineers supporting their clients and services utilizing the best technology available?

Our firm has continued to invest in cutting-edge technology to enable our field engineers to have laser survey tools, wireless tablet PCs and new ways to increase our productivity. Having the latest engineering and survey tools to provide the best quality possible is not only necessary, it is crucial for supporting the next stage of infrastructure build outs.

There is no doubt that the future will only further technology growth and development on the existing wireless sites with the addition of new site builds to fill coverage gaps and congestion. As an industry, we are pushing to get as much equipment as possible onto the towers and in the compound. We are adding remote radio units at the antenna sectors and equipment cabinets on the ground to squeeze as much out of the site as possible. In these situations, the accuracy of the engineering survey of the tower and ground space is essential for the design of the equipment, fiber and coax routes, and utilities. A small margin of error in design can result in lengthy time delays and large cost increases during construction.

We want more

We continue to embrace the wireless tools and connectivity available that allow us to enjoy the business and social benefits of the wireless ecosystem, but we want more. We have an expectation of wireless connectivity regardless of where we are, and when we find ourselves in areas with limited coverage or no coverage, we find it just unacceptable. In an industry that appears to have no limitations, what are the limitations?

Is our advancement throttled back by the availability of wireless spectrum? The simple answer is yes, and I was therefore pleased to listen to FCC Acting Chairwoman Mignon L. Clyburn, during CTIA 2013, announce the upcoming FCC spectrum auctions. The availability of spectrum and the right spectrum is essential for the United States to compete and push forward to stay ahead of the worldwide competition in wireless technology deployment.

So what's next

Where will we be five years from now? Will it be 6G or something completely different? Regardless of what the technology is called, certain things will remain. First and foremost will be speed to market with regard to technology deployment. This will increase the need for professional engineers with the latest wireless and survey tools, qualifications and experience to ensure that the technology is designed accurately and deployed correctly. ∎

Stephen Banks is a partner and senior vice president of KMB Design Group. His email address is *sbanks@kmbdg.com*, or telephone (732) 280-5623.

New Missouri Law Limits Antenna Siting Requirements from Local Jurisdictions

By Curtis M. Holland

On July 5, Missouri Gov. Jay Nixon signed into law HB 331, which is formally known as the Uniform Wireless Communications Infrastructure Deployment Act.

The Act will have a dramatic and positive effect on the wireless telecommunications industry. Among other things, the new Act significantly limits what have long been considered to be overly burdensome and tedious application requirements that local jurisdictions frequently require for new towers, collocations, and significant modifications, as those terms are defined in the Act. The Act is intended to streamline and simplify the application process by limiting consideration of applications for these facilities to traditional land use and zoning principles. The Act makes clear that local jurisdictions may continue to exercise zoning, land use planning and permitting for these types of facilities, but among other things it prohibits local jurisdictions from doing the following:

- Requiring information regarding an applicant's business decisions with respect to its designed service, customer demand or quality of service to or from a particular area or site. This means a jurisdiction is prohibited from requiring an applicant to provide propagation maps, dropped call data, signal strength data or similar types of information in connection with any application.
- Evaluating applications based on the availability of other potential locations for the placement of a support structure, including the option to collocate on other support structures instead of constructing a new support structure or substantially modifying an existing site.
- Dictating the type of wireless facilities, infrastructure or technology to be used by an applicant.
- Imposing environmental testing, sampling or monitoring requirements or other compliance measures for RF emissions that are categorically excluded under the FCC rules.
- Prohibiting the placement of emergency power systems that comply with federal and state environmental requirements
- Imposing surety requirements.
- Conditioning approval on the applicant's agreement to provide space for local governmental services at less than market rate.
- Imposing any requirements or obligations regarding the presentation or appearance of facilities, including those relating to the kind or type of materials used and those relating to arranging, screening or landscaping facilities if such regulations or obligations are unreasonable.
- Charging an application fee, consulting fee or other fee associated with the submission, review, processing and approval of an application that is not required for similar types of commercial development. Fees charged by an authority for or directly by a third party providing review or technical consultation to an authority must be based on actual, direct and reasonable adminis-

trative costs incurred for the review, processing and approval of an application. In no case should the total charges and fees exceed $500 for a collocation or $1,500 for an application for a new support structure or for a substantial modification of a support structure.
- Limiting the duration of the approval of an application.
- Imposing moratoriums for any period longer than six months.

There are also affirmative obligations imposed on local jurisdictions for determining the completeness of and taking action on an application. Generally, these obligations are 120 days for a new tower, 90 days for significant modifications, and 45 days for collocations — or they are deemed approved.

There are many other good aspects to this bill. For a complete understanding of how the bill works and how it may affect any applications you are pursuing, read the bill for yourself and consult with your zoning team.

Special thanks to Craig Unruh at AT&T for his work and to everyone who supported this bill through passage by the legislature and execution by the governor. ∎

Curtis M. Holland is a member of the Missouri-Kansas Wireless Association. An attorney with the Polsinelli law firm with an office in Overland Park, Kan., Holland concentrates on real estate development, zoning and land use entitlements, administrative permitting and government regulations. His email address is *cholland@polsinelli.com*.

agl REGIONAL CONFERENCES

4 Powerful Reasons
to attend the next
AGL Conference
in Chicago, Sept. 19

① **Benefit** in a cost effective and convenient setting
② **Network** with industry colleagues and leaders
③ **Understand** about the latest network developments
④ **Learn** with the experts in construction safety

Featured Speaker

**Keynote Luncheon Interview
with Rich Biby of AGL**
Jonathan S. Adelstein
President & CEO
PCIA - The Wireless Infrastructure Association

Opening Speaker

Opening Keynote Address
James Carlini
President
Carlini & Associates

Conference Emcee

Patricia Troxell-Tant
President and CEO
Solution Seven

AGL Regional Conference
Thursday, Sept. 19
7:30am – 3:30pm
Register at www.agl-mag.com/events

The Westin Chicago Northwest
400 Park Boulevard
Chicago, IL
630.773.4000

Tower Tech Session

Wednesday, Sept. 18 – 3:00pm - 5:00pm
Separate registration and $25 fee required.

Presented by the National Association of Tower Erectors (NATE) and sponsored by Caltrop Construction Services. Join instructor Scott Kisting, Vice President, Mid-west Underground Technology, for a comprehensive two-hour session.

- **LEARN** about hazards associated with performing LTE installations
- **ACQUIRE** the critical understanding of structure overloading, modifications and lack of anchorages
- **DISCOVER** how knowledge and proper training can help, and even save, tower personnel

Meet and greet conference attendees at our networking social
Wednesday, Sept. 18 - 5:00pm - 7:00pm
The Westin Chicago Northwest
Sponsored by TE Connectivity
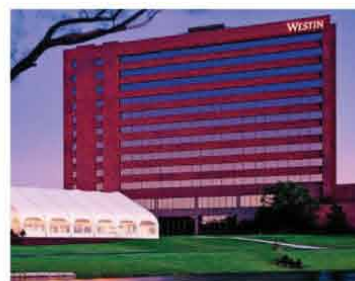
Conference Only $95
Attend the AGL Conference near you and choose from the remaining dates and locations.

Boston – November 5
Boston Marriott Newton

Pleasanton – December 5
Hilton Pleasanton at the Club

201

Tower mark

Survey results and trends and forecasts for the wireless and tower in

13
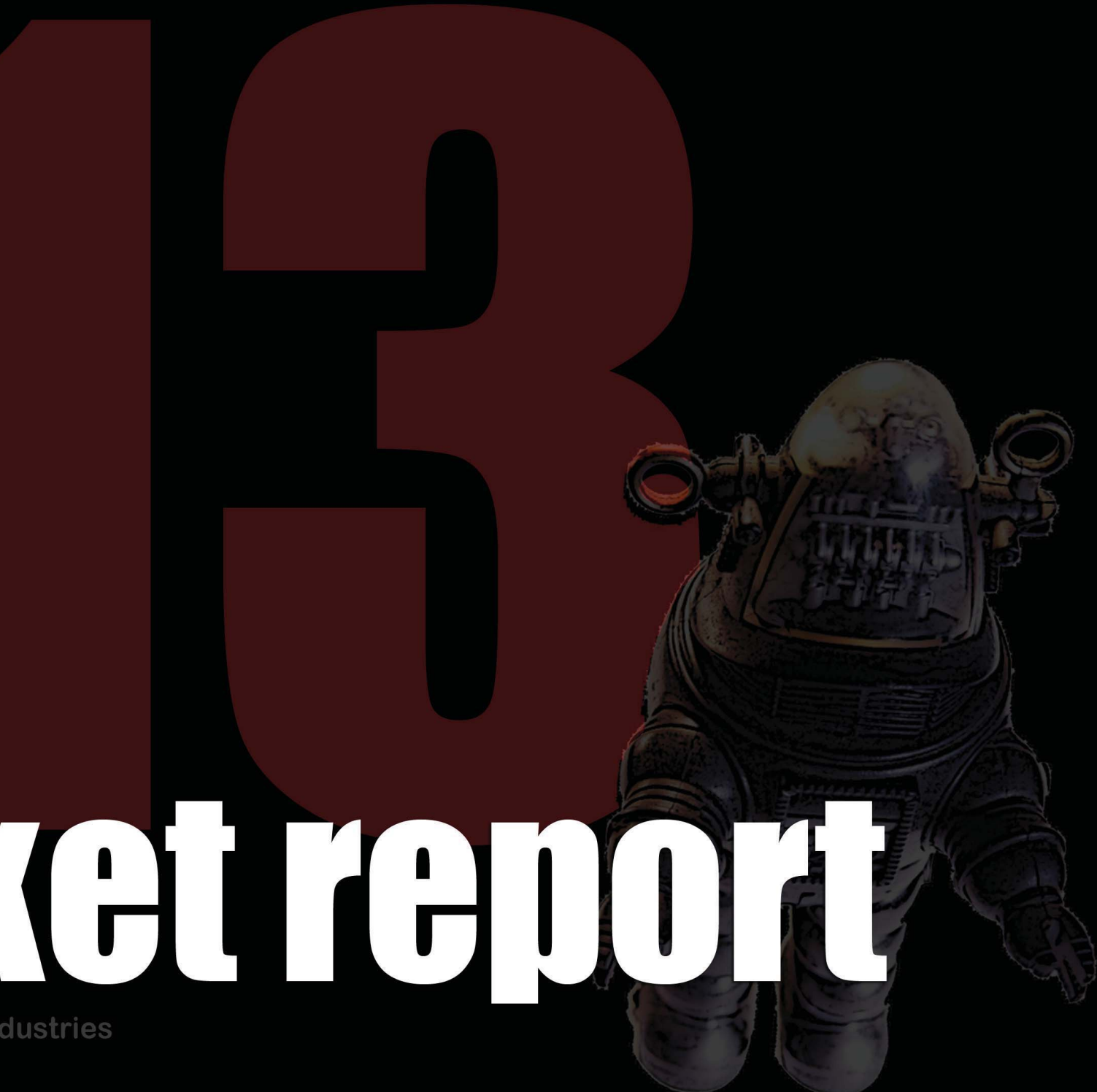
ket report

dustries
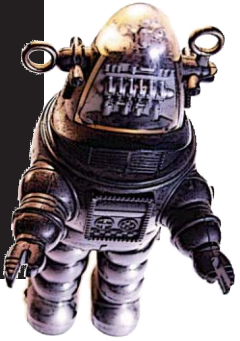
AGL 4th Annual Tower Market Survey 2013

By Jim Fryer

The following survey results reflect answers given by 150 *AGL* subscribers. Some open answers were edited or eliminated because of irrelevance or incoherence. Although conclusive empirical data points cannot be derived from a small sampling, this work nevertheless represents the largest known survey of tower owners. The varied responses reflect an industry struggling to cope in an environment of slowed growth, new technologies, increased government regulations, and new and challenging barriers to entry.

Are you a tower owner or manager? (yes/no) Yes: 63% No: 37% Non-tower owners were asked to respond to a later question.
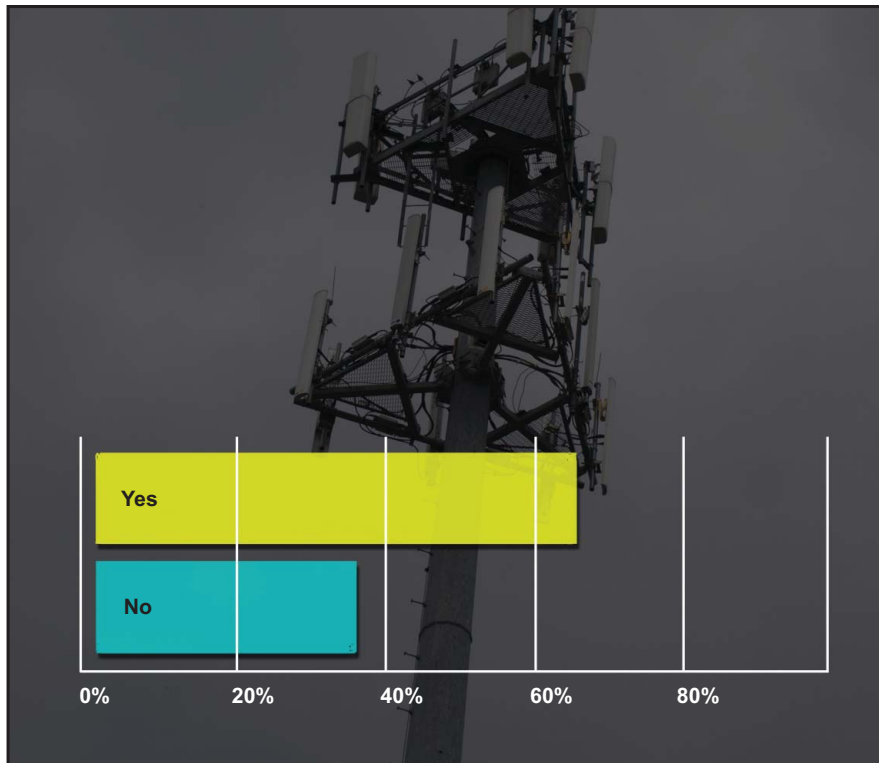
tower market report
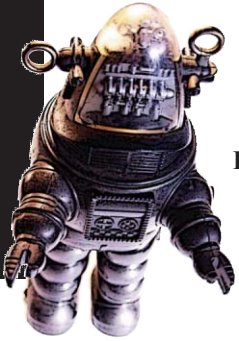
How many towers do you own or manage?

Comment: More than half of the respondents, even though they have been considered to be a vanishing breed, are "mom & pops." But we also obtained good representation from the middle- and upper-tier towercos.

1 to 10: 54%
11 to 100: 21%
Over 100: 25%

What is the biggest challenge your tower company will face in the coming year?

Comment: Surprisingly, no one issue dominated. The usual suspects were all mentioned multiple times — consolidation, government regulation, finding tenants, structural capacity — but because the responses were spread over the entire United States and over different levels of site ownership, the challenges differed.

- Adding subscribers
- Businesses not renting repeater space, moving to their cell phones instead

- Capital for expansion
- Capital to quickly grow
- Carrier budgets for new builds
- Carrier consolidation and financial viability of non-top-tier carriers
- Carrier consolidation
- Carriers are not committing to new site builds or new site collocating.
- Carriers subcontracting their work to subs that are either incompetent, not knowledgeable or just dishonest
- Changes in load calculations

- Changing regulations and increasing client base
- Competition
- Continued wireless upgrades and necessary tower capacity
- Customer upgrades to 4G
- Dealing with tenants' upgrades
- Deciding when and if to sell
- Ensuring towers are upgraded for additional loading due to 4G/LTE antennas and feedlines
- Federal permitting — tribal responses
- Fighting increased tower assessments
- Finding additional tenants

- Finding qualified climbers
- Forest service fees
- Funding
- Getting lessees to get their ducks in a row prior to leasing
- Government regulations
- Growth
- Increase income on existing sites
- Increase our tower inventory when most carriers are more focused on LTE deployments
- Increased tower maintenance fees, but not really that much
- Keeping the site running
- Keeping tower techs trained on new equipment technology, fiber on towers, proper install methods. Tower-mounted radios, troubleshooting failures, with power and fiber to the radios. PIM testing and resolution.
- Keeping up with customer activity
- Land use entitlements
- Larger antenna sizes being used in a joint venture between two carriers
- Lighting
- Loss of Sprint
- LTE modification volume
- Making certain funds for inspections and maintenance are kept in our budgets
- Managing growth
- Monitoring tower and shelter activity
- NEPA, SHPO, zoning
- New business in a declining two-way market
- Quality installs of PCS and cellular systems
- Regulations
- Remote monitoring, tower lights, security
- Rev G building code (towers failing structural requirements), public safety grants and building own facilities, aging facilities
- Site acquisition
- State of North Carolina taking my property by eminent domain
- Stopping unauthorized work on towers or at tower sites
- Structural failures due to overloading and age; availability of trained and experienced tower crews
- Structural loading with LTE antennas and equipment

- Structural modifications and up-grades
- Subcontractor insurance, getting a certificate from them and the cellular company. A lot of the time the contractor works under the cellular company's insurance and does not let you know which one that is, or when they are going to do the work. I went to a tower site and found a company doing work for a cellular company and not using safety

---

Our sites have been radio sites for over 20 years, and they are still trying to figure out what impact our sites have had on the environment.

---

equipment or wearing hard hats. I kicked them off the site and called the tower company and the cellular company. I should have taken pictures and called OHSA.

- Tenant loss due to governmental changes in regulation. Lack of Wi-Fi frequencies, because most of the growth appears to be in that area. Consolidation of cellular providers; however, we haven't lost any because our sites are unique. Continuing adaptation to local county regulations, which are really make-work projects for county employees. Our sites have been radio sites for over 20 years, and they are still trying to figure out what impact our sites have had on the environment.
- The wireless carriers' boosting 2013 network deployments by increasing additional LTE antennas to their existing TDMA and CDMA antenna

radiation centers and not having an aggressive build program for new and additional collocation tower sites. The introduction of LTE is going to be a long, drawn-out process.

- Unrealistic carrier expectation of market rates for collocation rent
- Upgrading our lighting system
- We are a county government. We will be renewing leases on some of the towers we do not own.
- We are an electrical utility that managed PCS collocations on our transmission towers.
- Weed control—it's hard to find reliable companies to spray the sites and keep weeds down.
- Working with AT&T and the company's new turf vendors
- Zoning and entitlements, especially migratory bird protection measures versus the ability to build guyed towers in rural areas

What is your average rental rate for broadband?

< $1,000 per month: 20%
$1,000 to $1,500 per month: 19%
$1,501 to $2,000 per month: 21%
$2,001 to $3,000 per month: 25%
$3,001 to $3,500 per month: 4%
OTHER: 11% (*please specify*) Do not care to disclose. Do not normally lease space. No broadband. Public safety. We are a broadband company and our towers are for our use only; we don't rent.

Are you a member?

Comment: State wireless associations, which barely appeared in our first survey four years ago, now are the dominant group while the mom & pops clung ferociously to their independence by remaining unassociated.

CTIA   8%
PCIA   13%
NAB   3%

average rental rate

- <$1,000 per month
- $1,000 to $1.500 per month
- $1,501 to $2,000 per month
- $2,001 to $3,000 per month
- $3,001 to $3,500 per month
- Other, please specify

0%   20%   40%   60%   80%
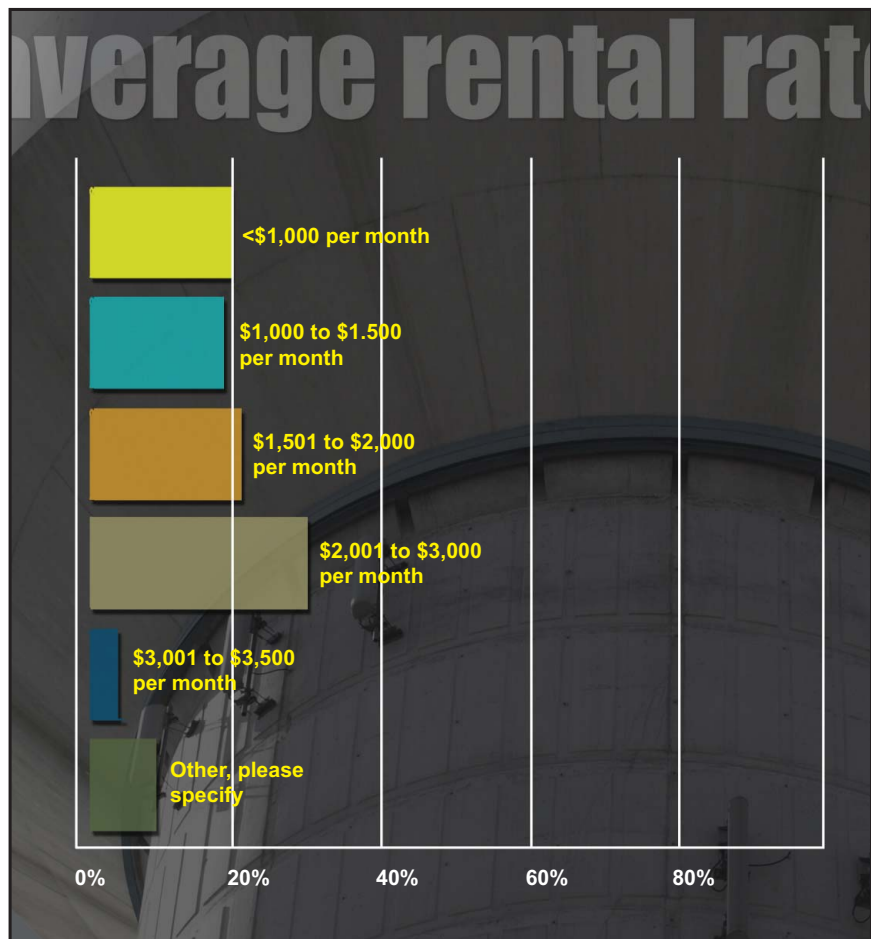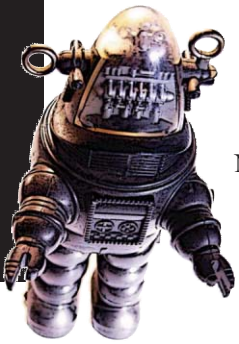
NATE   8%
APCO   2%
SWAs   25%
None of the above 41%
Other (please specify) 5%:
- AOWA
- ARRL

- Chief engineer for radio stations. We use towers and have various services on our towers other than broadcast.
- County government
- DAS Forum
- Enterprise Wireless Association, IEEE

- IEEE
- IUOTA
- NSPE
- UTC & UtiliSite
- We will soon be members of NATE.
- WWLF

Are you a member?

CTIA
PCIA
NAB
NATE
APCO
a state wireless association
none of the above
Other, please specify

0%   10%   20%   30%   40%   50%
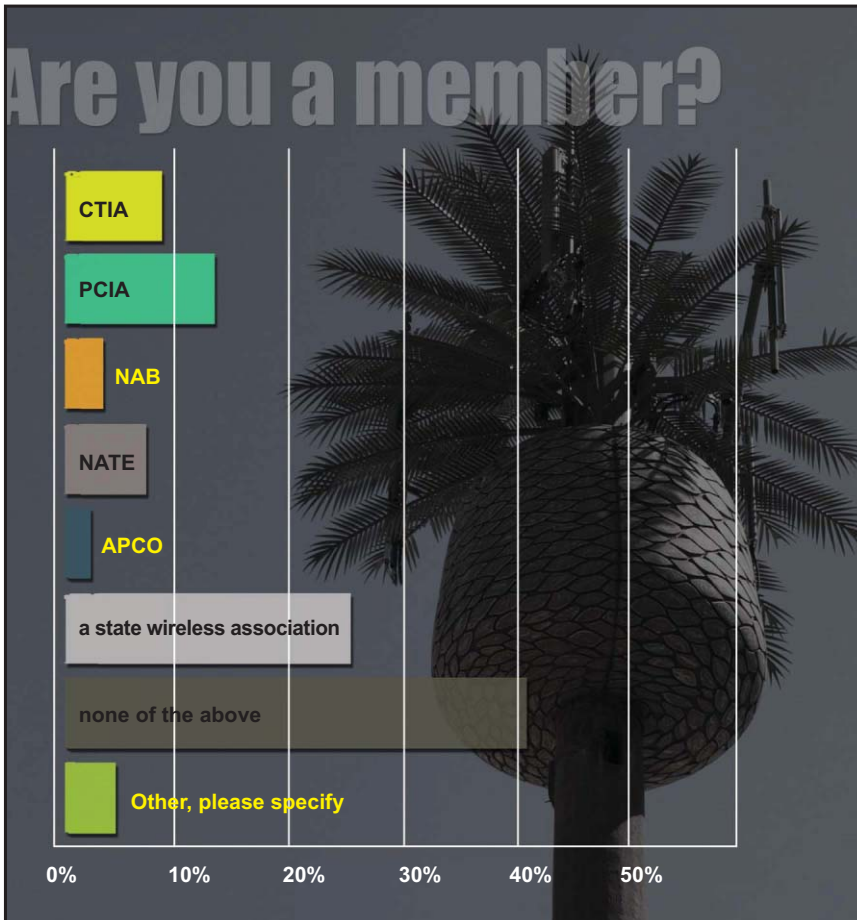
How do tenants find your sites?

Comment: Relatively unchanged from four years ago. Finding sites is hard work, requiring a variety of resources and using good old-fashioned shoe leather. Few sites are leased strictly and solely from a virtual source and in almost all cases are combined with a personal inspection of some sort.

- Drive by 23%
- Word of mouth 19%
- Our website 7%
- Internal resources 5%
- Site acq consultant 13%
- Media advertising 4%
- Tower database (commercial) 3%
- FCC database 16%
- None of the above 5%
- Other, please specify 5%

What is your biggest maintenance cost?

Comment: Lighting takes the prize as the biggest cost, followed by utilities, and then ground maintenance such as weed control and mowing. Inspections received a few mentions. No single item dominated the list, showing the diversity of the tower operations polled. The taller the tower, the more lighting be-

Maintenance Cost

(Chart showing percentages for categories: drive by, word of mouth, our website, internal resources, site acq consultant, media advertising, tower database (commercial), FCC dtabase, none of the above, other, please specify — with a vertical axis from 0% to 25%.)
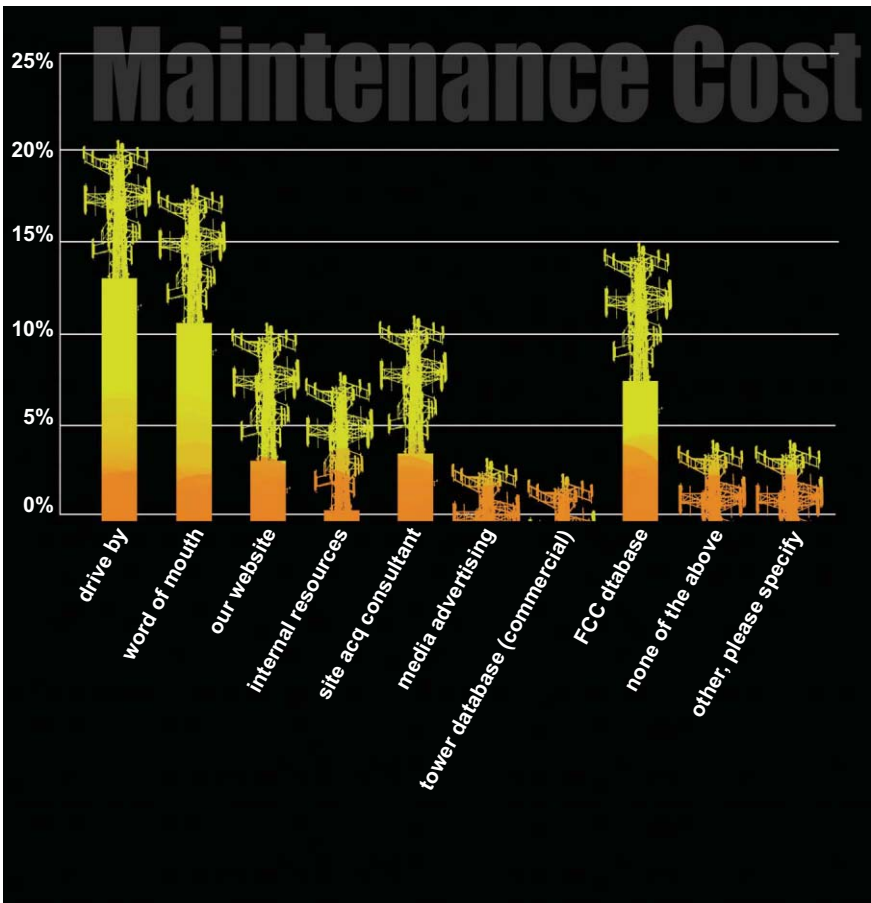
- Snow removal
- Software
- Strobe light failures and resulting costs. Parts, travel, tower crews and technician troubleshooting.
- Strobes and monitoring, and generator maintenance
- Taxes and insurance
- Tower inspections, lighting, mowing, snow plowing and tree trimming
- Tower paint and replacing tower members
- Tower reinforcement for LTE up-grades
- Towers failing Rev G and having to modify or rebuild
- Until a recent change to LEDs, it was

———————

Lighting takes the prize as the biggest cost, followed by utilities, and then ground maintenance such as weed control and mowing. Inspections received a few mentions. No single item dominated the list, showing the diversity of the tower operations polled.

———————

comes a cost factor, whereas for short towers not subject to FCC lighting regulations, general site maintenance is cited as the leading cost.

- Beginning to do inspections
- Building air conditioning
- Electric power to keep standby generator warm for quick start
- Electricity and taxes
- FAA compliance
- Generator maintenance
- Generators and fuel
- Grounds maintenance
- Improper equipment installations and safety violations that other tower and equipment owners fail to comply with. Our company resolves these issues and prevents them from happening again.
- Inspections, plumb and tension, and painting
- Insurance
- Interacting with county officials, diesel fuel for the generator during power outages

- Labor
- Landscaping and snow removal
- Light monitoring
- Lighting
- Lights and painting
- Mowing, cleaning and general upkeep
- Outdated existing xenon and incandescent lighting systems as required by the FAA, and maintenance
- Painting, lighting and insurance
- Painting and structural soundness review
- Pole repairs
- Power
- Regulatory and jurisdictional compliance
- Rent
- Restoring site after theft or vandalism
- Road maintenance on top of a mountain
- Safety equipment
- Site cleanup
- Site vegetation, generators, road maintenance

lighting. Now, it's groundskeeping — mowing, weed killing, road grading and snow plowing.

- Utilities, brush control, tower paint and lights
- Vandals
- Vegetation control
- Was lighting repairs, but did away with lighting as state changed requirements to match FAA

September 2013
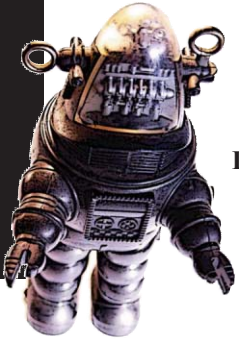
Do you plan on building more sites in the next 12 months?

Yes, planning on building new tower sites: 37%

Tower and DAS build out planned: 11%

Just DAS build out planned: 5%

What is your main reason for expanding?

- Fill in and new builds
- VHF SMR
- Convention center
- Carrier expansion and capacity towers
- Have to rebuild existing sites to accommodate current users
- Main emphasis is on collocations to existing tower portfolio and only constructing a new tower site when an anchor tenant has been identified and lease executed.
- Size of company is good.
- System capacity coverage
- Building new macro tower sites
- We commit to incremental growth
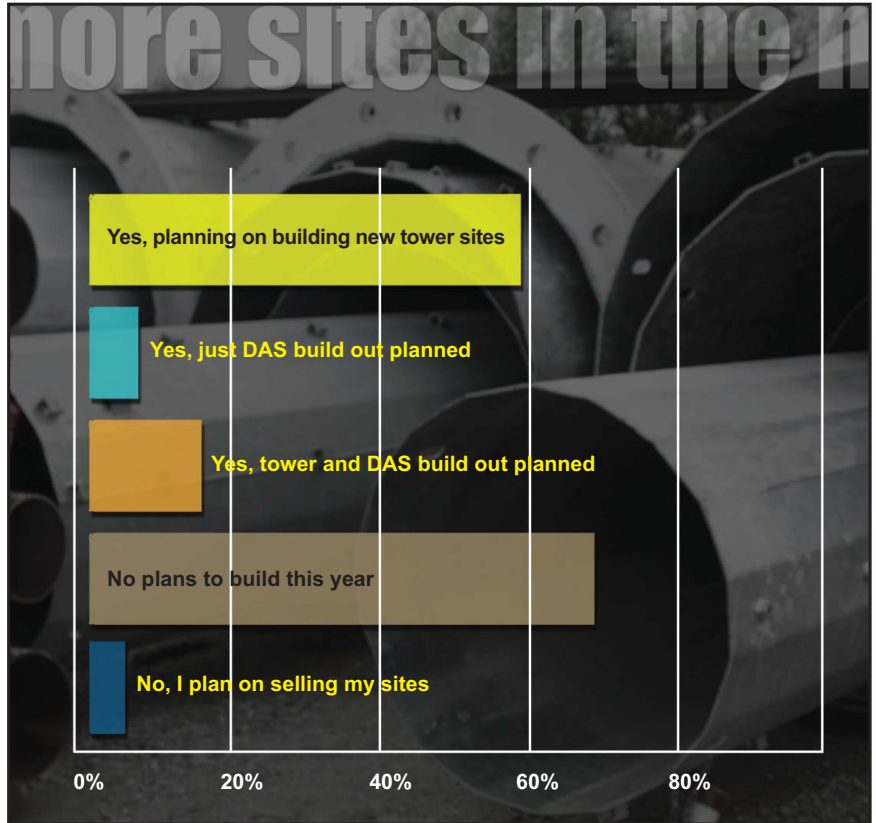
Yes, planning on building new tower sites

Yes, just DAS build out planned

Yes, tower and DAS build out planned

No plans to build this year

No, I plan on selling my sites

0%   20%   40%   60%   80%

tower market report

year over year.
- I anticipate growth at the end of this year as LTE and Sprint Network Vision wind down and carriers will need to add sites to their networks.
- We anticipate building some macro and DAS sites and nodes in 2013.

No plans to build this year: 43%
Plan on selling their sites: 4%
Reasons?
- Want to sell because of loss of revenues at current site
- Consolidation by carriers
- Leases have been negotiated down by third parties

Are you able to find qualified tower technicians to service your sites?
Comment: This question was added this year because there seemed to be a general grumbling, heard in casual con-

though the comments indicate that crews are working at capacity and increased build out may deplete both the quality and quantity of tower hands.
YES: 95%
NO: 5%
Comments on "If NO, how do you address that problem or how does it affect you? If YES, do you use various crews or have a dedicated service provider?"

- All timing-specific, although there are a few that I trust to complete jobs.
- Approved vendors
- I pay too much. Tower bulbs used to last over 24 months; now, I'm lucky to get a year. The last time I had the bulbs changed, the price jumped from $500 to over $600.
- Internal tower crews
- Our company has its own tower technicians who are certified and trained

- Our internal tower crews cannot service our sites and work. We end up doing the work, and it gets us behind on all aspects of the business.
- Shortage of qualified crews
- Some are good and others are not.
- Tower will not support expansion
- Two crews — one local for small jobs, the other from the tower manufacturer for bigger jobs
- Use various crews
- We establish and maintain relationships with local tower crews for faster and usually better service.
- We own our own tower company. When we are busy, we hire others to help.
- We have a list of qualified techs, but the industry is stretched thin with the quantity of work.

IF YOU ARE NOT A TOWER OWNER: How do you service the tower industry? (Engineering services? Legal? Maintenance?) Do you anticipate growth in the coming year? If so, from what? If not, why not?
Comment: Most service and equipment providers to the industry seem to anticipate growth in the coming year mostly because of LTE and DAS build out along with general expansion demands by the carriers.

Random replies and comments
- Acquisition and real estate: Growth? Yes.
- All of the above: Growth? Yes, do anticipate growth.
- Analyst: Growth? Yes to growth from DAS.
- Offering consulting and examination services to the legal profession: Growth? I am anticipating growth in the industry because of the vast amount of users and cases involving digital phone forensics and cell tower forensics.
- Carrier: Growth? Not much growth in new tower builds.
- Carrier: Allow collocations in our towers.
- Civil engineering
- Consulting: Growth? Yes, from LTE
- Construction
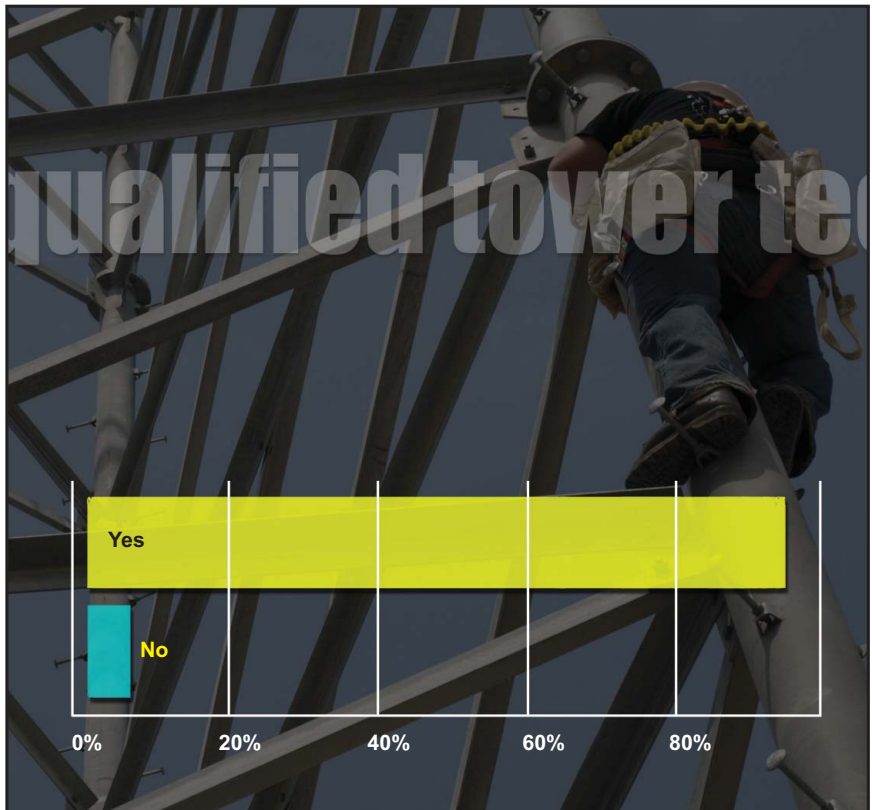
versations with tower owners, about the quality of tower techs in the market and their availability. The survey showed this to be more bark than bite as an overwhelming 95% answered "yes," al-

for every aspect of the tower facility maintenance and management.
- Our electrical linemen are the only crews allowed on the transmission towers to upgrade PCS sites.

- Contractor
- Do inspections for a branch of government: Growth? They want to get away from towers and go to leased lines.
- Engineering (RF, telecom, site), project management, site audits and zoning assistance
- Engineering and construction services
- Engineering and maintenance
- Engineering and surveying
- Engineering services: Growth? Expect minimal growth
- Engineering services: Growth? Yes, growth from redeployment of spectrum
- Engineering services: Growth? From Wi-Fi product line to take your indoor access point outdoors, from UPS systems for broadband radios
- Engineering: Growth? Very much of an increase
- Engineering, construction, tower ownership
- Engineering, site acquisition and construction management: Growth? Yes, we expect growth from services surrounding new site builds and coverage expansion.
- Engineering, tower manufacturing, tower construction and modifications
- Engineering, construction, sales, design, collocation and service
- Environmental consulting
- Expect normal lease growth of 3 percent and maybe a new tenant for the local electric utility
- Financial services, and mergers and acquisition advisory
- Full service: Growth? Slow but consistent growth
- Government solutions. Network engineering for all Department of Energy telecommunications
- Grounds maintenance: Growth? I hope for more growth.
- Growth in licensed microwave
- Growth with many different services, i.e., phone, data, two-way and broadcast
- Hopefully, more microwave and Wi-

Fi. Broadcasters at our site are leaving because we are in a poor market for broadcasting. Growth? Very heavy cable penetration. The days of high-power TV and radio stations are over, along with their high rental rates. We have to adjust to the new environment. Fortunately, we own our sites, so our overhead is low.
- I am an attorney for a number of tower owners. I do enjoy and value *AGL*.
- I need to rent two towers or sell them. I ran ads in the third quarter last year and received no response. I'm game for anything that works.
- I rent tower space and help tower companies find better ways to operate.
- I work with rural wireline and wireless providers that are building towers for lease to other wireless carriers. Also, my clients lease towers from other providers.
- Industry association (CTIA)
- Informational service for Ericsson
- Infrastructure development, operations and management: Growth? From continued 4G deployments and lifecycle management of existing infrastructure
- Infrastructure owner
- In-house
- Interested observer
- Land lessor to AM radio station tower
- Legal. Also, I sell a book (Antenna Zoning – Professional Edition).
- Maintenance: Growth? LTE, small cells and mergers
- Maintenance, engineering services and installation
- Maintenance, FCC services and engineering
- Maintenance: Growth? I believe growth will be the norm for the coming year(s).
- Management and maintenance
- Management, engineering, installation, service and maintenance
- Managing tower sites for a community college
- Manufacture towers and rooftop systems (concealment)
- Microwave backhaul and broadcast

tower installation and maintenance: Growth? I'm anticipating growth from all sectors of the tower industry.
- Monitor tower lights
- Network services through vendor company
- New construction, upgrades, collocations, maintenance, fiber install on towers and removal of towers: Growth? Growth because of LTE installations
- No, don't want to
- No expected growth, no contacts regarding possibly using my tower site for cell site
- Outsourcing to qualified engineering, environmental and maintenance services
- Owner: Growth? Growth is coming from 4G and LTE.
- Pre-construction development, site acquisition, zoning, permitting, and architectural and engineering work
- Product supplier to various customers ranging from carriers to general contractors: Growth? Tessco anticipates growth in advanced wireless service (AWS) build outs, tower modifications, DAS and small cells.
- Property manager — more towers
- Provide 12 to 15 build-to-suit opportunities for tower companies each year for a regional carrier
- Provide RFR safety certification training and EME hazard assessments: Growth? Definitely anticipating growth because the industry is growing by leaps and bounds
- Provide tower space and lease tower space.
- Real estate and valuation consultation
- Rental of excess space: Growth? Cellular companies expanding.
- Rental space: Growth? From FM radio, wireless radio and LoJack
- RF engineering, site acquisition, expert witness testimony, health and safety issues. We also acquire and sell towers, but at this time we have no sites under ownership.
- Safety training, certification and rescue

- Service provider, engineering and installation services to carriers
- SMR systems and engineering services
- Some site acquisition and consulting
- Systems upgrades, construction and contracting
- Telecom utility, provide backhaul, carrier services and tower collocation
- Telecomm general contractor
- Tower vertical space use is growing.
- We are a tower manufacturer and we expect a good year, as Verizon and AT&T, among others, seem to be building again.
- We are a wireless infrastructure, multifaceted construction company. We install eNode equipment in cell towers for Verizon Wireless in the Indiana and Kentucky markets. Growth? We are a growing company expecting growth in iDAS, oDAS, cell site installs (LTE) and cell maintenance. We are looking forward to

small-cell and DAS projects.
- We are wireless communications (fixed and mobile) consultants for public safety, local government, industrial and commercial clients. Our clients generally lease towers and sometimes construct their own towers. We develop the wireless system design and specifications. We identify existing suitable structures to meet system design requirements or prepare specifications for construction of private towers by our clients. Growth? Some small growth in North America, but typically stagnant compared with last year.
- We built towers for our own use and lease space from other tower companies to deliver broadband, SCADA and AMI for our members
- We develop needed tower locations the vast majority of the time with our secondary source of site locations coming from the carriers.
- We do not serve the industry per se. We only lease space on our existing

broadcast towers.
- We do site builds and also sell monopoles and power systems.
- We do tower erection and maintenance.
- We perform the structural analysis and construction for all PCS sites on our transmission towers.
- We provide coverage maps, lease negotiations and marketing services. Growth? We're experiencing growth and expect more this coming year.
- We provide utility collocation.
- We service via maintenance. Growth? We are anticipating growth as more and more clients or end users need to swap out old equipment for new equipment. Even quarterly preventive maintenance is offered. ∎

Jim Fryer is on the board of the Pennsylvania Wireless Association and is president of Fryer Marketing & Media, a tower market consulting firm. His email address is jim@fryermarketing.com.

Trends and Forecasts for the Wireless and Tower Industries

By Clayton Funk, Jason Nicolay and Ryan Carr

As carriers focus on enhancing their subscribers' experience by providing consistently reliable service throughout their networks, shared wireless infrastructure will continue to be the rule. Demand for cell sites continues to flourish, as carriers actively seek to modify and amend their existing leases and seek new sites to collocate on in order to meet the rapidly growing need for capacity and ubiquitous coverage.

The wireless industry and its related shared wireless infrastructure subsector continued to witness significant changes over the last year. However, much has also remained the same. The shared wireless infrastructure industry continues to be well positioned for future growth as data and mobile video use increase and continue to strain network capacity. Projected data usage on wireless networks, according to Cisco, is forecasted to grow by more than 66 percent annually from 2012 to 2017 (see Figure 1). We'll examine what has changed over the last 12 months and discuss some developments that probably will affect the shared wireless infrastructure and the wireless industries.

Several specific niches, collectively, make up the shared wireless infrastructure industry. The first niche, towers, includes vertical real estate for wireless carriers and broadcasters. A second niche, rooftops, uses existing commercial, retail and multi-unit residential buildings for antenna placement in strategic locations. A third niche, distributed antenna system (DAS) networks and small cells, historically a technology of last resort, is now viewed by most carriers as another method in the toolbox for achieving desired coverage and capacity. A fourth niche, backhaul, includes wireless backhaul (microwave) and wired backhaul (fiber-to-the-tower).

Originally, almost all of today's shared wireless infrastructure niches started as single-use facilities. However, speed to market and consumer demand for wireless services are the catalysts for installing more shared facilities. Niches such as small cells (femtocells, picocells, etc.) have gained popularity in the wire-

tower market report
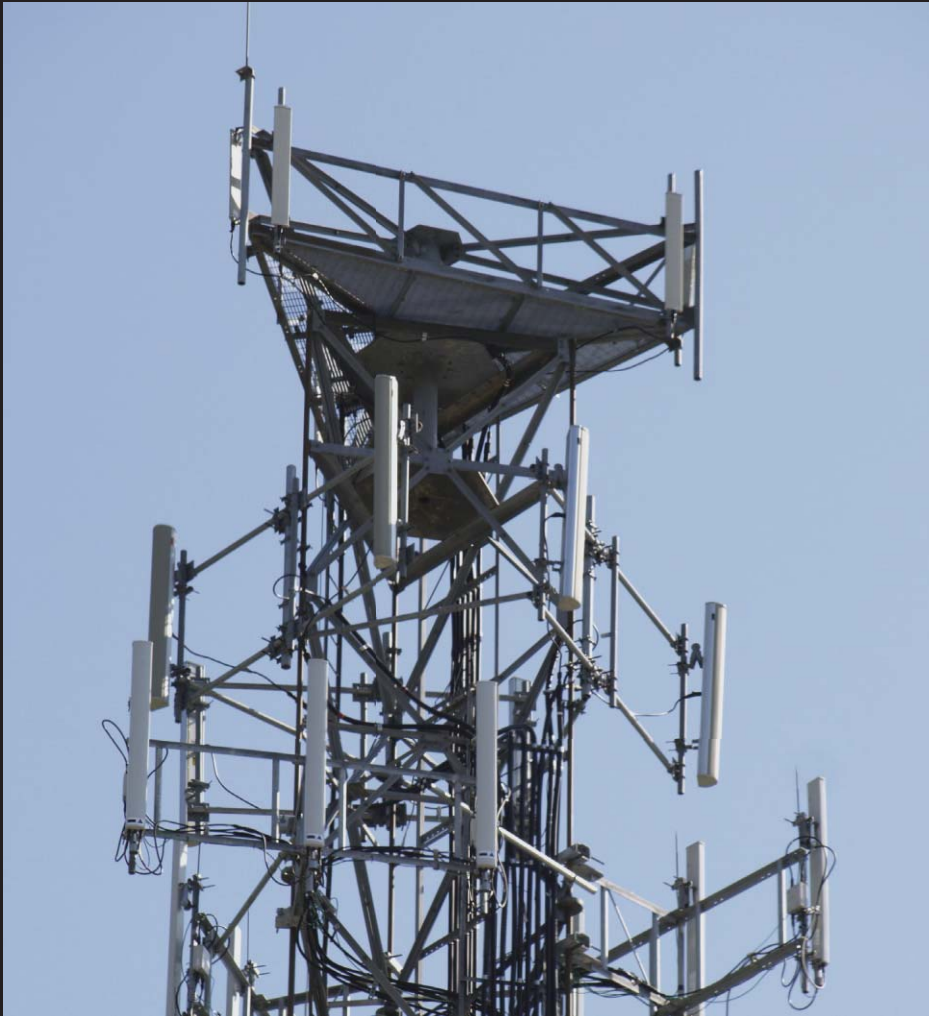
AGL Video Extra

**A Close-up of
Media Venture Partners**

less infrastructure industry for a coverage and capacity solution as carrier networks continue to evolve and adapt to consumer needs and demands.

Attractive to investors

Over the years, one fact remains unchanged — the shared wireless infrastructure industry attracts investors because of the following factors:

- Investment-grade customers (i.e., AT&T and Verizon) and other tenants commit to long-term contracts that produce a steady recurring revenue stream
- Infrastructure owners can financially and operationally leverage their assets
- The businesses are capital-intensive, requiring investors to continually commit capital that will ideally earn an attractive return on investment
- The industry has barriers to entry
- Ownership remains fragmented

Carriers and tower owners publicly decry difficulties with zoning approval for antenna sites and changes to existing sites. They both chafe at the limited access to prime locations to serve as coverage sites, capacity sites or both. However, for investors in shared wireless infrastructure, those same barriers to entry assist in protecting asset value by restricting competition.

Meanwhile, carriers themselves have to overcome their own barriers such as access to spectrum often acquired through Federal Communications Commission auctions and are required to meet established FCC license build out deadlines. Those expensive and lengthy processes limit the carriers' competition. Simply building out a network, even on a limited scale, can cost millions and into the billions of dollars, so access to and the availability of capital is yet another factor that limits who owns spectrum utilized for commercial services.

Tower owners have an ability to leverage their assets because of the recurring, contractual revenue the towers generate. The long-term agreements with investment-grade, national wireless operators

provide stability. The barrier to entry represented by zoning approval and access to capital helps to keep the churn rate among tenants low. Access to both debt and equity capital for tower owners tends to be easier and more abundant when compared with many other industries.

Fragmented ownership in the various shared infrastructure niches typically includes two or three larger companies and a large number of smaller entities. With more and more companies establishing

themselves in these niches, a deeper pool of potential acquisition targets results. These targets attract entrepreneurs with private equity funding who can foresee an exit to a larger consolidator at a future date.

The abundance of capital to invest is favorable for entrepreneurs, who are encouraged by the fact that the wireless industry's fundamentals continue to be sound.

Macroeconomic conditions

Over the last year, the U.S. economy
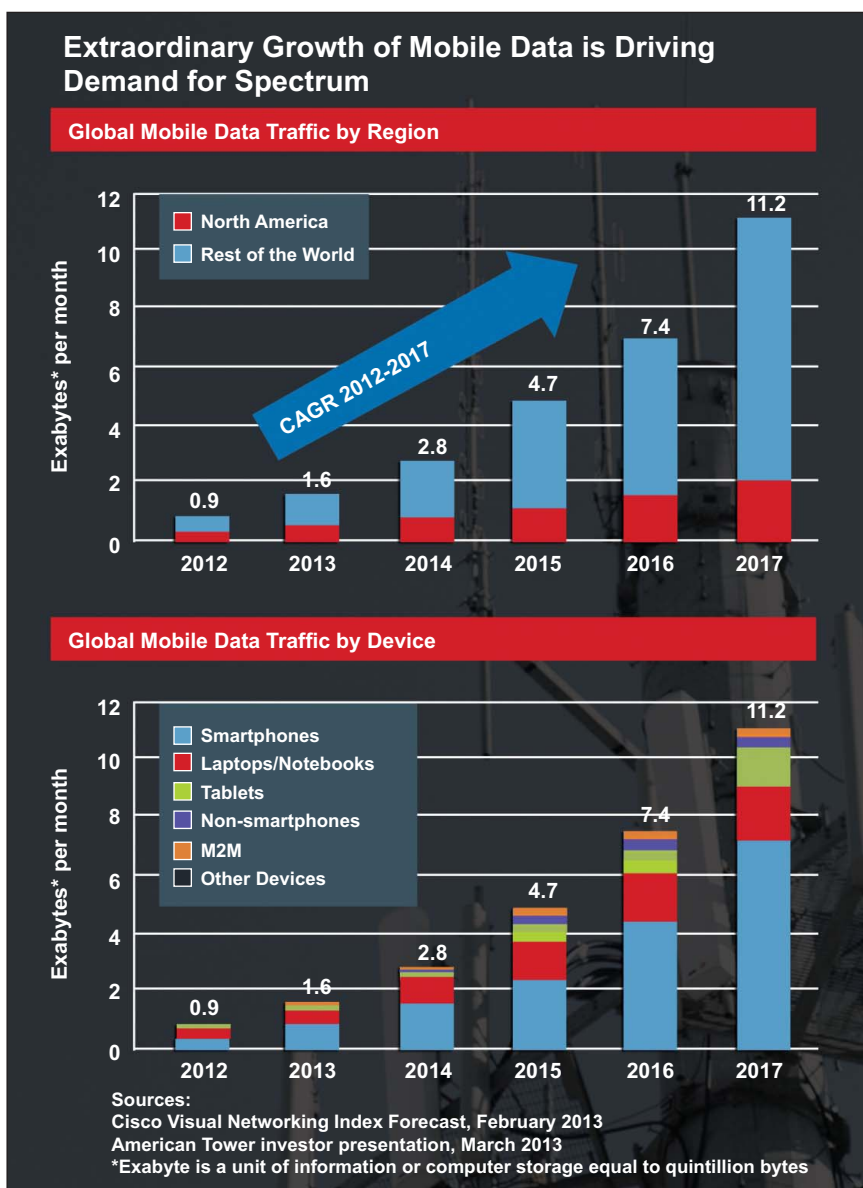
Figure 1. Customers' insatiable demand for wireless access to mobile Internet, data and other information will drive an increase in mobile data traffic by 13x over the next five years.

has continued to slowly and steadily improve, while Europe remains in a recession and China's economy has softened. In June 2013, consumer confidence remained strong, at a near six-year high. As a result, retail spending is anticipated to keep on pace and grow between 4 and 5 percent during 2013, and unemployment is remaining steady at approximately 7.5 percent despite federal spending cuts and higher taxes. Another positive factor in the U.S. economy is that interest rates remain low. Regardless of recent increases in 30-year mortgage rates and 10-year Treasury notes, Kiplinger believes interest rates will remain low in the near future and it has little reason to believe the Federal Reserve will increase the federal funds rate any time soon.

So what does an improving economy mean for tower owners? Strong consumer confidence should translate into wireless subscribers continuing to demand a faster and more consistent consumer experience, motivating wireless operators to continue their process of upgrading and enhancing their networks. Access to inexpensive debt should allow tower companies to continue to secure new credit facilities and debt issuances, allowing tower owners to pursue growth through organic development and acquisitions.

Wireless trends

Although the U.S. economy continues to steadily improve, there are still key areas to watch as one attempts to forecast where the shared wireless infrastructure industry is headed. First, continue to watch the performance and projections of the wireless carriers. Key metrics include subscriber growth, average revenue per user or account (particularly the growth of revenue from data plans) and capital expenditures. Second, watch the credit markets and take note of the availability of credit and the pricing of that credit. Solid cash flow from high-quality tenants who are under long-term contracts underpins the trends for shared wireless infrastructure companies, such

as tower and DAS owners.

Wireless carriers continue to see their own headwinds in growing their businesses as relates to voice communications. With the mobile phone market nearly completely saturated in terms of voice-only subscribers, price cutting has intensified for voice plans. However, data plans continue to remain stable with ample growth opportunities. Less-expensive, prepaid wireless services that do not require contracts have been increasingly in favor, at the expense of the postpaid sector dominated by Verizon and AT&T. Given the continued explosion in the usage of smartphones as well as the increased number of consumers turning to tablets and e-readers, carriers who can offer consistently reliable, fast networks for data usage have been able to grow their respective market share. Given that AT&T and Verizon are the two largest wireless companies, their operational and financial performance is a good barometer for the wireless industry.

First-quarter 2013 results had AT&T adding 365,000 net subscriber connections for a total of 107.3 million connections, while Verizon, with 720,000 net adds, had 98.9 million retail customers. AT&T reported postpaid net adds were just 296,000 to reach 70.7 million, while Verizon reported 677,000 retail postpaid net additions during the quarter, growing its postpaid subscriber base to 93.2 million. Connected devices such as tablets, e-readers and others continue to boost both AT&T and Verizon's net additions and served to attract new subscribers desiring access to the hottest consumer wireless devices.

Carriers will continue to focus on growing revenue from sources other than voice-only customers as they work to maintain and grow their average revenue per user or account. The good news is that 45 percent of AT&T wireless subscribers are postpaid smartphone subscribers as of March 31, 2013, an increase of 17.4 percent year-over-year. In its most recent quarterly report, AT&T said that approximately 31 percent or $5.1 bil-

lion of its wireless revenue is derived from data services, an increase of nearly 21 percent from the prior year. Verizon reported that over 61 percent of its retail postpaid subscribers used a smartphone device, an increase of 14 percent over a year, which has assisted with Verizon's total first-quarter service revenue increasing by 8.6 percent year-over-year to $16.7 billion. These metrics indicate that both AT&T and Verizon continue to shift away from their dependence on voice for revenue, which is further supported by the fact that more than 57 percent of Verizon's total network traffic goes over its LTE network.

Over the last 12 months, merger and acquisition activity among wireless carriers has been extremely active and robust. During that time, there are five deals to highlight that are driving consolidation and resulting in an infusion of capital into the carriers.

- **T-Mobile/MetroPCS:** T-Mobile USA entered into a reverse merger with MetroPCS, which valued the deal at $33 billion for the combined company. This transaction provided T-Mobile with access to highly desirable spectrum in urban markets and a significant number of subscribers. This deal closed in May 2013.
- **Sprint/U.S. Cellular:** U.S. Cellular divested its Chicago and St. Louis operating markets and sold the operations and related subscribers to Sprint for $480 million. This transaction closed in May 2013.
- **Softbank/Sprint:** Softbank agreed to acquire 70 percent of Sprint for a $20.1 billion valuation, which will provide an $8 billion capital infusion into the third-largest wireless carrier. Despite Dish Network's attempt to acquire Sprint, Softbank prevailed by sweetening its offer to shareholders. This deal has received shareholder approval and is awaiting the FCC's final blessing.
- **Sprint/Clearwire:** After multiple offers and counteroffers, Sprint received shareholder approval to acquire the remaining interest in

Clearwire it didn't already own. Despite multiple efforts by Dish Network to secure the opportunity to acquire a significant stake in Clearwire, Dish was outbid by Sprint. This deal closed in July.

- **AT&T/Allied Wireless:** AT&T agreed to acquire Atlantic Tele-Network's Allied Wireless operations (former Alltel assets) for $780 million. AT&T will receive attractive 700-MHz spectrum, an operating network covering 4.6 million people and approximately 585,000 subscribers. This deal is pending.

In addition to several carriers acquiring other notable carriers or wireless operations, most of the Big Four wireless operators (AT&T, Sprint, T-Mobile and Verizon) have been busy securing additional spectrum. Most recently, T-Mobile announced a $308 million purchase from U.S. Cellular of AWS spectrum covering the Mississippi Valley and its population of more than 32 million. In January 2013, Verizon successfully exited its 700-MHz B Block holdings through a series of divestures, which concluded with AT&T agreeing to acquire 39 markets covering 42 million people for $1.9 billion. While these were two of the most significant and sizeable transactions announced, the secondary spectrum market has remained active with more than 70 transactions closed or pending FCC approval since the beginning of the year.

Consolidation

Given the flurry of wireless and spectrum transactions over the last year, it is not unrealistic to assume there will be further consolidation among the Big Four wireless carriers, national pay-as-you-go operators and local wireless carriers. Future consolidation will provide carriers with additional access to much needed spectrum and support the need for additional capacity in urban markets especially.

The overall good news is that today's fundamentals for the wireless infra-

structure industry differ widely when compared with fundamentals from over a decade ago (see Figures 1 and 2).

All of the Big Four wireless operators have selected LTE technology for their 4G networks. Since last year, the wireless carriers have been busy deploying LTE equipment to upgrade and expand current networks. Verizon is leading the pack because it has substantially

what's next for the carriers? In the past 12 to 18 months, all Big Four wireless operators have indicated their intent to further upgrade their networks to LTE-Advanced in coming years. LTE-Advanced is focused on higher capacity with increased peak data rates, higher spectral efficiency, an increased number of simultaneously active subscribers and improved performance at cell edges.

Wireless and Towers: 2000 versus today	THEN December 2000	TODAY December 2012
Wireless		
Subs (in millions)	109	326
Penetration	38.9%	102.0%
MOUs/Month/Sub	309	586
MBs/Month/Sub	NA	694
ARPU	$52	$49
EBITDA Margin	26.7%	35.3%
Towers		
Cell Sites	104,288	301,779
Tenants per Tower	1.5	2.2
EV/EBITDA*	28.6x	19.4x
Leverage	10.4x	5.7x

Figure 2. In comparing today's wireless and tower industries with the way they were in 2000, it is important to keep in mind that there are large fundamental differences between the characteristics of the industries today and the characteristics of the industries more than a decade ago. (Source: Media Venture Partners, CTIA company filings and industry news.)

completed its rollout to cover 298 million people with its 4G LTE, then AT&T with 292 million people, Sprint with 100 markets now covered with a target of 200 million people to be covered by year-end, and T-Mobile with 24 million people covered.

With a couple of the 4G LTE network deployments nearing completion,

These achievements will be realized through carrier aggregation, enhanced use of multi-antenna techniques and support for relay nodes. Further network improvements that deliver a more consistent customer experience probably will result in tower owners receiving additional modification requests from their existing tenants and possibly new

tower market report

collocation interest as the networks continue to become denser.

Consistent with the last few annual market reports Media Venture Partners has completed for *AGL*, the merger and acquisition market for shared wireless infrastructure, especially towers, has shown incredibly robust valuations. Nearly every tower company is expressing strong interest in acquiring good-quality assets ranging from towers to DAS networks to portfolios of underlying ground leases. The last half of 2012 was filled with a large wave of tower transactions because many sellers wanted to lock in lower capital gains rates. As a result, 2013 to date has provided tower buyers with limited acquisition opportunities. The limited supply, along with the desire to deploy capital into tower assets, is driving strong demand for nearly all types of tower portfolios. With the

current supply-demand imbalance, the deal environment remains extremely competitive with more buyers trying to acquire towers than there are sellers.

Every deal is different, and various types of towers will be valued uniquely depending on a variety of factors. Although circumstances will vary for each transaction and not every tower or tower deal is the same, in general most deals for telecom towers are being completed at historically high multiples of tower cash flow, roughly between 16x and 19x, and upward of 20x or more in many instances. Broadcast, government and microwave towers tend to trade at multiples below where telecom towers are bought and sold, but nevertheless are achieving historic highs.

Over the last 12 months, several headline tower transactions with more than 100 sites were reported, but dozens of smaller acquisitions have also been

closed. Figure 3 highlights five larger tower transactions that were publicly announced and closed between June 2012 and June 2013.

Trading multiples

Public tower companies were trading at over 20x forward EBITDA (earnings before interest, taxes, depreciation and amortization) as recently as the fourth quarter of 2012. Although publicly traded multiples have declined slightly from those recent highs, private tower transactions continued to receive strong multiples at or above where the public tower companies have been trading recently (see Figure 4). For tower companies, despite their high-teens valuations, low-twenties EBITDA multiples have continued to be acquisitive.

Tower index stock price

Since last year's Tower Market Re-
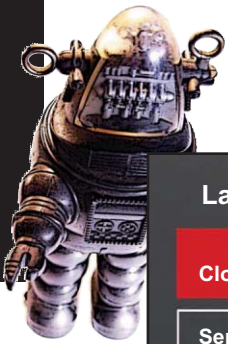
Large Tower Transactions from June 2012 to June 2013

Closed Date	Seller	Buyer	Towers	($ in millions) Price	TCF Multiple	Price per Tower
Sept 2012	T-Mobile	Crown Castle	7,200	$2,400.0	~19.0x	$333,333
Oct 2012	TowerCo	SBA Communications	3,252	$1,450.0	~15.5x	$445,879
Oct 2012	iWireless	TowerCo	119	$45.5	NA	$382,353
Dec 2012	Skyway Towers	American Tower	318	$169.5	NA	$533,019
Dec 2012	Diamond Communications	American Tower	340	$322.5	NA	$948,529

Figure 3. The tower merger and acquisition market during the last four months of 2012 was extremely busy, with the five largest deals in the past 12 months having been completed during this period.

port, public tower company valuations have continued to experience an increase in their per share price. Despite increased market volatility in June 2013, public tower stocks are trading at 88 percent of their 52-week highs as of June 28, 2013. On average, public tower stocks have seen their valuation grow by 32 percent since last year's report and by more than 58 percent since Jan. 1, 2012. As of June 28, 2013, public tower companies traded at an average of 19.4x 2013 estimated EBITDA (see Figures 5 and 6).

American Tower, Crown Castle International and SBA Communications have "buy" or "overweight" ratings of 87 percent, 73 percent and 89 percent from stock analysts, respectively.

Wireless capex

Capital expenditures by wireless carriers continue to drive growth for shared wireless infrastructure companies. Both public and private tower companies as well as the general market are consistently watching wireless car-

riers for any signal of decreased capex spending. Publicly traded wireless operators are projecting capex in excess of $25 billion during 2013, which will largely support the carriers' continued 4G network build out and anticipated upgrades to LTE-Advanced. As a result, tower companies, both public and private, continue to receive an increase in the number of amendments and modifications to their sites, especially in urban and suburban markets where carriers are focused on building their

Historic Enterprise Value to EBITDA Multiples (12 Months Forward)

Figure 4. The historical enterprise value to EBITDA (12 months forward) shows how the multiples for the public tower companies have fluctuated during the past decade. Companies represented are American Tower (NYSE: AMT), Crown Castle International (NYSE: CCI), SBA Communications (NASDAQ: SBAC) and defunct Global Signal (NYSE: GSL).

Trading Multiples for Public Tower Companies

($ in millions, except share price)

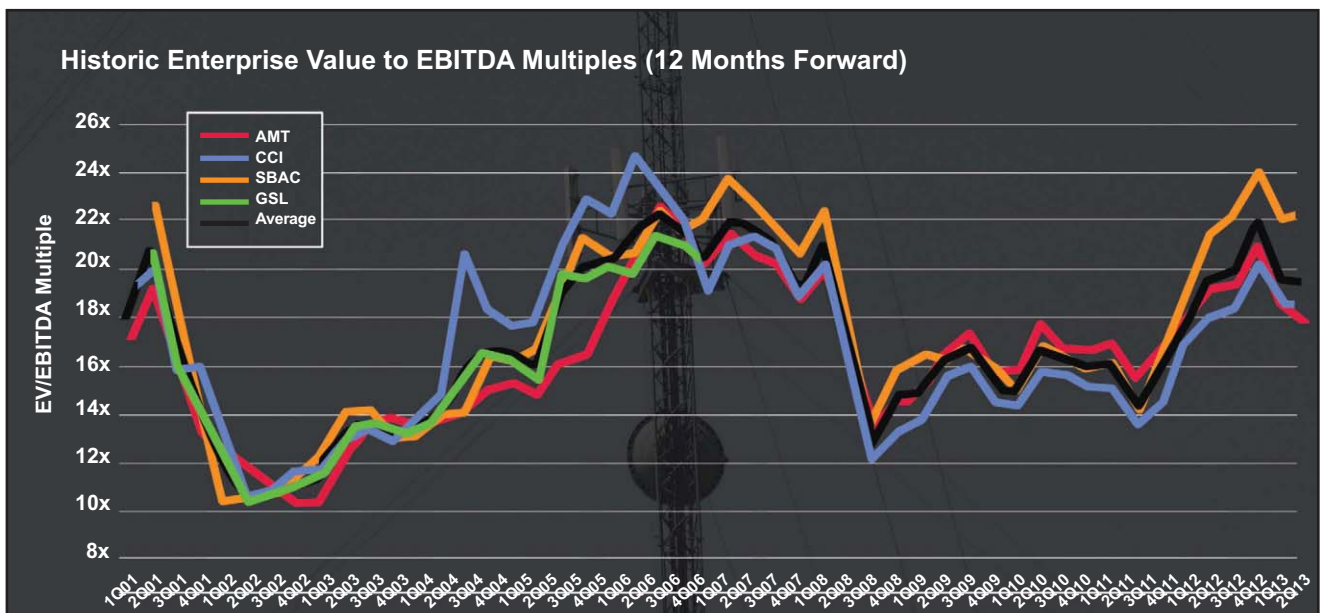| Company	Stock Price 6/28/2013	% of 52-Week High	Equity Value	Enterprise Value	Enterprise Value/			
					2013E Revenue	2014E Revenue	2013E EBITDA	2014E EBITDA
American Tower	$73.17	86%	$29,052	$37,569	11.4x	10.4x	17.8x	16.1x
Crown Castle	$72.39	89%	$21,966	$31,955	11.0x	10.5x	18.3x	17.1x
SBA Communications	$74.12	90%	$11,733	$16,974	13.5x	12.7x	22.1x	20.1x
TOWER AVERAGE		88%			12.0x	11.2x	19.4x	17.8x
CiG Wireless	$3.59	72%	$72	$81	5.3x	2.1 x	NA	NA

Sources: Consensus estimates and company reports

Figure 5. Tower stock prices have grown by more than 58 percent since the beginning of 2012. As of June 28, 2013, shares of publicly traded tower companies were, on average, trading at 88 percent of their 52-week highs and 19.4x 2013E EBITDA.

4G networks and securing additional capacity. Tower companies are also beginning to develop new coverage and capacity sites again as carriers' initial deployment of LTE nears completion in the core population centers.

► *Verizon* launched its first 4G LTE markets in December 2010, and on June 27, 2013, it announced its 4G LTE build out, covering more than 298 million pops in more than 500 markets or 99 percent of its existing network footprint, is substantially complete. In its first-quarter 2013 results, the wireless carrier announced it had spent approximately $2 billion on wireless capital expenditures or 55 percent of the company's first-quarter capex total. Verizon's wireless capex dollars largely went to enhance its current network and to complete the expansion of its LTE technology throughout its entire 3G footprint.

► *AT&T* also announced in its first-quarter results that the company plans to spend nearly $21 billion on capital expenditures during 2013. As of March 31, AT&T had already spent nearly $2.2 billion or 53 percent of its total capex on wireless-related capital expenditures. AT&T's wireless capex dollars are being used for network capacity and expansion and for the company's 4G LTE deployments. The carrier has used these capex dollars to cover more than 292 million pops with its 4G network, which includes a mix of both LTE and HSPA+ services.

► *T-Mobile* announced that its migration of MetroPCS customers onto its 4G HSPA+ and LTE network is ahead of schedule. During the first quarter of 2013, the company spent $1.1 billion in capital expenses and said that it had launched 4G LTE in seven major metropolitan areas. T-Mobile expects to cover approximately 200 million pops with 4G

Composite Value

Public Tower Companies' Composite Value Compared with S&P 500

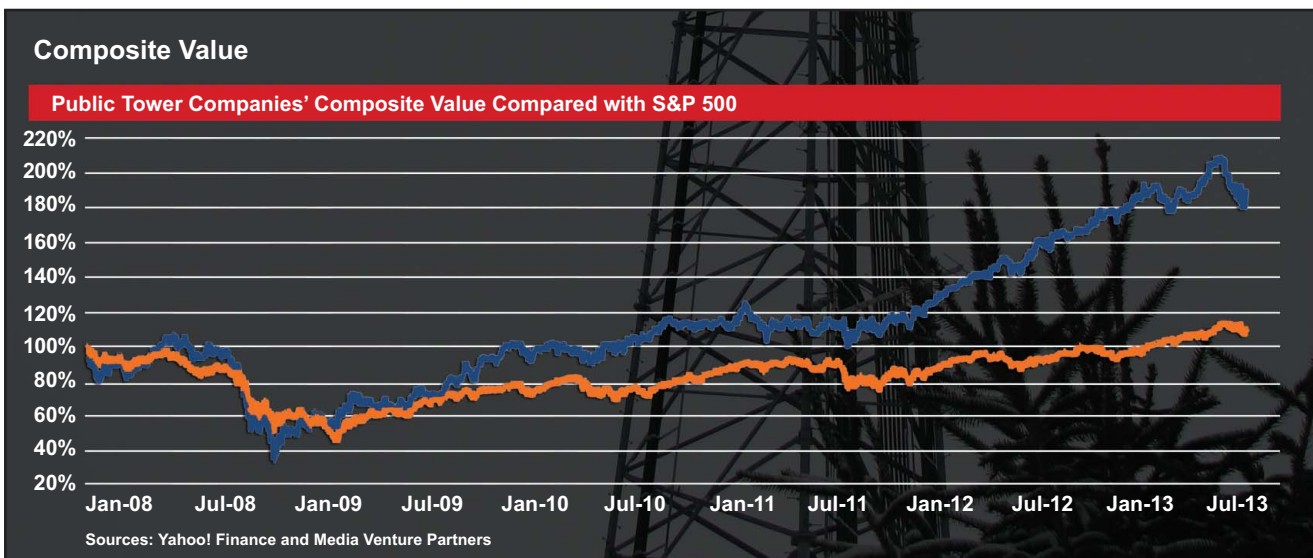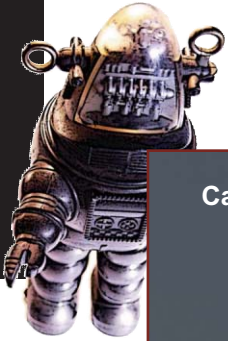Sources: Yahoo! Finance and Media Venture Partners

Figure 6. The value of shares in public tower companies has significantly rebounded since the most recent recession, which hit bottom during the fourth quarter of 2008. As of June 28, 2013, the value of public tower stocks has completely rebounded and significantly exceeded pricing from mid-2008 prior to the credit crunch.

Carriers' Network Upgrade Timeline

	LTE Spectrum Choice	2012	2013	2014
AT&T	• 700 MHz Lower B & C • AWS • WCS • 700 MHz D & E	LTE build ahead of schedule with 292 milliom people covered in more than 200 markets. Focus on completing LTE rollout by the end of 2013.		
Sprint	• 800 MHz • G-Block	Plan to deploy LTE-Advanced over owned 800 MHz in 4Q 13. LTE also over G-Block and likely bidder for for H-Block.		
Clearwire	• BRS/EBS	Deploying LTE network with $600 million. Milestones include 2,000 sites by June 2013, 5,000 sites by the end of 2013 and 8,000 sites by the end of 2014.		
T-Mobile USA	• AWS • PCS	Deploying LTE service in 2013 with $4 billion investment in its network. Moving HSPA+ to PCS and launching LTE on AWS.		
Verizon Wireless	• 700 MHz Upper C • AWS	Nationwide LTE buildout substantially complete with its network covering 298 million people in 500+ markets.		
C Spire Wireless	• PCS	Launched LTE over PCS in October 2012 covering 1.2 million people with plans to cover another 1.2 million in 2014 in Alabama, Florida and Mississippi by the end of 2013.		
Leap Wireless	• AWS	Cover 21 million pops with LTE as of Q1 2013, anticipate buildout costs of $100 million in 2013 to continue its LTE buildout.		
U.S. Cellular	• 700 MHz Lower B & C • 700 MHz Lower A	Over 58 percent of customers have access to 4G LTE and 87 percent will have access by the end of 2013.		

Figure 7. The Big Four and other large wireless carriers are rapidly deploying their 4G LTE networks. Many of the carriers are expected to have a complete nationwide 4G network footprint by the end of 2013.

LTE by the end of 2013. The company's most significant focus and progress has been on its $4 billion network modernization and 4G evolution effort, which will improve the carrier's voice and data as well as push them toward LTE.

► *Sprint* continues to be focused on its Network Vision project, which consolidates network technologies while also reducing the overall number of sites the company uses. The company's LTE network, which launched in 2012, covered nearly 90 cities by the end of the first quarter of 2013. Sprint will launch an additional 170 cities covering more than 200 million people by year-end. Sprint's coverage and LTE build out will be further enhanced with Sprint's access to Clearwire's LTE network through

the purchase of the remaining shares of Clearwire. During the first quarter, Sprint spent nearly $1.3 billion in wireless capex, which was 92 percent of the company's overall capex for the period.

► *Clearwire*, which first built out a WiMAX network in conjunction with Sprint, has begun its deployment of a TDD-LTE network with approximately 1,300 sites commissioned as of March 31, 2013. Clearwire has ambitions to have 2,000 sites commissioned by the end of June 2013. The company, which provides wholesale services for Sprint and Leap, expects to expand deployment of its LTE and VoLTE equipment to 5,000 base stations by the end of the year.

► *Leap* stated in its first quarter earnings announcement that it spent

$26 million in capital expenditures so far in 2013. The company estimates it will spend between $250 and $300 million in capex for the full 2013 calendar year. Leap is using its capex dollars to maintain and develop its current operating footprint. The company currently provides 4G LTE coverage to approximately 21 million pops and anticipates covering an additional 10 million pops by the end of the year. At an estimated cost of less than $10 per covered pop, Leap estimates it will cost approximately $100 million to continue to build out its LTE network.

► *U.S. Cellular* during its first-quarter earnings announcement stated it anticipates spending $735 million during 2013 on capex. It spent $118 million

during the first quarter. The company covers approximately 58 percent of its subscribers with 4G LTE and expects to expand LTE to 87 percent of its subscribers by the end of 2013.

► *C Spire*, a regional wireless operator in the South, began its LTE upgrade in the summer of 2012 and covered approximately 1.2 million pops in 20 markets by year-end 2012. The company plans to expand its LTE offerings to 500,000 people in Mississippi and an additional 700,000 people in Alabama and Florida throughout 2013.

Although several more spectrum owners have sold a significant amount or all of their wireless assets —SpectrumCo (made up of Comcast, Time Warner Cable and Bright House), Cox Communications, CenturyLink and many others — there is potential to see a new wireless entrant emerge. Dish Network, the most likely new entrant, has been busy making headlines in recent months. Dish successfully lobbied the FCC to allow the company to utilize its 40 megahertz of former satellite spectrum for terrestrial use (AWS-4). Most recently, Dish had been eyeing a potential acquisition of both Clearwire and Sprint, offers for which it subsequently withdrew after Sprint and Softbank, respectively, increased their offers for each wireless operator. Dish, with its various spectrum holdings, continues to exhibit an interest in becoming a major player in the wireless industry but has not yet acquired or developed such a platform.

Overall, rapid growth of data use is forcing carriers to upgrade network capacity and start planning for the next generation of networks and its deployment timeline. Towers are the direct beneficiary of any build out. See Figure 7 for a timeline of select carriers' 4G network build out timelines.

Credit environment

With the U.S. economy improving, albeit at a slow and steady pace, public tower companies are continuing to receive robust access to the credit markets. Since June 2012, public tower

companies have secured $3.13 billion in asset-backed securities, another $5.45 billion in senior debt capital and $1.75 billion in completed and announced credit facilities and term loans.

► *American Tower* secured $1.8 billion through asset-backed securities, $1 billion in senior unsecured debt and $750 million in an unsecured term loan over the last 12 months in domestic issuances. In June 2012, American Tower received a $750 million unsecured term loan with a rate of approximately 3.5 percent (LIBOR + 250 basis points) and maturing in five years. In January 2013, American Tower released $1 billion in 3.5 percent senior unsecured notes due in January 2023. In March 2013, American Tower completed a $1.8 billion offering of AAA-rated asset-backed securities priced between 1.55 and 3.07 percent and maturing in March 2043 and March 2048, respectively. Most recently, American Tower announced in June 2013 its intent to raise approximately $1 billion in a new unsecured revolving credit facility to replace its current facility. American Tower utilized the proceeds to repay certain senior notes, replace credit facilities, fund acquisitions and for general corporate purposes.

► *Crown Castle* has issued over $3 billion in senior notes over the last 12 months. In December 2012, Crown Castle issued $1.0 billion in 3.85 percent senior secured notes due in 2023 as well as another $500 million in 2.38 percent senior secured notes due in 2017. Most recently in February 2013, Crown Castle completed its offering of $1.65 billion in 5.25 percent senior unsecured notes due in 2023. Crown Castle used the proceeds to repay certain notes, to fund recent acquisitions and for general corporate purposes.

► *SBA Communications* over the last 12 months has secured $1.3 billion in senior unsecured debt and $1.33 billion in asset-backed securities. In July 2012, SBA Communications priced $800 million of 5.75 percent senior unsecured notes maturing in July 2020. Again, in September 2012, SBA Com-

munications priced $500 million of 5.625 percent in senior unsecured notes due in October 2019. Most recently in April 2013, SBA Communications sold $1.33 billion in asset-backed securities priced between 2.24 and 3.722 percent with maturity dates from 2043 to 2048. SBA Communications used a portion of the proceeds to fund acquisitions, repay existing revolving credit facilities and pay down existing term loans.

An improving economy and an attractive asset class — shared wireless infrastructure — have meant public tower companies are continuing to receive favorable interest rates and excellent credit ratings. Despite recent public concerns about increasing interest rates, public tower companies are continuing to take advantage of their access to the capital markets to issue new notes and repay older ones nearing maturity to extend maturity dates.

The future

Consumers continue to view wireless as an everyday necessity instead of a luxury or option. The tower market was and will continue to be a direct beneficiary of the wireless industry's strong staying power and as a result, the tower market has proven to be fairly insulated from macroeconomic issues. The tower deal environment, although slightly sluggish the first few months of this year in terms of the volume of deals, could see some sizeable transactions come to market the last half of 2013. Similar to the past couple of years, tower owners considering selling some or all of their assets in 2013 have the benefit of being in a sellers' market because of the limited inventory on the market and the depth of the interested buyers. The wireless industry, overall, continues to have the underlying characteristics of being a long-term winner as wireless voice, data and mobile video use do not show any signs of decline.

Trends continue to show a move toward everything wireless. There is a robust market for companies developing products specifically for wireless users, including mobile apps
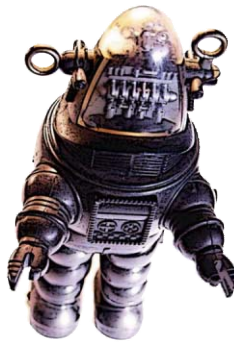
and dynamic mobile web content. Popular smartphones, tablets and other handheld devices are being designed for multiple networks. Demographics show younger adults choose wireless over wireline with approximately 36 percent of households now being wireless-only. Wireless is an everyday part of life for the future of our country and does not seem to be going away, nor is it threatened to be replaced by any new modes of communication. We are quickly headed toward a day when many people will only access the Internet via mobile devices.

Although subscriber penetration is completely saturated with an over-102 percent penetration rate, minutes of use remain high and data as a percentage of revenue has been growing by approximately 20 percent at the two largest wireless operators over the last year.

Upcoming FCC auctions for AWS-2 and 600-MHz spectrum (Broadcast Incentive Auction) could see new entrants emerge into the wireless world, and these companies could be potential new tower tenants. Although during the past couple of years several companies with large spectrum positions or operating business have exited the business or have gone through bankruptcy restructurings — SpectrumCo, Cox Communications, Open Range and LightSquared — there are several prospective new tenants to keep an eye on, most notably Dish Network. Despite the industry losing a few tenants that were previously viewed as potential tower tenants, new and healthier ones have sprouted in their place.

It will be interesting to watch over the next several months to a year to see whether the increased use of small cells by the various wireless carriers continues to be primarily end-user driven and utilized by single customers or, in a fashion similar to the way the tower industry evolved, whether the carriers end up relinquishing control of these facilities and small cells become more of a neutral-host business like towers. The tower industry as a business niche emerged in the mid-1990s as carriers realized they could save both time and money on the front end by having third parties invest their own time and money to develop sites while the carriers focused on network design, marketing and subscriber growth.

If it makes financial sense for both carriers and third-party owners, shared infrastructure will continue to become the rule, rather than the exception, as carriers respond to consumer demands. The macro cell site build out will continue to flourish while being complemented more and more by alternative sites, like femtocells, picocells and distributed antenna systems. Backhaul demand, whether via fiber-to-the-tower or microwave, will

---

If it makes financial sense for both carriers and third-party owners, shared infrastructure will continue to become the rule.

---

continue to increase significantly as wireless subscribers use mobile devices for more and more data-intensive applications, such as mobile video streaming and data services, rather than just voice. Overall, the shared wireless infrastructure business continues to be a robust and viable business niche, complementary to and providing mission-critical solutions for the wireless industry. ∎

Clayton Funk is a managing director, Jason Nicolay is a vice president and Ryan Carr is an analyst with Media Venture Partners, a division of Financial Telesis. MVP is a telecom-focused investment bank. Funk can be reached at cfunk@mediaventurepartners.com or (816) 977-2822. Nicolay can be reached at jnicolay@mediaventurepartners.com or (816) 977-2823. Carr can be reached at rcarr@mediaventurepartners.com or (415) 391-4877.

www.agl-mag.com

SEPTEMBER

AGL TOWER OF THE MONTH

www.agl-mag.com

TOWER OWNER (FOREGROUND)
Dumont Telephone Company

TOWER TYPE
Lattice

HEIGHT
190'

YEAR BUILT
2006

TOWER OWNER (BACKGROUND)
Verizon

LOCATION
Parkersburg, Iowa

site technology

Alignment Solutions Improve Antenna Installation Results

Antenna alignment solutions eliminate site revisits and re-climbs by ensuring antenna installation matches the RF design.

By John Vetter

When deploying towers, crews have historically relied on compasses along with their keen eyes to determine if antennas were properly aligned. Back in the days of voice, these options, which can best be described as less than precise, were passable. In today's world of high-bandwidth 4G LTE networks, a more accurate solution is necessary because a 2- or 3-degree variation can degrade performance, depending on horizontal antenna beamwidth, and can force costly site revisits and re-climbs to be conducted.

Slight variances in antenna beam tilt and azimuth from a tower site's original RF design can dramatically reduce coverage in some areas of the footprint while increasing coverage overlap in others. The result is decreased data rates on all affected networks. Compounding the problem is that antennas in more than one sector often are misaligned, which can create exponential problems.

Depending on the site and initial coverage area, an adverse cumulative effect will occur if antenna misalignment is greater than 3 degrees on multiple towers. There will be significant performance and quality problems because of the slight antenna tilt variation as both coverage and quality gaps increase by up to 100 percent with ±3 degrees of tilt error. If similar conditions exist at additional nearby sites, the effects are further compounded because the antennas' changed radiation patterns infringe on the coverage area of their neighbors, increasing co-channel interference and degrading performance of their receivers.

Widespread problem

Problems caused by failure to precisely align the antenna system according to its specifications during installation or an upgrade occur frequently. The antennas in each sector should obviously be precisely aligned to produce the desired results, but if the crew relies on a compass, troubles arise. That's because a compass is a basic tool that relies on the skill of the

person using it and the user's knowledge of magnetic deviation from true north. It is also adversely affected by nearby ferrous objects, such as rebar or piping in the ground, fencing or even

> **The effects of antenna misalignment are seen in more ways than network performance.**

jewelry worn by the technician.

Using a compass will lead to inconsistencies in setting up antenna azimuth and tilt during tower installation, thereby reducing overall network performance. However, the degree of degradation depends on the amount of the discrepancy between the designed and installed parameters. Further, inconsistencies in establishing these parameters during installation vary the network coverage and capacity.

Significant financial effects

The effects of antenna misalignment are seen in more ways than network performance. Carriers, turf vendors and general contractors will all notice it on their bottom lines. Table 1 outlines the costs associated with sending a three-

Crew cost for antenna position re-verification (with travel time and expenses)	$1,500
Cost for site acceptance RSSI/coverage re-drive	$2,500
Total revenue lost by doing rework rather than new site	$5,000

Table 1. The true cost of site antenna revisits.

man crew to re-climb and re-verify an existing site. The out-of-pocket costs total approximately $1,500, but the real expense is nearly $6,500 when lost revenue is factored in, because that crew can't move forward to install or upgrade a new tower site. If you add the multiple that nearly 40 percent of all sites are misaligned to the level in which they need to be corrected, these financial figures become astronomical.The obvious solution to reducing the number of site revisits so carriers and contractors can focus on new work rather than rework is to replace compasses with more modern alignment solutions designed specifically for antenna alignment. Crews can use these simple-to-operate tools to help broadband LTE networks meet their designed capacity and ensure the best possible return on the multibillion-dollar investment associated with 4G LTE networks.

Selecting the right tool

Not all antenna alignment tools are created equal, and certain performance specifications must be considered. To maximize bandwidth of 4G LTE networks, as well as their investment, many carriers are specifying an antenna tilt of ±0.25 degrees. To meet this stringent requirement, as well as others, antenna alignment solutions must be highly accurate.

The solution shown in Photo 1 utilizes a unique design that integrates advanced accelerometers that allow it to capture downtilt and roll to the ±0.25 degrees mandated by carriers. It also incorporates a two-GPS system to produce real-time azimuth measurements of up to ±0.3 degrees RMS and ±1.0 degrees R99. An internal gyroscope is integrated into the tool to maintain alignment when GPS satellite positioning is not available. The system also includes a drop-tape kit for accurate AGL recording of antenna radiating center height to ±1 foot.

Figure 1 shows the expected probability versus heading error of the antenna alignment solution shown in Photo 1. A 0.5-meter antenna spacing was used that resulted in a ±0.53

Photo 1. The AntennAlign alignment tool uses a unique design that integrates advanced accelerometers that allow it to capture downtilt and roll to the ±0.25 degrees mandated by carriers. It also incorporates a two-GPS system to produce real-time azimuth measurements of up to ±0.3 degrees RMS and ±1.0 degrees R99.
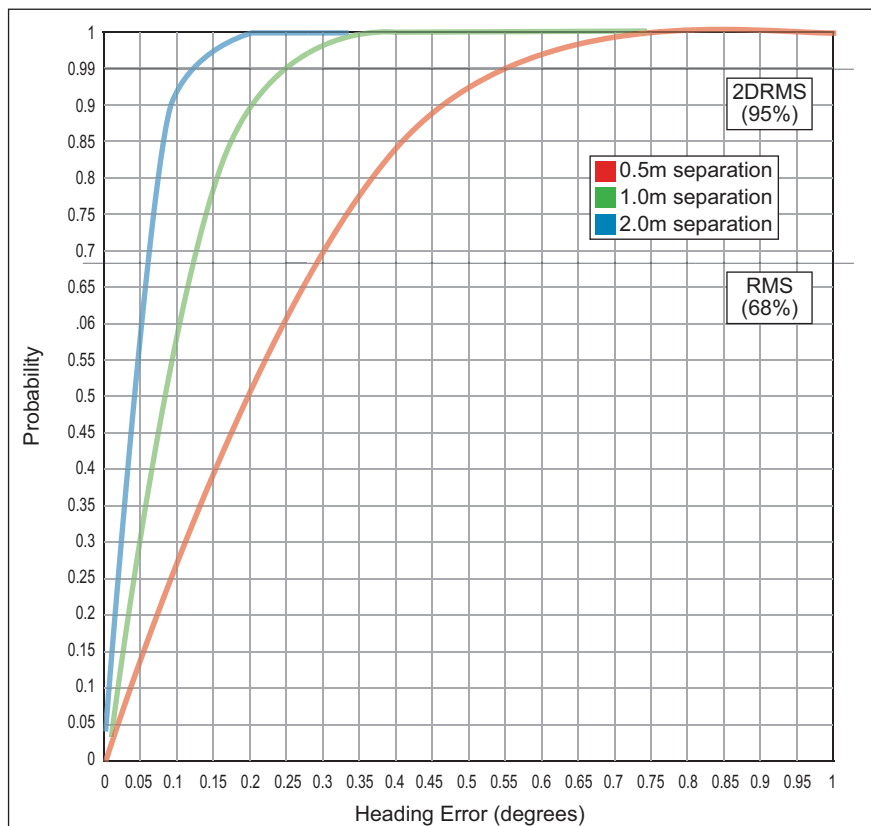
Figure 1. This is the expected probability versus heading error of the antenna alignment solution shown in Photo 1. A 0.5-meter antenna spacing was used that resulted in a ±0.53 degrees R95 (95 percent) instantaneous heading accuracy.

site technology

Sunsight Instruments
AntennAlign
Alignment
Tool

Site Alignment Results
MCO-118

Sunsight Instruments
125 Candace Drive
Maitland Florida 32751
3212449443

JOB: LTE-11-050523   **Phase 1 LTE Buildout**
AAT S/N: 8010259

SITE: MCO-118   Orlando Truck Depot
MSL: 31m   Final Latitude: 28.644846   MCO-Orlando
                    Final Longitude: -81.355583

Antenna Position	Azimuth Target	First	Final	Mech D-tilt Target	First	Final	Roll Target	First	Final	Height Target	First	Final	Capture Timestamp First	Final
Alpha (1) LTE01	0	0	0	1.0	-0.5	0.9	0.0	1.2	0.2	145.0	N/C	N/C	2013-05-15 15:30:27	2013-05-15 15:31:29

Final Lat	Final Long	Ant S/N	TMA/RRU/MHA S/N	Exp Elec D-tilt	Obs Elec D-tilt	Notes
28.644846	-81.355583	DBXLH-6565D-VTM	TX780628PF	1.0	1.0	LTE Build for cluster 2.

Antenna Position	Azimuth Target	First	Final	Mech D-tilt Target	First	Final	Roll Target	First	Final	Height Target	First	Final	Capture Timestamp First	Final
Beta (2) LTE01	120	120	120	0.0	0.4	0.4	0.0	-0.7	0.3	145.0	N/C	N/C	2013-05-15 15:32:16	2013-05-15 15:32:51

Final Lat	Final Long	Ant S/N	TMA/RRU/MHA S/N	Exp Elec D-tilt	Obs Elec D-tilt	Notes
28.644851	-81.355583	DBXLH-6565D-VTM	TX469252PF	1.0	1.0	LTE Build for cluster 2.

Antenna Position	Azimuth Target	First	Final	Mech D-tilt Target	First	Final	Roll Target	First	Final	Height Target	First	Final	Capture Timestamp First	Final
Gamma (3) LTE01	255	256	255	3.0	-0.7	2.8	0.0	-0.4	0.0	145.0	N/C	N/C	2013-05-15 15:33:37	2013-05-15 15:34:37

Final Lat	Final Long	Ant S/N	TMA/RRU/MHA S/N	Exp Elec D-tilt	Obs Elec D-tilt	Notes
28.644851	-81.355580	DBXLH-6565D-VTM	TX469252PF	0.0	0.0	LTE Build for cluster 2.

Table 2. A key factor in working with antenna-site auditors is to have comprehensive reporting. Antenna alignment solutions can provide detailed reports that include site name, sector name, antenna serial number and antenna position. Crew members can also type in notes within reports for additional details on a specific tower. This capability allows one master document to be created for more efficient recordkeeping. Comprehensive reports such as these simplify submission of site documentation to carriers and eliminate audit disagreements.

degrees R95 (95 percent) instantaneous heading accuracy. The expected instantaneous performance of the solution should be along the 0.5-meter red line. Because of the complexity of the cellular antenna

> **Maintaining proper antenna alignment will allow networks to maintain their designed capacity and coverage, bringing a greater return on the multibillion-dollar investment. Antenna alignment optimizes the precious RF spectrum, which ultimately will allow carriers to maximize the number of services they offer.**
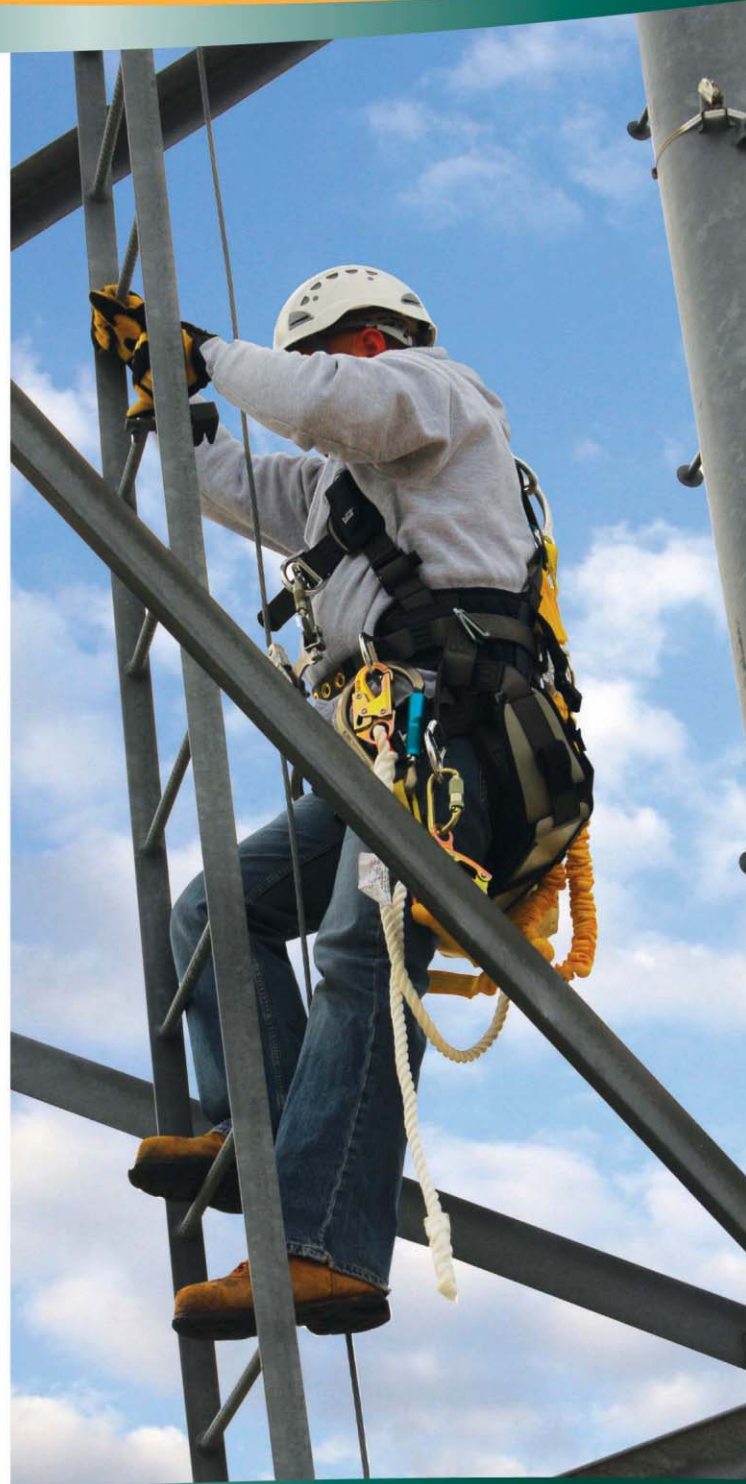
environments (in-band RF, physical obstruction, high-multipath possibilities) and the proximity of the GPS antennas to the GPS receiver in the antenna alignment solution, the accuracy specifications

were maintained at ±1 degree R99, well within the recommended tolerance.

The use of GPS satellites for antenna alignment is vastly superior to a compass. It is also the same method used by most third-party auditors, many of whom use the identical solution shown in Photo 1. Another key factor in working with auditors is to have comprehensive reporting. Antenna alignment solutions can provide detailed reports (see Table 2) that include site name, sector name, antenna serial number and antenna position. Crew members can also type in notes within reports for additional details on a specific tower. This capability allows one master document to be created for more efficient recordkeeping. Comprehensive reports such as these simplify submission of site documentation to carriers and

eliminate audit disagreements.

Site revisits and re-climbs associated with antenna misalignment have a significant financial effect on general contractors and carriers. Selecting the proper antenna alignment solutions can ensure towers are installed to the original RF design and maintain their alignment to reduce costly site revisits and re-climbs.

Additionally, maintaining proper antenna alignment will allow networks to maintain their designed capacity and coverage, bringing a greater return on the multibillion-dollar network investment. Antenna alignment provides another important advantage. It optimizes the precious RF spectrum, which ultimately will allow carriers to maximize the number of services they can offer.   ■

John Vetter is vice president of sales and marketing, Sunsight Instruments (*www.sunsight.com*). An RF engineer, Vetter has been involved in deploying and installing wireless networks in North America, South America and the Caribbean during his career, which includes positions with Ericsson, Clearwire, MetroPCS and Lucent.

NATE
National Association of Tower Erectors

Your partner in safety, standards and education.

New Guidance Permits Union Reps During OSHA's Inspections

OSHA's new interpretation may provide unions with unprecedented access to private property and non-unionized employees. Employers should be prepared to confront a union representative or activist.

By Mark A. Lies II and Kerry M. Mohan

Private-sector union membership remains near record lows, forcing unions to devise new and creative ways to access employers' facilities to organize employees. Unions have long used OSHA safety and health complaints as a tool to pressure employers into recognizing a union at a nonunionized facility or to affect collective bargaining at a unionized facility. However, a recent OSHA letter of interpretation from former Deputy Assistant Secretary Richard E. Fairfax has potentially made it easier for unions to organize nonunion facilities. Under this recent guidance, nonunionized employees can select a union organizer or community activist to be the employees' walkaround representative during OSHA inspections. In light of this development, host employers can expect unions to use this interpretation to attempt to access employer facilities, and OSHA to support employee requests to have unions as employee representatives during an OSHA inspection.

Employee reps during inspections

The Occupational Safety and Health Act, its regulations, and OSHA's *Field Operations Manual* authorize employees to select an "employee representative" to participate during the walkaround portion of an OSHA inspection. During the inspection, the walkaround representative is permitted to follow the OSHA inspector, ask questions, talk with the inspector and identify potential hazards. In unionized facilities, the union typically has a designated individual for all OSHA inspections.

In nonunionized facilities, the employee walkaround representative may be a senior, well-respected individual who is part of the employer's safety committee, or no employee at all. However, in practice, it has long been understood that the employee representative had to be an actual employee and not somebody from the outside. Although some OSHA offices have attempted to permit non-employees to participate in inspections at nonunionized facilities,

they have almost always withdrawn this request when questioned about their authority to permit the non-employee's access.

Letter of interpretation

In OSHA's new letter of interpretation, OSHA states that where employees are not represented at a workplace by a union, one or more employees may designate anyone they choose to be their employee walkaround representative, including a union representative, a community representative, or a technical person. This re-interpretation of the Occupational Safety and Health Act, OSHA's regulations, and OSHA's *Field Operations Manual* potentially provides union organizers unprecedented access to a nonunionized employer's facility. For instance, a union can file an OSHA complaint on behalf of nonunionized employees and remain in contact with OSHA until the inspection occurs. Then, when OSHA representatives show up at the facility, the employees may request that the OSHA compliance safety and health officer (CSHO) allow the same union representative, who is not an employee, to come into the plant and be their employee walkaround representative.

Similarly, a community representative (activist) who is not an employee could be designated. Such an individual could have economic, social or political interests that are adverse to those of the employer. The CSHO does not have to allow this individual if he believes the person might disrupt the inspection.

Dangers of non-employees

The participation of a union representative or community activist in an OSHA inspection can lead to significant issues. First, the non-employee's participation will almost certainly lead to increased citations. Many large unions have sophisticated health and safety officials who may be more knowledgeable than the CSHO. Thus, the union representative probably would identify any

> ## The participation of a union representative or community activist in an OSHA inspection can lead to significant issues.

potential citation or hazard he sees to the CSHO, including many the CSHO may have not observed or recognized. Second, the union's involvement gives the union an immediate presence within the employer's facility to communicate with employees at the facility about the union's interest in employee safety and the benefits of a union to foster safety. The union representative may wear pro-union clothing or buttons, which will attract attention and cause employees to question why a union is there. Third, it provides unions and activists the op-

portunity to take video or photographs of an employer's operation that can be used for union promotional purposes.

Recommendations

To limit the potential of a non-employee union representative or community activist participating in an OSHA inspection, an employer should consider taking the following precautions or actions.

Require the union representative or activist to follow administrative requirements.

- Have employees identify an employee walkaround representative prior to any potential inspection. A non-employee representative probably couldn't be named if the employees have already designated their representative. The employees' selection can be done via an employee safety committee or an informal employee consent.
- Provide any designated employee representatives with OSHA 10 Hour or other enhanced safety training. A basis for OSHA's new guidance is that employee walkaround representatives may not be sophisticated enough to represent employee interests during the inspection. To challenge this belief, the employer should offer to provide the employee representatives with OSHA 10 Hour or other enhanced safety awareness training to ensure they are knowledgeable about health and safety issues to be able to meaningfully participate in the inspection.
- Challenge the non-employee's credentials. OSHA may believe that a non-employee representative may be able to better represent the employees' interests because of his superior knowledge of health and safety issues. Thus, the employer

can challenge the non-employee's health and safety credentials to show that the non-employee's participation would not only be worthless, it would actually be disruptive and confuse issues during the inspection because the individual is unqualified.

- Require the union representative or activist to follow administrative requirements. In the event OSHA

permits a union representative or activist to be the walkaround representative, the employer can require the union representative or activist to go through the same administrative burdens as any other visitor to the facility. Although these administrative tasks may not prevent the non-employee from participating, it may significantly limit the extent of the person's participation. For

safety

instance, the employer can require the non-employee individual to:

- ○ Sign a document indemnifying the employer for any injury that may occur in the facility and waiving any potential claims against the employer
- ○ Agree to provide and wear all required personal protective equipment (PPE), including respiratory protection and flame-retardant clothing
- ○ Sign a confidentiality agreement prohibiting the individual from: 1) taking any video footage or photographs within the facility, and 2) disclosing any information obtained during the inspection
- Participate in any orientation programs that are required of all non-employee visitors
- Obtain your own expert for the inspection. One way to silence the non-employee representative is to

engage your own expert to participate in the walkaround. Consider retaining an expert who can follow

---

Employers should be prepared to confront a union representative or activist at their front door.

---

the non-employee and challenge any statements or observations he makes

- Say "no" and require OSHA to obtain a warrant. Ultimately, an employer always has the right to tell OSHA that it will allow a non-employee union representative or activist to participate in the inspection only if OSHA obtains a warrant requiring it. At that point, OSHA will be

required to go before a judge to get a warrant, which may cause OSHA to reconsider its position. An employer should contact legal counsel before taking this action to discuss the risks and benefits of this strategy.

Conclusion

Without question, OSHA's new interpretation potentially provides unions with unprecedented access to private property and non-unionized employees. Thus, employers should be prepared to confront a union representative or activist at their front door when they accompany the OSHA investigator and should have a plan to challenge the non-employee's participation or to limit the participation as much as possible. ∎

Mark A. Lies II is a partner in the Chicago office of the Seyfarth Shaw law firm. His email address is *mlies@seyfarth.com*. Kerry M. Mohan is an associate with Seyfarth Shaw in the Chicago office. His email address is *kmohan@seyfarth.com*.

Tower Xchange

Meetup Africa 2013

October 1 and 2, Birchwood Hotel, Johannesburg

A unique, invitation-only gathering of the top 200 decision makers in the African tower industry

Do you provide products, services or investment in African towers?

- Meet decision makers at African operators, towercos and investors
- Tailor your agenda to focus on tower transactions or opex reduction
- Round table sessions with key stakeholders from YOUR targeted countries
- Ensure your company receives RFPs from Africa
- Meet leading turnkey infrastructure, RMS and energy equipment vendors
- A year's worth of networking in two days!

The TowerXchange Meetup is usually by invitation-only, but you can apply for a pass or an exhibition booth at **www.towerxchange.com/meetups/africa**

regulation

Supreme Court Upholds Antenna-siting Shot Clock

It's called deference, and thanks to a recent Supreme Court ruling, federal courts may have to extend more of it to U.S. regulatory agencies after a ruling in a case involving the antenna-siting shot clock.

By Anthony B. Gioffre III, Andrew P. Schriever, Lucia Chiocchio and Ryan Tougias

In a case having potentially far-reaching implications for the level of deference that courts are to afford federal administrative agencies charged with implementing congressional legislation, the United States Supreme Court recently confirmed the FCC's authority to interpret the Telecommunications Act of 1996 (TCA), recognizing that "[s]tatutory ambiguities will be resolved, within the bounds of reasonable interpretation, not by the courts but by the administering agency." (See *Arlington v. FCC*, 11-1545, slip op. at 5, 2013 WL 2149789 [May 20, 2013]).

In *Arlington v. FCC*, the Court affirmed the FCC's authority to issue its *Declaratory Ruling to Clarify Provisions of Section 332(c)(7)(B)* [see 24 F.C.C.R. 13994 (2009)], the so-called shot clock ruling whereby the FCC established guidelines for what constitutes a reasonable time for municipalities to review and act on wireless facility-siting applications. Prior to this FCC ruling, many wireless facility-siting applicants experienced indefinite municipal review delays, and they asserted that such delays frustrated federal communications policy by thwarting the rapid development of wireless infrastructure and the goal of providing wireless data access to all Americans. The FCC issued the shot clock ruling in response to a petition seeking clarification of Section 704 of the TCA, which requires a municipality to "act on any request for authorization to place, construct, or modify personal wireless service facilities *within a reasonable period of time* after the request is duly filed with such government or instrumentality." [Emphasis added.] In its declaratory ruling, the FCC interpreted this provision to hold that it is presumptively unreasonable when a municipality exceeds 90 days in consid-

---

Prior to this FCC ruling [the antenna-siting shot clock], many wireless facility-siting applicants experienced indefinite municipal review delays.

---

ering a collocation application and 150 days in considering other wireless facility applications.

Arlington resolved an inherent tension between a court's authority to interpret acts of Congress and the authority vested in an administrative agency charged with the same task, with Justice Antonin Scalia writing for the majority and finding that in this instance, courts are required to defer to the FCC's interpretation of a statutory ambiguity in the TCA. The opinion applied the now-canonical formula derived from *Chevron U.S.A. Inc. v. Natural Resources Defense Council, Inc.,* which set forth the criteria to be applied when a court reviews an agency's construction of a statute that the agency is charged with administering. A court must first look at whether the federal statute has spoken to the precise question at issue, in this case, the meaning of what constitutes a "reasonable period of time" under the TCA. If the statute is silent or ambiguous on the issue, as was the case here, the court reviewing an agency's interpretation must decide whether the agency's answer is based on a permissible construction of the statute.

Entitled to deference

The Supreme Court found that because Congress delegated general authority to the FCC to administer the TCA through administrative rulemaking and adjudication, Congress permitted the FCC to issue the shot clock ruling to address the statutory ambiguity and clarify exactly what constitutes "reasonableness," and because the FCC stayed within the bounds of its statutory authority, its interpretation of the TCA was entitled to deference.

Justice Scalia's opinion lends strong support to the argument that in a case in which a court's interpretation of an ambiguous federal statute is at odds with the interpretation of an administrative agency charged with administering the statute, the agency's interpretation should control even if that means departing from prior court precedent.

District court authority

By way of illustration, in addition to the "reasonableness" issue, the shot clock ruling also addressed a disagreement among federal Courts of Appeals as to "whether a State or local policy that denies personal wireless service facility siting applications solely because of the presence of another carrier should be treated as a siting regulation that prohibits or has the effect of prohibiting such services." In other words, some jurisdictions have held that a municipality does not effectively prohibit the provision of personal wireless services under the TCA by denying one carrier's ability to enter a market where that market is already served by another. Under this approach, if Carrier A sought to build a wireless facility, but Carrier B already served the targeted area, then a municipality could deny Carrier A's application because Carrier B already provides service. In its declaratory ruling, the FCC rejected that approach, finding "we construe the statute to bar State and local authorities from prohibiting the provision of services of individual carriers solely on the basis of the presence of another carrier in the jurisdiction." In light of *Arlington*, to the extent a district court finds itself caught between conflicting interpretations as between its governing circuit court and the FCC, the Supreme Court now provides a district court with authority (and one could argue a mandate) to treat the FCC's interpretation as carrying the force of law, as opposed to viewing the FCC's decision as merely persuasive authority.

Arlington's effect probably will be significant. The decision presents an advo-cate in the administrative and federal regulatory arena with a useful tool with which to resolve tensions arising between the courts and administrative agencies when it comes to which body's decision should be controlling, with the governing rule now being that the agency's interpretation of an ambiguous federal statute, if made within the scope of its authority, should be given deference even if the interpretation is at odds with court precedent. In the short term, this approach may exacerbate tensions between administrative agencies and courts that might be reluctant to depart from their own precedent. In the long term, *Arlington's* clear mandate as to when an agency's interpretation should be controlling will lend itself to a more predictable, uniform approach across the federal circuits as courts apply and defer to lawfully issued agency interpretations of congressional legislation. For the telecommunications industry, the ruling probably will result in greater certainty in how federal courts as well as state

regulation

and local administrative agencies across the country will apply the TCA with due respect to the FCC's binding interpretations. Because the FCC is charged with ensuring the rapid deployment of wireless infrastructure to provide greater access to all Americans, we can expect that courts

Arlington gives advocates in the administrative arena a powerful tool with which to persuade municipalities, as well as courts reviewing municipal decisions, to adhere to FCC and other administrative agency interpretations.

and administrative agencies that will be required to apply lawfully exercised FCC interpretations with the force of law will issue more and more decisions that help

fulfill that mandate.

Arlington also provides the wireless industry with another tool for use in the on-the-ground application process and implementation of Section 6409 of the federal 2012 Middle Class Tax Relief and Job Creation Act for the expeditious build-out of critical wireless infrastructure. Section 6409(a) provides in part: "Notwithstanding Section 704 of the Telecommunications Act of 1996 or any other provision of law, a state or local government may not deny and shall approve any eligible facilities request for a modification of an existing wireless tower or base station that does not substantially change the physical dimensions of such tower or base station."

Section 6409 effectively pre-empts the use of a discretionary approval process for modifications to existing, eligible wireless facilities so that critical wireless

infrastructure can be deployed in a timely manner. U.S. Rep. Fred Upton (R-Mich.), in support of Section 6409, explained that it "streamlines the process for siting of wireless facilities by pre-empting the ability of State and local authorities to delay collocation of, removal of, and replacement of wireless transmission equipment." His statement appears in the *Congressional Record* for Feb. 24, 2012. Although Section 6409 is intended to promote the expeditious build out of wireless infrastructure, like most new federal laws, its intended effect has not yet been realized in many communities.

In addition to requiring many communities to revisit their local zoning and land use regulations for compliance with the federal law, Section 6409 created some ambiguity among the industry and state and local governments regarding its application and interpretation. As the industry sought implementation of Section 6409 for rapid infrastructure build out, many questions arose about the meaning of the

phrase "wireless tower or base station" and the definition of "substantial changes" to existing facilities. In some cases, the result of these uncertainties undermined the purpose of Section 6409 by delaying administrative review of eligible facility requests while the applicant and municipality debated the meaning of the terms in Section 6409.

In response to inquiries from the industry and state and local governments about these uncertainties, on Jan. 25, 2013, the FCC offered guidance on the interpretation of Section 6409 in a public notice, "Wireless Telecommunications Bureau Offers Guidance On Interpretation Of Section 6409(a) Of The Middle Class Tax Relief And Job Creation Act Of 2012." In this document, the FCC explained what it means to "substantially change the physical dimensions" of a tower or base station and defined "wireless tower or base station" to include "a structure that currently supports or houses an antenna, transceiver or other associated equipment

that constitutes part of a base station" as well as a distributed antenna system and small cells.

So, how can *Arlington* be a useful regulatory tool for the industry in applying Section 6409 and its intended effect of promoting timely deployment of wireless infrastructure? Simply put, *Arlington* gives stronger weight to the FCC's guidance in interpreting provisions of Section 6409 because the Supreme Court's reasoning can be used to resolve the uncertainties and ambiguities of Section 6409 that may arise as it is implemented. When faced with questions about whether a proposed modification is an "eligible facilities request" afforded pre-emption from local discretionary review under Section 6409, applicants can point to the FCC guidance document for clarification and use *Arlington* to support the decision that a municipality is bound by the FCC's interpretation. Thus, similar to its effect in the litigation realm creating a more uniform approach across federal courts,

Arlington provides the industry with a legal framework to argue for the consistent application of Section 6409 on the local and state level as the industry seeks to build out its infrastructure.

In sum, *Arlington* gives advocates in the administrative arena a powerful tool with which to persuade municipalities, as well as courts reviewing municipal decisions, to adhere to FCC and other administrative agency interpretations. The effect will be to reduce, and in many cases eliminate, legal wrangling over statutory construction issues that have been resolved by the administrative agency and, for the telecommunications industry, to promote greater uniformity in municipal decision-making, furthering the federal goal of rapidly deploying wireless infrastructure. ∎

Anthony B. Gioffre III, Andrew P. Schriever, Lucia Chiocchio and Ryan Tougias are members of the Cuddy & Feder law firm's telecommunications department. They can be reached at (914) 761-1300 or email *telecommunications@cuddyfeder.com*.

engineering

Site and Tower Information Modeling (STIM)

A quality-improving, cost-saving and value-creating solution for the telecom industry brings the advantages of Building Information Modeling (BIM) to site and tower information management.

Jiazhu Hu, Ph.D., P.E.

Tower owners and tenants face having to pay for recurrent engineering studies during a tower's lifetime. Many engineering studies have redundancy that could be avoided through the use of a site and tower information modeling-based solution. A site and tower information model represents a tower's physical and functional characteristics digitally. The use of a site and tower information modeling-based solution could reduce engineering cost and speed the delivery of antenna site and tower-related projects, much to the advantage of tower owners and those who rent antenna space on their towers. A financial study shows that the savings on engineering spending would be more than 50 percent in

a 10-year period. The turnaround time for certain engineering services could be reduced from an industry average of one to two weeks to as little as a couple of hours.

BIM and STIM

The National Institute of Building Sciences defines a building information model as a digital representation of the physical and functional characteristics of a facility. Building information modeling (BIM) is a process that involves generating and managing such a model. The building information model becomes a shared knowledge resource to support decision-making about a facility from the earliest conceptual stages through

design and construction. It continues during a facility's operational life and eventual demolition.

Building information modeling is transforming the way buildings are designed, constructed and managed. Since the birth of the concept in the 1970s and particularly since Autodesk published the white paper "Building Information Modeling" in 2003, building information modeling technology has gained momentum. It has changed conventional design and construction and has begun to create a new standard for the industry. "A basic premise of BIM is collaboration by different stakeholders at different phases of the life cycle of a facility to insert, extract, update or modify information in the BIM to support and reflect the roles of that stakeholder," said Dana K. "Deke" Smith, executive director of the BuildingSmart Alliance, a council of the National Institute of Building Sciences.

The revolutionary building information modeling technology will improve quality, productivity, cost, efficiency and safety for the building construction industry. Because of the intrinsic similarity in most aspects of the engineering work — planning, design, construction and maintenance — the same benefits that building information technology brings to the building construction industry can be achieved in the telecommunications industry. Instead of a building,
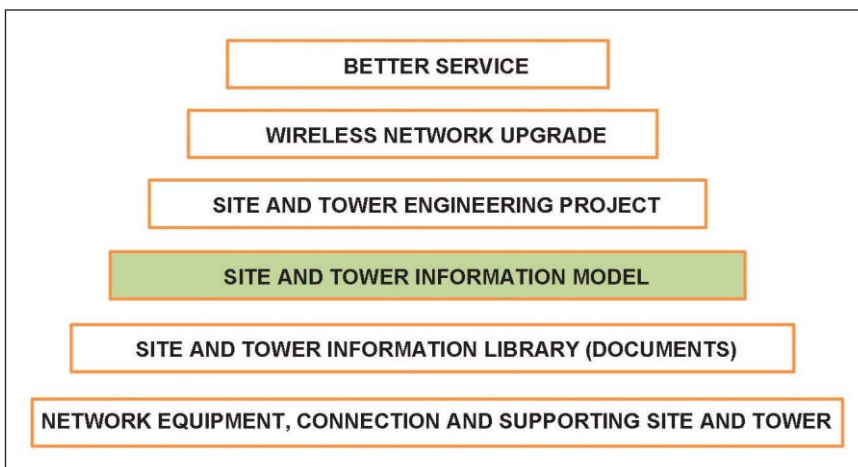

Figure 1. A site and tower information model serves as a base for engineering decisions.

the facility becomes the antenna site and the tower. Instead of the building information model, the model becomes the site and tower information model. The process that involves generating and managing the model becomes site and tower information modeling. The site and tower information model would serve as a shared knowledge resource for information about a site and tower, forming a reliable basis for decision-making during their life cycle from earliest conception to demolition (see Figure 1).

Well-developed site and tower information modeling software would serve as an information center for all site-related and tower-related projects, including site and tower design, construction and maintenance, along with wireless network design and deployment. The following information examines typical civil and structural engineering services for site and tower development to show how the site and tower information modeling concept could benefit the telecom-

munications industry.

Figure 2 shows a typical process of data communication for civil and structural engineering service projects for antenna site and tower development with a traditional solution. Look at the structural analysis project, for example, to see problems related to the traditional solution.

STIM for engineering projects

Many companies use software installed on stand-alone computers to perform tower structural analysis. For the initial structural analysis, engineers need to collect all the information from all kinds of documents. They have to download, copy and print the documents, read and interpret the documents, manually input the data to create the analysis model and then perform the analysis. For subsequent analyses done by the same service vendor, engineers can pull out the previous saved analysis model, make necessary modifications to the model and

then perform the new analysis. Retaining the analysis model can save much effort in subsequent structural analyses.

The analysis model of a tower is a great value to any company that needs to perform tower structural analysis. The more work there is to be done, the greater the value of the tower analysis model. However, the fact is that a tower owner usually does not own the computer model of the tower, and for various reasons, engineering service vendors are not sharing the models and information. So tower owners and carriers are wasting money on re-creating an analysis model of the same tower when they select different vendors to perform work on the tower during the course of its service life. The more tenants on the tower and the longer the tower stands, the higher the number of engineering companies that will become involved and the more money tower owners and tenants will waste on redundant engineering work.

The traditional solution for engi-

engineering

neering work is characterized by the use of paper and electronic file-based documentation and requires engineers to read and interpret data from documents with scattered site and tower engineering information. The traditional solution has these disadvantages for managing the site and tower information:

Redundancy — The work of collecting project information, reading and interpreting the same data from the same documents for each round of service work by different service vendors is repetitive.

Inconsistency — There can be widely observed, quality-deteriorating discrepancies among the various engineers' interpretations of the same project information such as tower structural model and loading data, and geotechnical information.

Low efficiency — The repetitive nature of the work can cause lengthy deliverable turnaround time, making the tower asset less competitive in the fast-paced market. The outdated interface of the software and tools for structural and loading definition adds inaccuracy and uncertainty to the tower structural model, slows the process and reduces the quality of structural evaluation and other engineering tasks.

These disadvantages could be avoided using a site and tower information

---

Using the latest information technology greatly improves cooperation and collaboration among stakeholders.

---

modeling-based solution that integrates the latest engineering and information technologies. The site and tower information modeling-based solution is characterized by database-based information modeling. It starts with the concept of creating a site and tower information model associated with the asset for its lifetime regardless of any change of ownership, tenants or loading. Using the latest information technology greatly improves cooperation and collaboration among stakeholders. With the shared information model, any authorized user can access the desired information and retrieve it from a single source. Accordingly, any information updates made by the user would be updated to the single source as well. Figure 3 summarizes the process of the site and tower information modeling-based solution.

The repetitive work of reading and interpreting the same data from the same documents would be mostly eliminated. The serial service work would see high consistency. The interface would be intuitive and straightforward so that users with minimum knowledge of the

Figure 2. The process of a traditional solution for engineering work.

engineering

discipline could perform certain tasks in accordance with industry requirements and standards. Because the site and tower information modeling-based solution would be on a platform with shared information, the task execution and verification process would be much faster, leading to efficient project execution and delivery. A site and tower information modeling-based solution could provide flexibility for model update scenario evaluation for users to optimize designs (see Figure 3). Altogether, this would be a value proposition for tower owners and tenants, not only reducing spending but also making project execution easier and smoother. Here are some of the advantages:

Quality improving — There would be more consistency and accuracy for engineering services through improved information communication and collaboration.

Cost savings — Tangible savings would be achieved on most engineering

services.

Value creating — Site and tower assets with a site and tower information modeling-based solution would have a higher resale value and other competitive advantages for tower space leasing.

STIM software development

The development of site and tower information modeling-based software would not be easy. To develop software for implementing the concept, the tele-

---

Antenna sites and towers need frequent, rigorous structural integrity checks.

---

communications industry needs standards and specifications for practitioners to use to specify and articulate with a

high level of clarity the content and reliability of a site and tower information model for various design and construction purposes.

There are numerous differences between the telecommunications industry and the general building construction industry regarding facility components and their attributes, design and construction projects and execution processes. Site and tower information modeling would have specific requirements not commonly seen in general building information modeling. For example, antenna sites and towers need frequent, rigorous structural integrity checks because of loading changes that occur when systems are upgraded. As more and more carriers collocate on one tower, the tower may undergo rounds of structural reinforcement, including foundation strength enhancement. This type of situation is not commonly considered in the building information modeling software, so the general building information modeling

Figure 3. The process of a STIM-based solution for engineering work.

September 2013

73

engineering

Figure 4. The relationship between the site and tower information model and services.

software could not be directly adapted to the telecommunications industry.

However, the rules and principles for building information modeling software development (*BIM Handbook* by Chuck Eastman, et al., 2011) could be referred for site and tower information modeling software development. The site and tower information model would be composed of objects with intelligence in support of functional analysis in addition to graphic visualization. The objects would be described with both physical and functional attributes. In consideration of site and tower information modeling and data exchange among different versions of site and tower information modeling software, certain standards and specifications similar to building information modeling industry foundation classes need to be established to promote data interoperability.

Studies show that inadequate interoperability among different versions of software for building information modeling adds significant cost to the building construction industry, which is a precaution

Certain standards and specifications similar to building information modeling industry foundation classes need to be established.

for site and tower information modeling development in the telecommunications industry. Both building information modeling and site and tower information modeling are intended to facilitate collaboration among various industry stakeholders. Figure 4 shows the primary service tasks around the site and tower information model that could be saved in the cloud. Each disciplinary task h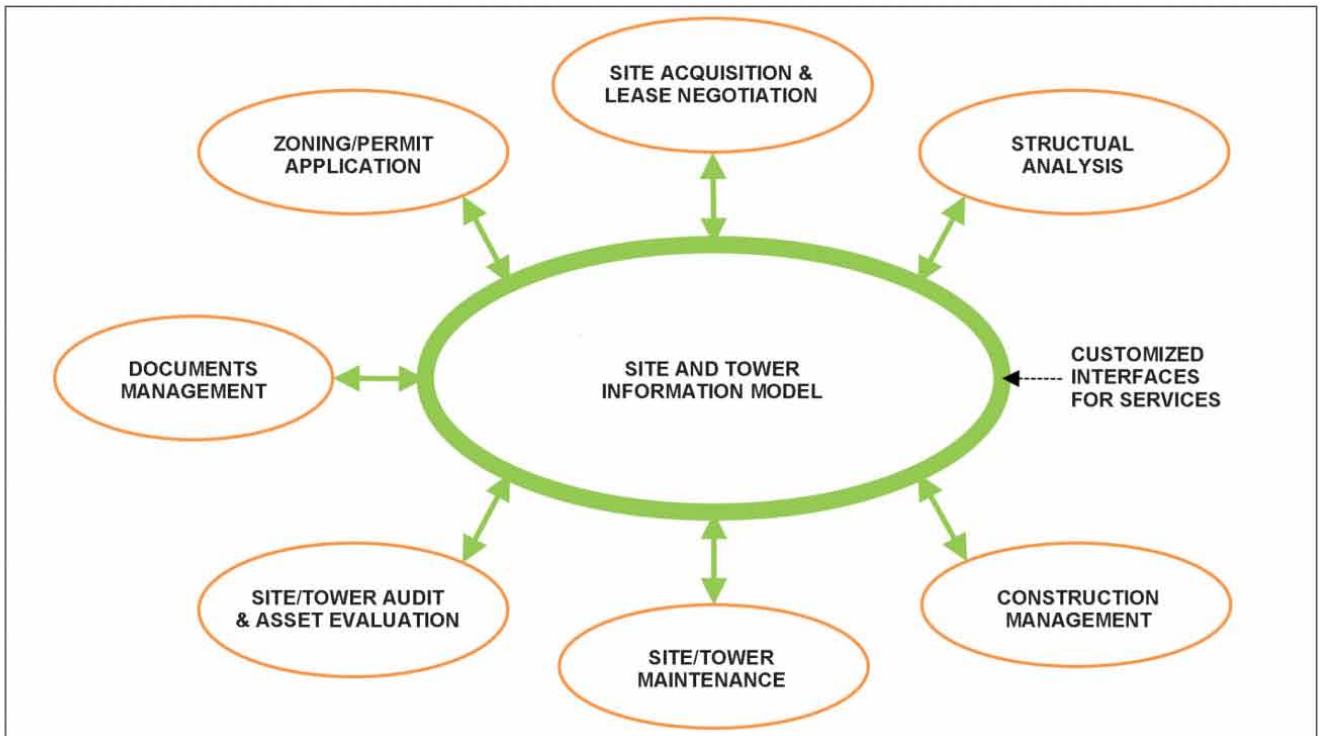as an Internet-based connection and interface to interact with the site and tower information model. Obviously, developing the site and tower information modeling system itself is a task that requires close collaboration among the stakeholders.

Site and Tower Information Man-

agement is a startup company that has been formed to develop a site and tower information modeling-based solution for telecommunications infrastructure development. The company works with tower owners, original equipment manufacturers and wireless carriers in an effort to provide a quality-improving, cost-saving and value-creating solution for the telecommunications industry. The company welcomes comments from

engineers, wireless carriers, tower owners, industry leaders and others with an interest in joining it for the venture. ■

Jiazhu Hu, Ph.D., P.E., is the founder of Site and Tower Information Management. Jiazhu's research and development focuses on engineering collaboration improvement. Among his many technical articles is "A Study on Cover Plate Design and Monopole Strengthening Application," *Thin-Walled Structures* (Vol. 49, No. 9, 2011). His email address is *jiazhu.hu@siteandtower.com.*

When you join the Wisconsin Wireless Association, you help to make a difference.

Through donations to the General Federation of Women's Club's Wisconsin chapter, the Wisconsin Wireless Association helps to purchase pediatric jump bags for use by Wisconsin ambulances. Pediatric jump bags help to save the lives of small children because medical requirements for small children often differ from those of adults. The right equipment optimizes the care that the responding team is able to provide.

Wisconsin Wireless Association

Promoting awareness

The Wisconsin Wireless Association helps to promote positive awareness about the wireless infrastructure industry by representing the industry at the Municipal Treasurers Association Annual Conference and the League of Wisconsin Municipalities Annual Conference.

The Wisconsin Wireless Association is participating in the Public Service Commission of Wisconsin's development of a statewide broadband plan, "Wisconsin's Playbook for Broadband Progress."

Wisconsin Wireless Association

wisconsinwireless.org

ACTIVITIES

Sept. 19 *AGL* Wireless Infrastructure Conference in Chicago

Oct. 16 League of Wisconsin Municipalities in Green Bay

Dec. 5 Holly Jolly Trolley Tour Fundraiser in Milwaukee

A public service ad from *AGL*
Photo courtesy of R&B Fabrications

SEPTEMBER 2013

DAS™
and Small Cells

A BIBY PUBLISHING, LLC, PUBLICATION

ENTERPRISE-LEVEL
BYOD/X

SPECTRUM CONDITIONING

UNIFIED COMMUNICATIONS

september 2013   vol. 1, no. 3   contents

DAS and Small Cells Magazine

on the cover

Shopping malls offer big opportunities for neutral-host DAS and for Wi-Fi systems installations.

Cover design by Scott Dolash
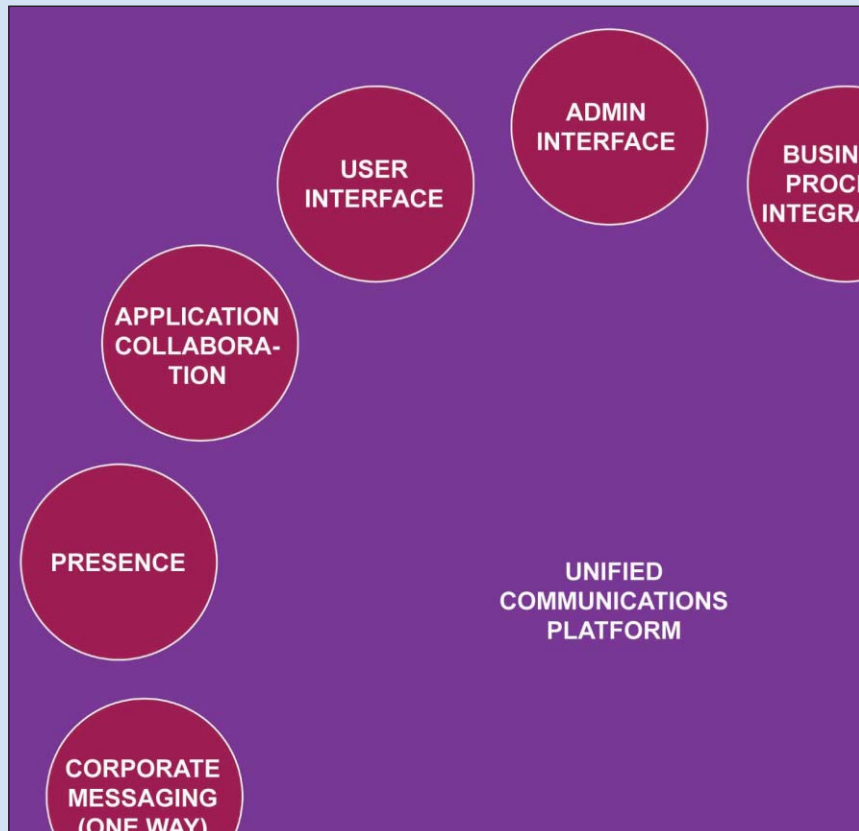
DAS and Small Cells Magazine is published four times a year by Biby Publishing LLC, P.O. Box 2090, Ashburn, VA 20146-2090, and is distributed for free to qualified individuals.

POSTMASTER: Send address change to *AGL* Circulation Department, 28591 Craig Ave., Menifee, CA 92584.

Interested in advertising in *DAS and Small Cells Magazine,* in *AGL* magazine, *AGL's* website or e-newsletters, or sponsoring *AGL's* Regional Conference? Visit *www.agl-mag.com/advertise* for information.

Features

Department

advertiser index

editorial comment

Soon — It's All IT

Small cells supported by distributed antenna system (DAS) networks will have a tremendous influence on wireless voice and data networks of the 21st century. Research that deals with that market segment reports that small cells will carry upward of 70 percent all wireless network traffic – both digitized voice and normal data. I generally find that number believable.

Because much of this is still in either development, beta test or simply on the drawing board and because technology develops so quickly, there is room for prognostic error. There is no doubt in my mind what is going to happen. There is some doubt as to when and exactly what it will look like in 2020. The rollout timetable, final product and predicted revenue will differ from what is predicted, but small cells will be the core infrastructure of the next wireless platform.

The potential revenue for small-cell technology, fueled by the bring-your-own-device (BYOD), bring-your-own-anything (BYOX) and unified communications (UC) deployments, is in the multiple tens if not hundreds of billions of dollars. The revenue is forecasted to start in the next couple of years.

Targeting resources

How do you position yourself to best capitalize on your expertise? Where do you have to expand your horizons to make sure you are in the bull's eye of the technology? Where do you target your resources to maximize return on investment (ROI)?

Small cells will present an antipodal metric — data, rather than voice, which is the macro network's brass ring, will reign. The need to support the transmis-

sion of huge amounts of data has been the motivation behind technology innovation for some time now, but what will change is that the same network built for data will be called upon to carry voice traffic, too, in the form of voice over Internet Protocol (VoIP). Eventually, analog voice and cellular digital packet data (CDPD) on licensed carrier networks will fade. Carriers and their traditional traffic aren't going the way of the dinosaur yet — they still rule the licensed macro infrastructure — but VoIP will become the voice component used in small cells, and unlicensed Wi-Fi will become the small-cell information transmission medium for VoIP and data.

Macro networks will become the transport medium for data sent between small networks and what remains of the global voice infrastructure. No matter what compression schemes may be developed, macro networks don't have the bandwidth to handle the impending data tsunami that the next few years will bring, and small cells do.

Steep ramp-up angle

Small-cell opportunities will rival those of the early days of cellular, but with a much steeper ramp-up angle and a much smaller window of opportunity for getting a piece of the pie. Once BYOD/X and UC gain traction, the small-cell revolution will spread everywhere. This time, the wireless industry won't be the leader, although it will be a significant player. Why? Because wireless technology is mature. Whether it is in small cells or macro cells, the wireless technology is the same. It is just a matter of scaling the technology and integrating data platforms, mainly Wi-Fi.

This time the leaders will be enterprise IT experts who will be asked to implement and manage both the RF segment and the communications network. Members of the IT team will be the ones getting their hands dirty, and wireless will be asked to provide the hardware and make the deployment. After that, it's all IT. ■

By Ernest Worthman, Editor
eworthman@agl-mag.com

bring your own device

Small Cells Enable Enterprise-level BYOD/X

Platform neutrality will enable the mobile workforce of the future. Mobile devices and Wi-Fi hotspots will arm the future workforce. Small-cell technologies will play a big role in this workspace realignment.

By Ernest Worthman

Forward-thinking organizations improve employee productivity by arming workers with smartphones, tablets and other portable devices used according to well-managed connectivity plans. This should come as no surprise to information technology (IT) departments and wireless systems providers, whether licensed or unlicensed. The untethered workplace horse left the gate when the first cell phone was offered for sale in 1983.

According to a 2013 report released by iPass, 70 percent of all employees worldwide are under some sort of bring your own device (BYOD) policy at their workplace. Seven out of 10 workers are empowered with mobile access to their job functions and can use their devices with equal efficiency in and out of the workplace. By all indications, the trend shows no sign of abating and the norm may well be that a workplace will be wherever and whenever the worker wants it — and the employer supports it.

Soon, BYOD will be BYOX (bring your own anything). Although BYOX is still only a concept, savvy IT and wireless frontrunners should be bracing themselves for problems that BYOX will bring.

"Bring your own device" refers to employee-owned communications hardware. It can be anything, a simple big-button cell phone for visually impaired workers, a basic 2G voice/text device, the latest and greatest tablet PC or anything in between. The nightmare for IT is how to manage and support all of the platforms and software such as GSM, CDMA, CDPD, multiple computer/tablet operating systems, Wi-Fi, 3/4G, LTE, public safety and WLANs that the deep well of hardware requires.

IT departments also must consider document and application collaboration. Enterprise applications will need to be agile and flexible to allow workers to move work among devices and groups. Application collaboration was fairly easy to administer when the application platform was uniform. Now collaboration involves managing applications written for different operating systems — Windows, Mac and Android currently — and any new platforms, applications and devices.

BYOX

With "bring your own anything," mobile workers will push the envelope to make their jobs easier and more convenient. Workers using devices and applications with which they are comfortable and working from nontraditional locations show increased productivity.

Remote work reduces or eliminates commuting, office socializing and peer interaction. When left to their own preferred devices and settings, mobile workers can be much more productive. The operative word here is "can," because the remote sites are beyond the organization's control. It is left to the worker to make the most of such liberties. The job has to get done, and results make the difference. If results don't support employees working remotely under BYOX policies, then employers revisit traditional options.

The largest BYOX problem is control, exacerbated by worker attempts to find easier and more convenient ways of doing their jobs. Finding new document collaboration applications flexible enough to move work among devices and groups is even more difficult with BYOX. IT departments must find a sweet spot between meeting the needs and requirements of the consumerized employee and having the worker out of sight and perhaps beyond the control of IT, while nevertheless keeping corporate data secure. The answer for enterprise mobility management (EMM) involves mobile device management (MDM) strategies, which in turn require policies that take advantage of the specific capabilities of smartphones and tablets for using applications. EMM suppliers will need to understand the demands

MNO

INTERNET

ENTERPRISE
FEMTOCELL

BROADBAND
ROUTER
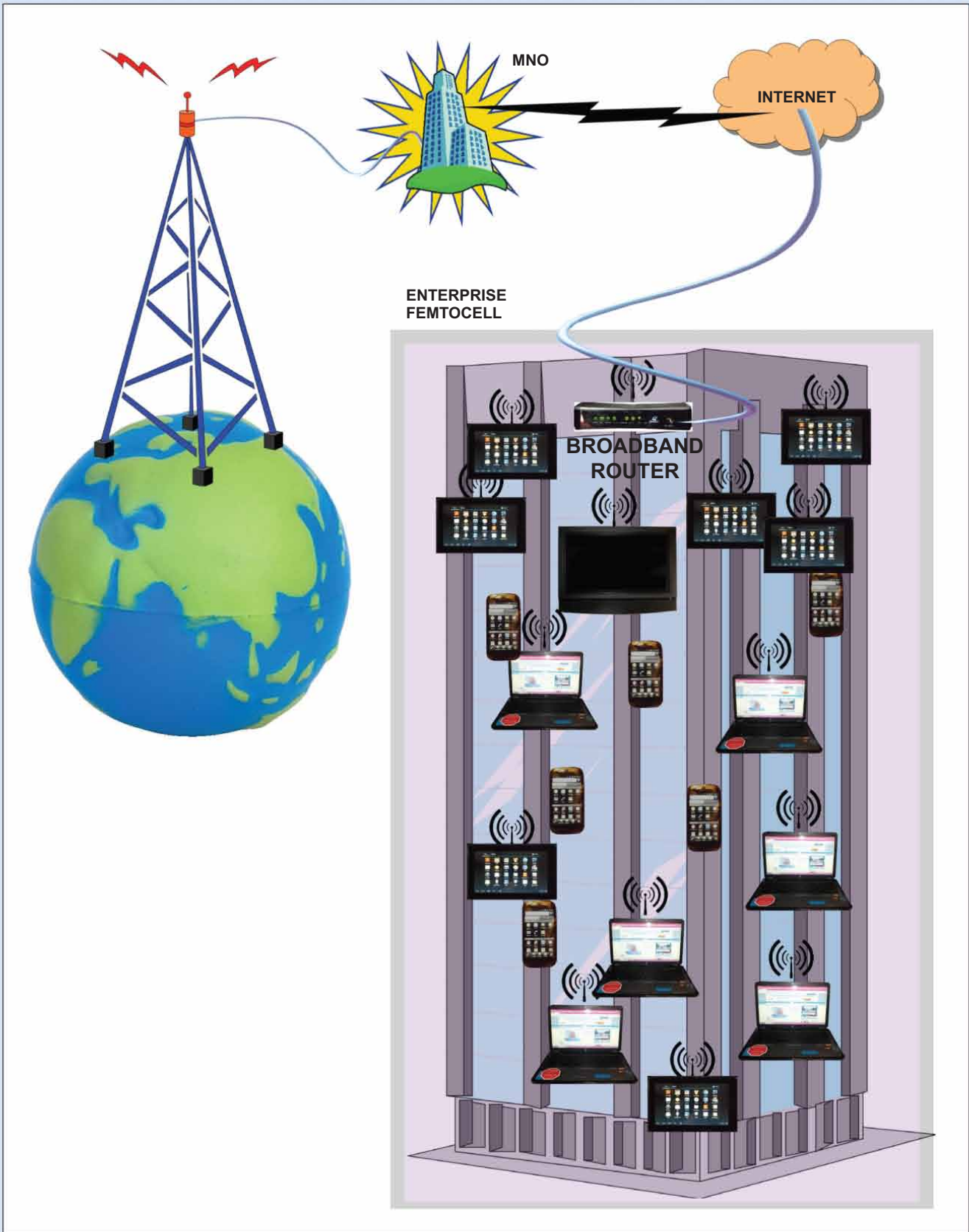
The enterprise BYOD/X small cell takes internetworking to the next level by integrating user-owned devices within the cell. BYOD/X improves productivity by giving workers the comfort of using their own devices. Meanwhile, the small cell increases the efficiency of the communication and ties it to the macro network.

SEPTEMBER 2013 | **DAS and Small Cells** | **83-7**

bring your own device

and offer a flexible menu of offerings accordingly. These new frontiers will have to encompass current and future mobile devices.

Follow the money

Although it may seem that BYOD/X offers no win for the IT department, there is a reason IT specialists won't have to lock their doors while exasperated workers are trying to run them out of town on a rail. Device and application compatibility will come. Hardware and software developers know that they have to follow the money, and today's money is on BYOD/X and interoperability. Compatibility will become less and less of a problem as interconnect and the interface become more and more transparent.

The overwhelming problem for IT departments is how to put in place a low-level EMM layer that can support the widest range of applications and BYOD/X devices. IT departments will become more like brokers of technology than keepers, developers or controllers of technology. Their responsibility will be to understand the technology and deploy it in ways that benefit the workers and the organization. Fortunately for IT departments, vendor and in-house resources can bring them up to speed. Along the way, IT control of what the worker uses, what it will be used on, and where it will be used will loosen fairly quickly. IT has been blessed, or cursed, with the job of making technology work reliably. IT specialists are at the bottom of the funnel when something doesn't work. They often are told to make it work by those with little understanding of the infrastructure and its components. The way IT has met the objective has been to control the enterprise and determine what can be used and what can't. The transition to BYOD/X will be a bit of a rude awakening for IT and painful for some. A statistic from the iPass report is that 35 percent of all respondents said a company's BYOD policy can sway their employment choices. If an organization hesitates to move into the BYOD space, it could potentially risk depleting its talent pool.

The path to BYOD

BYOD cannot be implemented willy-nilly. Organizations must follow a strategic initiative. They cannot rely on dealing with problems as they arise. For enterprise IT, a BYOD program has multiple phases and touches multiple stakeholders. The best solution is to use a structured approach to planning, piloting, executing and reviewing. Figure 1 shows the results from a poll of some enterprises that are on the BYOD path. The numbers indicate the percentage of
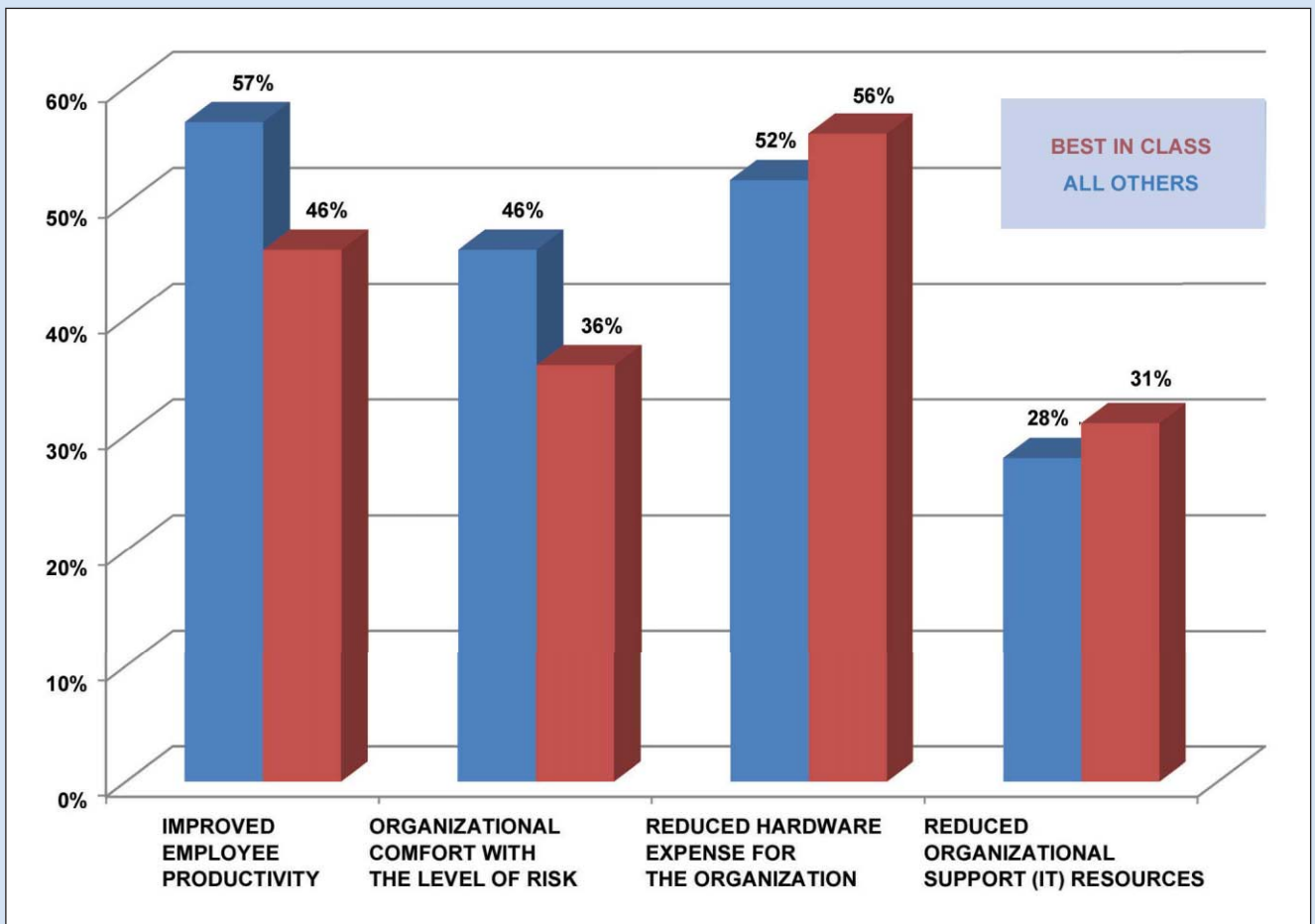
Figure 1. The results of a poll taken of some enterprises that are on the BYOD path indicate the percentage of respondents who see the value in BYOD for improving productivity and reducing an organization's expenses for hardware and IT support.

respondents who see the value in BYOD for improving productivity and reducing an organization's expenses for hardware and IT support.

The first step is to choose a BYOD strategy. In taking this step, the organization conducts a high-level assessment of the ultimate goal and potential roadblocks. The assessment defines goals and timetables and how universal the organization's BYOD capabilities should be. It crafts responses, solutions and workarounds to the roadblocks. The first step defines the stakeholders and the effect the BYOD strategy will have on them.

Meanwhile, stakeholders will have an effect on BYOD, too. In the long run, stakeholders and employees will have the most significant effect on the chosen platform because it must work for them, not the organization. Problems range from technical to strategic, administrative, financial and legal. BYOD strategists should identify and contact all stakeholders to obtain inputs and opinions that will shape the program.

Examples of stakeholders include the human resources (HR) department, the IT department itself, employees and their representatives, attorneys and the finance department. HR handles terms of employment, employment contracts and the company's rights to its data when employment terms change or end. IT handles application delivery, deployment and support. Employees may have representatives such as unions that examine employee BYOD equipment rights. Lawyers analyze and draft contracts. The finance department handles accounts receivable, accounts payable, payroll and other accounting functions. Third-party enterprise architects and contractors may be involved. The organization receives employee feedback during the first step.

In the second step, the organization is segmented into however many groups are required. The needs of each group are analyzed and potential solutions are considered. During this step, employee access protocols and related risks to each group are determined. Most organizations have departments and functions with potential conflicts of interest. For example, a company that sells high-tech devices would have proprietary technologies. The sales force would want to have all the tools they can get their hands on. Meanwhile, the research and development department would be cautious about giving access to sensitive, confidential data that, if it were to fall into the hands of competitors, could harm the company. Thus, during the second step, security layers are determined and defined.

The third step addresses planning and implementation. During this step, tools and technologies are selected. Infrastructure hardware, applications and wireless components on all levels are analyzed, chosen and integrated. The third step lays out the process and procedures to install the infrastructure. It defines networking

bring your own device

strategy and the applications that will run across the enterprise. Another function of this step is to address the internetworking protocols and application management, defining who has control of what, from hardware to application access.

Next come field trials, on a beta level at first, with the lowest-risk groups, applications and hardware. Testing uncovers how well the BYOD devices function with the organization's infrastructure, and it reveals and documents bugs, security issues and roadblocks, whether expected or unexpected. One thing field trials must accomplish is to implement a comprehensive, accurate and complete documentation system. If only one potential problem is ignored, but it turns out to be important, the result of a full roll out can be catastrophic. Once the field trials are completed and if everything goes well, the doors are opened and the system is up and running.

If all works well and any bugs found can be resolved, then the system is closely managed by the assigned department, which is almost always IT. It is a good idea to have a real-time feedback program so problems can be immediately addressed.

BYOD and organizational security

In a recent poll of senior-level IT executives, nearly 80 percent expressed concerns that BYOD devices can create a significant security risk for the organization's data, policies and procedures, some of which are beyond their control.

Two vectors form potential security risks: inside-out and outside-in. A typical inside-out scenario is one in which the device is lost or stolen. This is IT's worst nightmare because the device is beyond anyone's control. A similar, but not so devastating, scenario is one in which employment terminates under hostile conditions and an ex-employee attempts to use a device in a harmful manner, or the device contains company intellectual property. When IT still controls a compromised device, IT can immediately block access to company data and kill the device because generally all smart device connections use virtual private networks and require authentication.

There is always concern about the data outside of the organization. Over the years, organizations have found it much more secure to keep the data on their servers. This keeps employees working in IT-controlled space versus downloading data, modifying it and uploading it. That control will extend to BYOD.

An example of an outside-in vector would be a security hole from an external site that downloads and installs malware or viruses. On Android-based smartphones and tablets, this problem is becoming alarming because the Android application market has exploded. By some estimates, there are nearly a half-million apps for Android-based hardware. The big security hole with Android is that apps are not screened, compared with Apple, which does screen submitted apps. Anybody can offer an Android app. Even so, the majority of security breaches are made using dual-use Windows-based net/notebooks and laptops. The reason is the same as for non-BYOD devices — users tend to be lax in security vigilance, believing the device has built-in security. For the average worker, similar thinking prevails with BYOD devices.

To try to get a handle on security, BYOD strategies use security policies that address potential risks with multiple layers of security software that have to be between the BYOD device and the organization's data. To be effective, policies have to be followed. In most cases, workers are required to install policy software or apps on their devices, and then IT can monitor the BYOD in a number of ways. Although the move to have an unrestricted BYOD environment is tempting from the workers' side, there will always be certain policies and procedures that employees will be required to follow when working with BYODs. Mature workers tend to be more cooperative about adhering to BYOD policies. Younger, especially Gen Y, workers are largely dismissive of such restraints. A report from Workforce indicates that more than 70 percent of Gen Y workers admit to disobeying BYOD policies.

A third, seemingly benign, security breach is friends and family and social networking. Although most of us have little to fear from leaving devices unattended in our social circles, a small percentage of people we know may take advantage of us.

The great enabler for BYOD proliferation is small-cell technology. Consumer experience with Wi-Fi sites leads workers to expect the same in the workplace. Enabling a successful BYOD user experience in the workplace requires soft handoffs and self-organizing networks driven by long-term evolution (LTE) communications technology. These technologies will be implemented in the form of heterogeneous networks. For a drill down on hetnets, see the June issue of *DAS and Small Cells Magazine*.

IT department options

To manage the wireless infrastructure, the IT department has a number of options. The department may have responsibility for the entire infrastructure or it may have responsibility only for the Wi-Fi segment. The wireless telecommunications carriers such as AT&T Mobility and Verizon Wireless may manage and be responsible for the wireless interface. IT may or may not be responsible for the service nodes, depending on the architecture and preferences. If IT is to handle the service nodes, then expertise in carrier architecture is necessary. If IT doesn't want to be the point group for everything, then the mobile network operator's enterprise mobility management can be enlisted to handle the licensed segment and interface. In the end, in all but the largest of organizations, IT will become more of a broker of services than a master of them. That will be the best way to manage costs, platforms and technologies, and will optimize the value proposition of BYOD ownership.

However it plays out, small-cell solutions will become the backbone of the BYOD campus because they offload traffic to unlicensed Wi-Fi networks and strategically placed small cells, and they are scalable. Wi-Fi has some problems to iron out, such as seamless roaming and soft handovers, but it has such momentum, flexibility and compliance that

it will be problematic to replace it with some yet-unknown solution. Wi-Fi is universally implemented and accepted, and it is well understood by the user and the provider. Although it is likely that other Wi-Fi-type technologies will develop and become part of the infrastructure, in the near future, Wi-Fi is the only realistic solution available that works for offloading and routing local data. It is the only realistic solution that can offer sufficient capacity to handle all of the devices while allowing workers to roam within the enterprise just as they do outside of it.

The support infrastructure flyover

The underlying technology that will enable intelligent networking will be hetnets. Indoor RF environments become increasingly complex and challenging as the density of the deployment increases. In multistory buildings where mobile devices experience a three-dimensional RF environment, BYOD will see networks and small cells with higher levels of RF congestion than it would in macro cell environments. It isn't unreasonable to expect up to a dozen or more handovers per minute in multistory, multiple-building campuses. Thus, both the devices and the small-cell infrastructure must rely on hetnets to manage the intelligence that handles the hardware and software platforms to support self-organizing and multi-access 3G, Wi-Fi and LTE/4G small cells using the enterprise-Ethernet local area network as a managed service. This hardware will then connect backhaul and macro-cell networks to the mobile network operator's core network.

Conclusion

With a moving target such as BYOD/X and with little real-world experience on which to rely, it is difficult to predict what the landscape for enterprise mobility management will look like in 10 years. The immaturity of the technology means that there is no common BYOD platform for hardware OEMs, software developers, IT, workers and organizations. That causes problems for corporate executives because BYOD's momentum slams up against the lack of standard platforms. The existence of so many untried and untested offerings has corporate executives on a slow, cautious adoption path. Nevertheless, the BYOD movement has traction. It is an unstoppable behemoth. Organizations have little choice but to embrace BYOD — it's a matter of when, not if. The fact that technology is an unforgiving teacher and has dished some unforgiving lessons is not lost on corporate executives. They have learned that some of these lessons, and the go-slow mentality on the platform side of BYOD will, inadvertently, be beneficial. It means that when BYOD is finally rolled out ubiquitously, it will be a solid platform that will redefine how the world works. ∎

SEPTEMBER 2013 | **DAS and Small Cells** | **87-11**

How Spectrum Conditioning Benefits DAS Network Design

Indoor and outdoor distributed antenna systems can recover lost capacity to carry more traffic, improve spectrum use and deliver improved performance with spectrum conditioning.

By Bill Myers and Ted Myers

The air interface is becoming more polluted with random, unpredictable interference on a daily basis, and distributed antenna system (DAS) operational qualities make them especially vulnerable. To overcome the challenges of depleted radio-frequency spectrum, operators are packing more carriers into their existing licensed spectrum, squeezing the guard bands between carriers to their limits.

Although the idea of a DAS is to provide specific coverage and capacity to a defined area, doing so means deploying more antennas than traditional systems use. That means more antennas to pick up interference that can impede network performance. By actively conditioning the physical layer of the DAS, operators can prevent RF problems and use spectrum to maximum effect, ensuring customers the best quality of service.

The following information details DAS architectures and offers an example to explain how spectrum conditioning improves network reliability and performance by improving handset battery life and network capacity.

Spectrum conditioning

Digital signal processing identifies and minimizes unwanted adjacent-channel RF in the network's air interface, or physical layer. It reduces the influence of the near-far effect and co-channel interferers. All types of systems can benefit from spectrum conditioning, including neutral-host, private, over-the-air donor, dedicated eNode B, node B and base transceiver station fiber-fed special venue systems indoors or outdoors.

The DAS dichotomy

Wireless network operators are challenged to find the most cost-effective way to provide continuous service as callers move indoors. Many technologies provide indoor coverage, such as overbuilt macro networks, over-the-air repeaters, DAS, microcells, picocells and femtocells. DAS flexibly integrates specific indoor coverage with broader wireless networks.

Indoor DAS types include active or passive, neutral-host or private, over-the-air or dedicated enodeB/nodeB/BTS equipment either local to the DAS deployment or in a BTS hotel. Figure 1 illustrates the complexity of DAS configurations and leads to the type of system.

Indoor versus outdoor: Indoor networks are typically deployed in high-traffic buildings such as airports or convention centers, with remote antennas connected via fiber to a central hub. Outdoor networks similarly use fiber to connect the system of antennas back to a central hub, but typically must cover a much larger geographical area.

Neutral host versus private operator: A neutral-host DAS network provides coverage within its domain to all service providers in the supported frequency bands, regardless of air interface or operator. A private operator network is implemented by a single operator to provide service to its customers over its own network and does not support other types of connections.

Active versus passive: Active networks use repeater amplifiers to rebroadcast the carried signals through the DAS. Passive networks are simpler, using only cabling, splitters and antennas to distribute the signal to the antennas of the DAS.

These DAS configurations vary in design but all bring multiple antennas into a specific area to provide coverage that would not be practical with a macro solution.

The bad with the good

The good — Indoor DAS systems provide a high level of coverage and service to the "great indoors" without suffering the building penetration losses that affect macro wireless networks with outdoor transceiver equipment. However, the indoor DAS system has to contend with the interior environmental factors, such as wall, floor and ceiling types and makeup, partitions, furniture and various types of interior
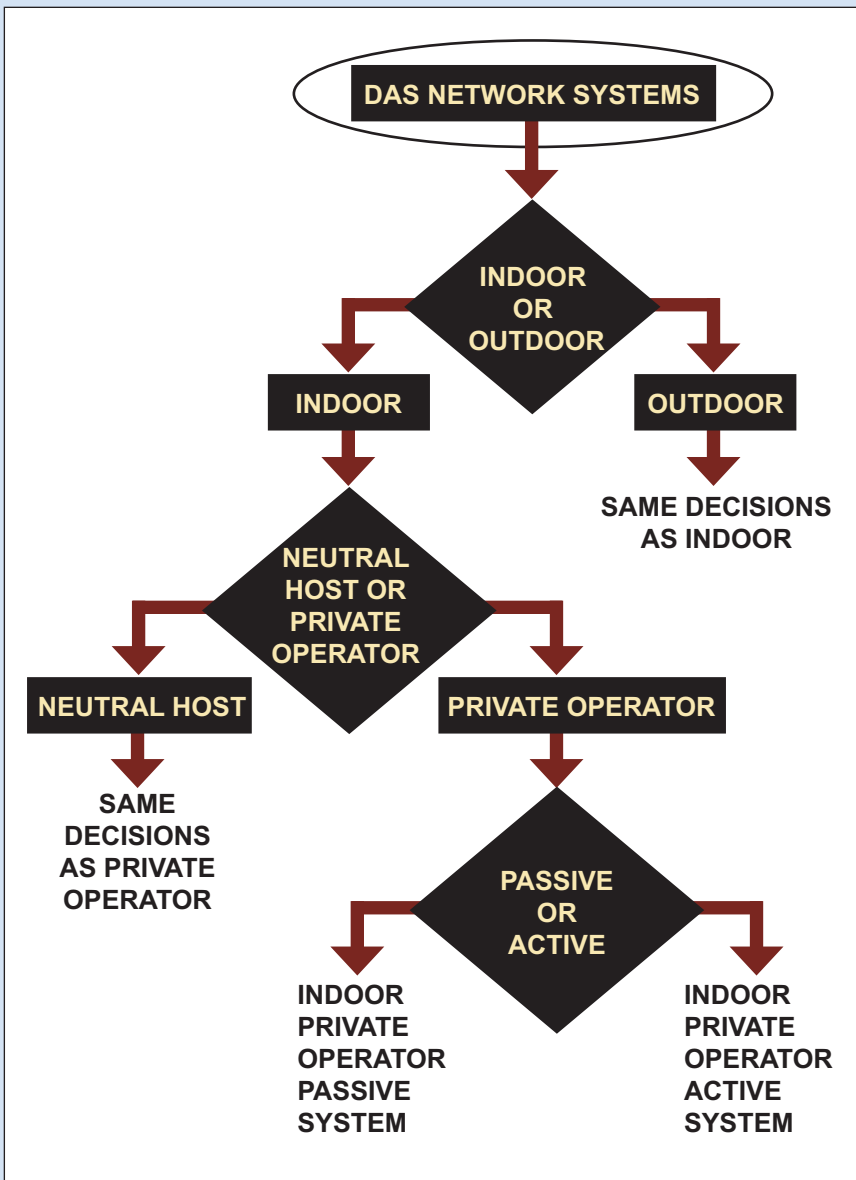
Figure 1. The complexity of DAS configurations leads to the type of system selected: active or passive, neutral-host or private, over-the-air or dedicated enodeB/nodeB/BTS equipment either local to the DAS deployment or in a BTS hotel.

effect and co-channel interference. The problems caused by any of these phenomena degrade performance in numerous ways, including a reduction in carried traffic, an increase in dropped calls, lower data transfer rates, reduced coverage areas and reduced handset battery life.

Interference in DAS networks

In an ideal world, there would be no competing wireless service providers operating in adjacent frequency bands. There would be no near-far effect because all carriers would use the same air interface, and power control would behave in the same way for all users being served by a single cell site. If there were competitors, they would all be operating with the same air interface with cell sites at the same distance as yours with ample guard bands separating carriers. In the ideal world, there also would be no random co-channel interference to steal capacity available to carry traffic.

In the real world, however, operators experience all three problems of adjacent-channel RF, the near-far effect and co-channel interference. These problems affect the path loss plan, propagation coverage models and reverse-link channel power. Figure 2 shows RF interference captured in an actual DAS network as seen on a spectrum analyzer.

The display shows the presence of co-channel interference that unnecessarily increases channel power, stealing capacity and reducing data transfer rates. It also shows adjacent RF affecting the adjacent-channel interference ratio, which further increases the noise rise, disrupts link planning and reduces throughput and capacity.

The near-far effect from competing operators or adjacent Global System for Mobile Communications (GSM) operations also affects signal quality. Specifically, consider Universal Mobile Telecommunications System (UMTS) users being serviced by an in-building DAS with adjacent GSM users being serviced by an external macro cell site. Even at its lowest level, the GSM handset transmit power will desensitize

materials, along with path losses from infrastructure components such as cables, splitters and attenuators. The insertion losses and their effect on the noise figure need to be calculated when the indoor system is designed, which leads to highly complex, carefully balanced designs that come with problems. Zones of operation within indoor DAS networks resemble macro networks but with unique properties and problems including handoff coordination, coverage, pilot pollution and link balancing. The DAS system has to be carefully engineered for handoffs within itself

and for handoffs to and from the surrounding macro network.

The bad — Although indoor DAS networks typically use shorter distances between access points or antennas and the user equipment, the proximity of users to access points exacerbates the near-far problem. Users close to access points are under power control from the DAS while users not served by the DAS are under power control from a macro site but are as close to the DAS access point as the DAS users. All types of DAS networks are susceptible to high-power adjacent RF, the near-far
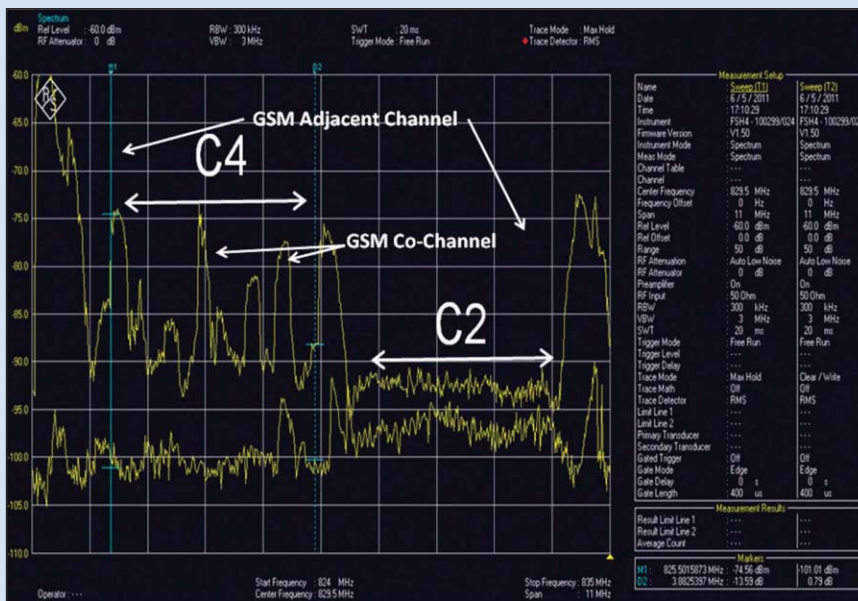
spectrum conditioning

Figure 2. As seen on a spectrum analyzer display, RF interference includes adjacent-channel RF, the near-far effect and co-channel interference. These problems affect the path loss plan, propagation coverage models and reverse-link channel power.

the adjacent UMTS receiver, degrading performance. This is the real world, and deploying spectrum conditioning to counter these effects will restore the DAS to the originally designed capabilities and deliver the desired subscriber experience.

DAS and GSM/UMTS coexistence

In a DAS network, four interference cases can affect the performance of a coordinated UMTS/GSM collocation deployment. These cases are related to transmit and receive characteristics of the base transceiver stations and the user equipment for both air interfaces.

- GSM uplink as victim, UMTS user equipment as interferer
- GSM downlink as victim, UMTS node B as interferer
- UMTS uplink as victim, GSM user equipment as interferer
- UMTS downlink as victim, GSM BTS as interferer

A report on a sharing study issued by the Electronic Communications Committee within the European Conference of Postal and Telecommunications Administrations (CEPT), "Compatibility Study for UMTS Operating Within the GSM 900 Band and GSM 1800 Frequency Bands" (ECC Report 82),

provides comprehensive network simulation results on the compatibility of UMTS and GSM operating in the same frequency band. In the study, the limiting scenario was determined to be Case 3, with the UMTS uplink as the victim and the GSM user equipment as the interferer. In this situation, the GSM handset in the adjacent band is powered up and being serviced by a distant macro cell site that overwhelms the near-in UMTS DAS node B. Even in the most favorable conditions, the limited power control of the GSM user equipment (typically +5 dBm minimum) has a significant effect on the adjacent UMTS network operation.

The effect of adjacent-channel interference on a UMTS system is typically parameterized by the adjacent-channel interference ratio (ACIR), the ratio of power from the desired signal to the power from interference from adjacent channels. The ACIR itself is a composite quantity based on the performance of the UMTS Node B and user equipment (UE) transceivers. The relationship between ACIR and adjacent-channel selectivity is shown here in Equation 1, where ACLR is the transmitter's adjacent-channel leakage ratio and ACS is the receiver's adjacent-channel selectivity:

$$\frac{1}{ACIR} = \frac{1}{ACS_{\text{UMTS node B}}} + \frac{1}{ACLR_{\text{GSM UE}}}$$

The ACIR then represents a composite quantity that includes the effects of both out-of-band power blocking and in-band power leakage, and the net loss in capacity can be evaluated. To optimize performance, network operators should strive to optimize ACIR. Equation 2, which calculates the effect of adjacent RF on the node B, restates that relationship and clearly indicates that ACIR will improve as both ACS and ACLR increase.

$$ACIR = \frac{1}{\frac{1}{ACLR} + \frac{1}{ACS}}$$

Mathematically, it is straightforward to demonstrate that if either ACLR or ACS is arbitrarily larger than the other, ACIR becomes dominated by the smaller quantity, thus limiting performance to the weakest link. At the base station, the ACIR of the uplink can thus be improved by improving the Node B receiver ACS, but only to the point at which the ACIR is dominated by the user equipment ACLR. Table 1 represents information compiled from 3GPP technical standards, TS25.104, TS25.101 and TS45.005, and provides typical ACLR and ACS performance.

Given the constraints of ACLR of the GSM handset and ACS of the node B, spectrum conditioning offers an opportunity to improve performance in two complementary ways. First, additional filtering can be dynamically assigned to provide additional selectivity at the band edge, improving upon the ACS of the node B's receiver. Second, at the same time, spectrum conditioning is applied to reduce the effect of GSM transmissions either adjacent to or co-channel with the UMTS band being used. Spectrum conditioning provides pure spectrum for the UMTS channel in both cases, reducing the amount of RF power from interfering signals that can reach the Node B radio cards. In a DAS, the situation is further exacerbated because of the minimal distance between the GSM user equipment and the DAS

Parameter	UTRA-FDD BTS	GSM UE
ACLR (dB)	NA	33
ACS (dB)	46.3	NA

Table 1. Adjacent-channel leakage ratio (ACLR) and adjacent-channel selectivity (ACS) for wideband code-division, multiple-access Universal Mobile Telecommunications System Terrestrial Radio Access (UTRA-FDD) base stations and user equipment.

antenna. Spectrum conditioning readily addresses this difference.

DAS antennas

The problems for DAS networks do not end with adjacent-channel interference. Distributing antennas throughout a building or event site brings the system closer to potential sources of interference such as ID card readers, wireless routers, wireless microphones, two-way wireless communications systems, poorly designed RF amplifiers and other electronic equipment, together with environmental passive intermodulation (PIM). The many unpredictable sources of co-channel interference can drastically affect network performance, reducing capacity and disrupting the carefully planned DAS network coverage. These types of interference cause the network to increase user equipment transmit power to overcome the interfering signal, which can further cascade and affect adjacent DAS antenna zones. This phenomenon has been studied well and can be demonstrated to affect data capacities and zone coverage.

The takeaway

Spectrum conditioning provides a robust and dynamic response to these sources of interference. Known, constant interference at a particular frequency can be specifically blocked, enabling the network to operate at lower power levels, intrinsically reducing interference. With lower power levels and less interference, even better signal conditioning results can be achieved because the automatic deployment of dynamic notch filtering becomes more effective at selectively rejecting narrowband interfering signals while leaving the rest of the signal undisturbed. Together, these spectrum conditioning capabilities combine to provide re-

silience to both known and unknown sources of co-channel interference, preventing degradations in system performance before the network is affected.

Conclusion

Global mobile data traffic is growing at rates over 10 times faster than voice. Data traffic is reaching hundreds of petabytes per month, and soon will be in the thousands. This requires wireless operators to squeeze as much capacity as possible from the existing spectrum they own — maximum utilization is a must. Yesterday, networks had the bandwidth and could afford, and compensate for, the loss of capacity to guard bands, interference and unpredictable environments. Today, that is not the case. Idle capacity rarely exists, competition for bandwidth is fierce and critical high-traffic periods, sites and events demand that every bit of efficiency be squeezed out of available bandwidth.

Now, with spectrum conditioning through RF digital signal processing (DSP), smaller guard bands and offsets to increase spectrum available for carriers are possible. Mitigating co-channel interference, whether random or self-induced such as GSM, can recover vital capacity being unnecessarily wasted, resulting in improved data transfer rates. Proactively conditioning high-profile, high-traffic sites such as DAS environments from high-power adjacent RF can maintain capacity, performance and throughput, all while improving battery life for the end user by keeping user equipment transmit power low. ∎

Bill Meyers is director of business development and product management at ISCO International. His email address is bill.myers@iscointl.com. Ted Meyers is the company's vice president of technology. His email address is ted.myers@iscointl.com. The company offers digital signal processing solutions for 3G and 4G LTE spectrum conditioning.

technology viewpoint

Unified Communications' Connection to Small Cells

Small cells and unified communications will be the platform for the next generation of fully integrated communications.

By Ernest Worthman

As their use of increasingly advanced modes of communications grows, businesses will seek ways to integrate communications with various business processes to make them more efficient and less costly, and to improve operations, customer service and sales. With Wi-Fi as the data platform of the future, small cells are viewed as the best solution to manage local data and move it in and out of the macro wireless mobile communications network in support of unified communications (UC).

Here's a definition of unified communications that's a mouthful. It comes from Wikipedia. "Unified communications is the integration of real-time communication services such as instant messaging (chat), presence information, telephony (including IP telephony), video conferencing, data sharing (including web-connected electronic, interactive white boards (IWBs), call control and speech recognition with real-time communication services such as unified messaging (integrated voice mail, email, SMS and fax)." Perhaps a more down-to-earth definition might be that unified communications is a combination of presence and availability — which lets users see the location of colleagues — with voice, media and messaging that makes communication easier among all participants.

Unified communications will be the killer global communications platform of the future, a conclusion supported by research. Transparency Market Research forecasts the worldwide market for unified communications and collaboration services to hit almost $62 billion by 2018.

The unified communications transport layer will use the transmission control protocol and Internet protocol (TCP/IP) stack. Thus, anything that can use the Internet can be part of unified communications. The most difficult aspect is how to integrate voice communications.

Small-cell primer for UC

At the center of the small-cell radar screen is Wi-Fi, so expect Wi-Fi to be the default data platform for unified communications. In the next few years, data is expected to outpace voice at a frenzied pace. By 2020, 70 percent of all user-generated traffic will be data, according to a report by IDC. And much of the traffic will flow within a local wireless network — for example, coworkers communicating with each other, surfing the net and using BYODs. That's short for "bring your own device(s)," meaning employees bring their own smartphones, mostly, and sometimes tablets and laptops to use at work. That's where small-cell technology is being directed.

AT&T says all of its small-cell deployment will include Wi-Fi. The unified communications market will closely align with the small-cell market. Those who understand the economic and technical principles of unified communications will be the front-runners.

The voice component of unified communications will be voice-over-Internet protocol (VoIP). Because VoIP is a data platform, unified communications' voice component will be tightly integrated with small cells. Because Wi-Fi is expected to be the pre-eminent data platform, small cells are viewed as the best solution to manage local data and move it in and out of the macro network.

Small-cell deployments have promising applications and they seem to have unified communications somewhere in the equation. More about how the pieces come together lies ahead, but first, the following information will identify the playing fields where unified communications and small cells will team up.

Small cells will be ideal for the consumer to use to create networks in homes. Home networks have better communications reliability because the base station is closer to the user equipment, improving the air interface for a better consumer experience. A small cell ensures better voice quality and higher data throughput for all devices that use it.

Small cells will solve the problem of poor in-building wireless coverage
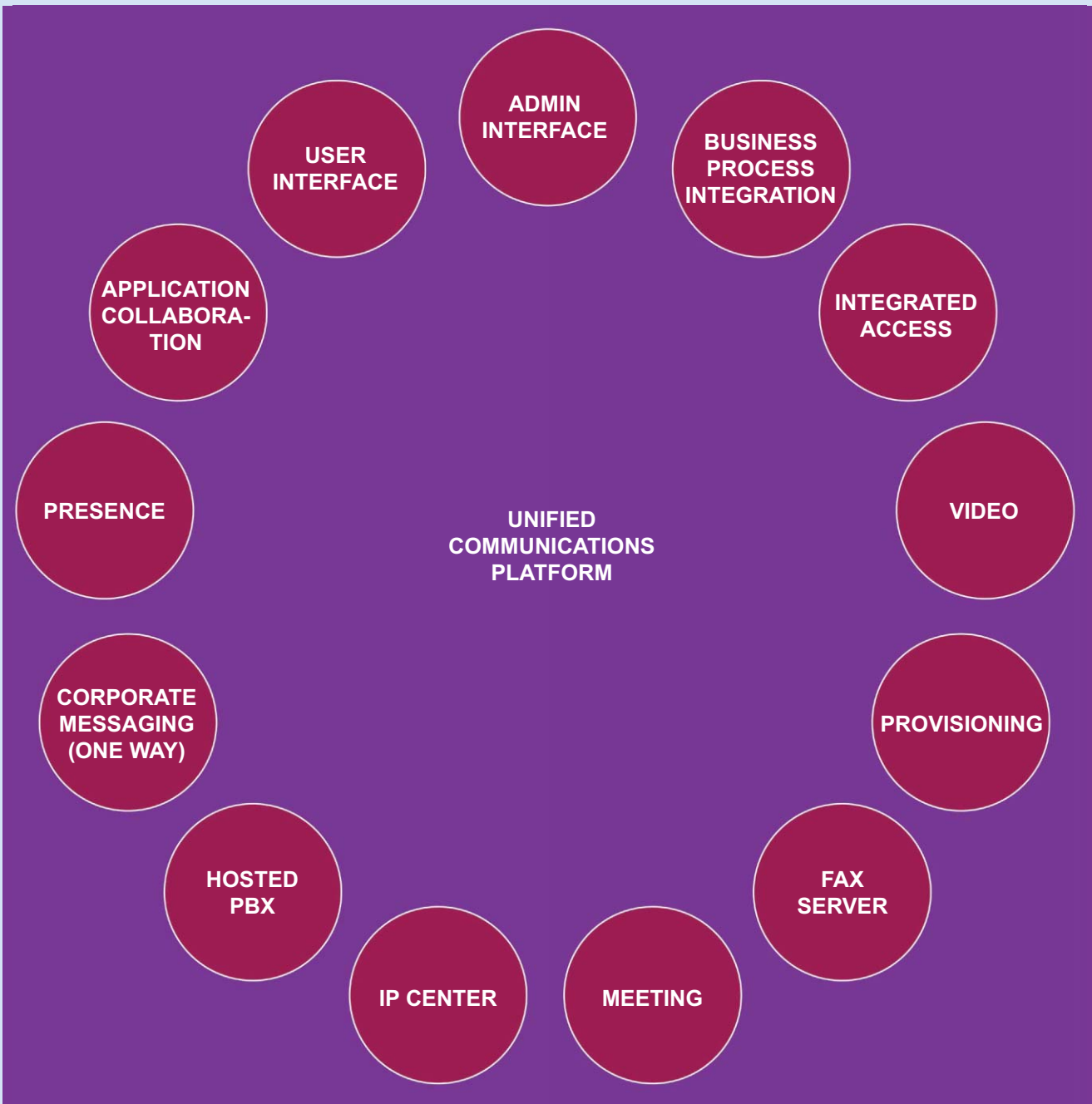
Unified communications can play host to many subset communications modes.

or performance for enterprises. The top three reasons for deploying enterprise small cells are to optimize in-building coverage, to optimize high-data-usage areas and to offset an inability to expand the macro network. Installing one or more small-cell networks solves those problems.

Commercial deployments are scalable and flexible and offer higher-tier options. The options include frequency-agile and more powerful transceivers, multiple interconnects, power management and autonomous self-organizing network (SON) options. Enterprise solutions will integrate variable grades of service and higher levels of expandability and upgradeability. Compared with consumer fixed-option sites, commercial installations will be more pay-as-you-grow systems with unlimited potential.

City centers, stadiums, music venues, malls, convention centers, transportation centers, resorts, museums, zoos, large hotels and streets are prime targets for small cell sites filled with low-powered data devices that operate on unlicensed frequencies and small cellular network devices that need to be routed to macro sites. The so-called "metrocells" are ideal for covering selected venues and for filling RF voids within the macro network. They also can be used to extend coverage to rural locations where macros are not cost-effective.

technology viewpoint

VIRTUAL

PHYSICAL

IMPROVED BOTTOM LINE

ENHANCED PRODUCTIVITY

BETTER OPERATIONAL EFFICIENCY

LOWER COMMUNICATION COSTS
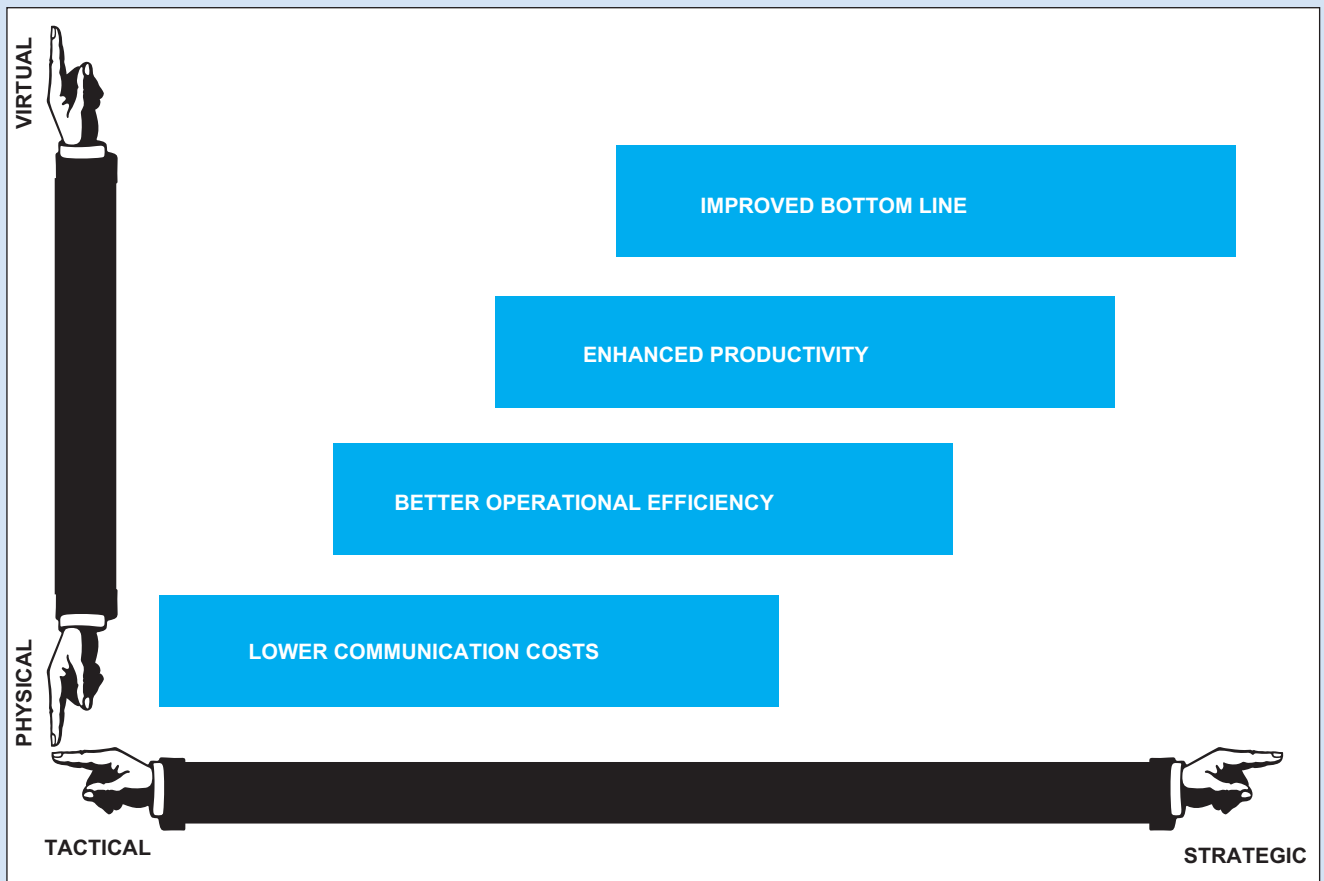
TACTICAL

STRATEGIC

Figure 1. The relationship of company motivators and how they serve the organization as they move from physical to virtual.

Whether private or carrier-owned, the small cell market seems to be on the verge of explosive growth. Idate Research Reports expects the femto-cell market to reach 23 million units worldwide by 2017. The Dell'Oro Group puts the number at 62 million units by 2015. That's a wide disparity, but most of the statistics indicate that widespread small-cell deployment will begin in earnest in late 2013 and ramp up dramatically in 2014. By 2015, most of the densification of wireless coverage will be accomplished with small cells.

UC flyover

Unified communications seems like the final frontier of integrated communications. In theory, it sounds awesome. Everything from voice to data to video and audio, real-time messaging and collaboration, live web conferencing and more will be on a single, integrated platform. Unified communications and collaboration solutions are touted as being able to converge communications

and collaboration services with business processes. This convergence will enable real-time presence awareness for these services and make them accessible to end users through a consistent, familiar interface.

The future UC-capable ecosystem will be global and omnipresent; it will encompass a wide breadth of vendors. No single vendor will have the depth to supply all of the elements for a complete unified communications solution. Key UC players include the switch and telephony vendors, desktop application vendors such as Microsoft and IBM, mobility vendors, unified messaging vendors, and conferencing and collaboration vendors.

Successful solutions must span multiple convergence points, bringing together multivendor networks. Many companies will forge alliances and share resources to bring complete solutions to customers. This approach will lead to standard platforms for all vendors to use.

Eventually, unified communica-

tions will be the way we communicate. Cloud-based networks will become the host for the majority of data, and hosted services will proliferate over managed services. Mobile clients such as tablets and netbooks will be the preferred user interface and will become smarter and more agile from one generation to the next. Unified communications will integrate with social software, contact centers, embedded presence, vendor specialization and an evolving supplier channel.

UC pain points

VoIP — The first, and perhaps the biggest, step toward ubiquitous unified communications is to update the telephony infrastructure to VoIP. However, VoIP makes a lot of people nervous. Although wireless phones are the norm, the way they are used in voice communications is much the same as the wired infrastructure. Wireless phones are not as reliable as plain old telephone service (POTS), yet they are much more reliable

than VoIP, which is neither regulated nor standardized. Today's VoIP offerings are not particularly compatible with each other, and to function, they have to have certain software and hardware in place. For universal VoIP implementation, support must be at the operating system level.

Nevertheless, VoIP is gaining traction quickly because today's business environment is so keenly cost sensitive that implementing VoIP can, once the initial investment is recaptured, lower organizational and enterprise telephony and other voice communications costs significantly — score a point for return on investment (ROI). Nothing moves an industry like the smell of a new opportunity to make big money. The aroma is bringing the VoIP industry to the table and motivating it to innovate platform-independent solutions.

In the enterprise, VoIP deployment opportunities vary. Some organizations have greenfield opportunities (i.e., an infrastructure into which they must deploy an entirely new set of communications technology). There are any number of reasons, but the bottom line is that there is no path to upgrade or integrate the present infrastructure.

For other organizations, moving to VoIP may take place in stages. Hybrid options include VoIP computer-to-computer-only connections, computer-to-any-phone connections, mobile softphones and apps and landline phones using an analog telephone adapter. Hybrid options allow organizations to more gradually morph to software-centric communications at a pace they are more comfortable with.

In all deployments, IP-based voice communications are considerably less expensive, and there is a direct correlation between software- and hardware-based platforms for any technology. The softer the management protocols, the lower the operational costs become, once the initial investment is made and the hardware is deployed.

Messaging — Unified messaging (UM), including a subset, instant messaging (IM), is becoming at least a blip on the radar screen. Although it is much easier to implement because it is digital

from the start, unified messaging has growing pains for some of the same reasons as VoIP (multiple platforms and software). For unified messaging, the universalization curve is not nearly as steep because it doesn't have as many options as voice, and there are established technical platforms to which all messaging protocols adhere. Unified messaging addresses one of the organization's top pain points — waiting for

information. Because unified messaging will be a real-time, universal platform, it is expected that information will become much easier and quicker to access.

Collaboration — Web conferencing and video conferencing are all over the map. Many components have to be in place for conferences to succeed. Multiple platforms, software and hardware make this segment of communications erratic. Unified communications will

HUBER+SUHNER
Excellence in Connectivity Solutions

lte.

«SENCITY® Optima for In-Building Coverage»

Features
- Broadband omnidirectional antenna 690 MHz - 6.4 GHz
- Covers all cellular bands including LTE 700
- Low IM
- Above drop ceiling mounting option

Benefits
- Effective RF coverage
- Reduced number of antennas
- Reduced interference between building floors

HUBER+SUHNER Inc., 19 Thompson Drive, Essex Junction, VT 05452. Phone: 800.493.975 | hubersuhner.com
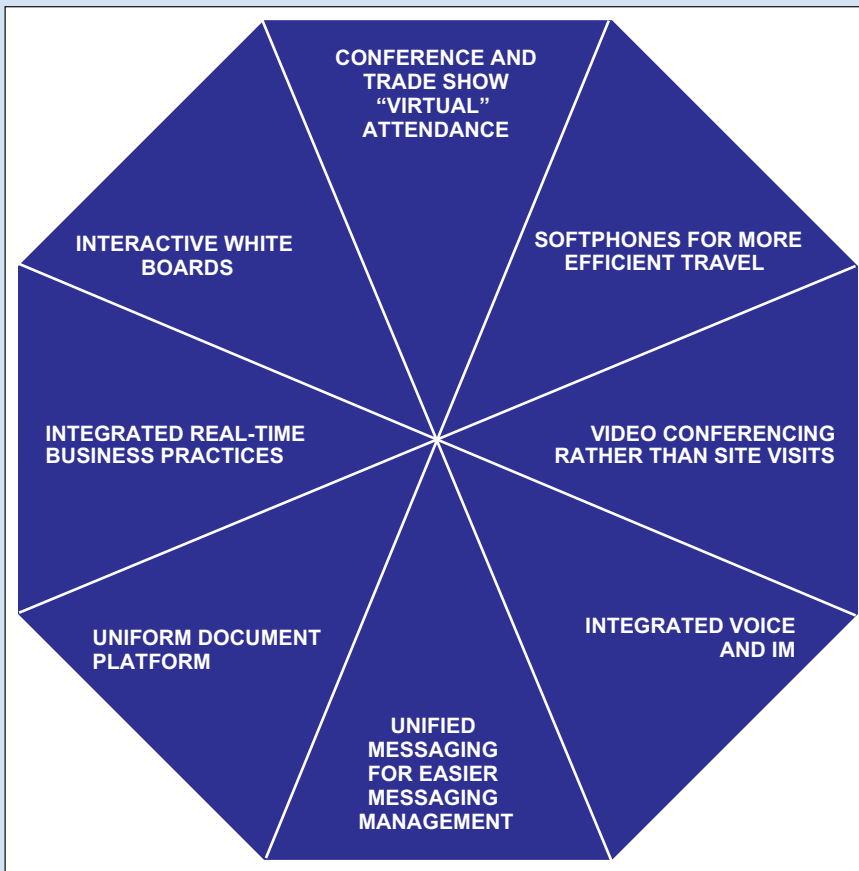
technology viewpoint

Figure 2. Elements of productivity that unified communications influences.

improve this type of collaboration and productivity and make it work right the first time, every time.

The real result of convergence

Converged technology may be exciting, but the bottom line is that unified communications bring communications and collaboration services together with business processes. Productivity gains and cost savings from real-time communications and collaboration platforms translate directly to the bottom line. Figure 1 represents the relationship. The solutions enable real-time presence awareness, web conferencing, voice, video, unified messaging and telephony, and make them accessible to users through a consistent, common interface.

Any number of charts break out how much time is saved by implementing a unified communications solution in an organization, but many are from solution providers and may be optimal only in a perfect world. Realistically, research seems to confirm that a solid unified communications platform used by motivated workers can save anywhere from 30 minutes to a couple of hours per day, per worker. Figure 2 represents the elements of worker productivity that unified communications can influence.

To have true convergence, the framework of unified communications and collaboration must be comprehensive, yet flexible enough to adjust to existing and future computing and telephony investments, and to core business processes. Although this may not be the case for initial offerings, as unified communications solutions mature and organizations upgrade platforms, the UC framework will become more and more universally deployable. That translates into a UC framework that will offer a wide selection of capabilities. The next-generation platforms will offer collaboration solutions that are agile and that adapt to user preferences by integrating into the environment within which users are most comfortable operating, or into the environment that's best suited for a given task.

The converged solutions will eventually span the continuum of platforms and seamlessly integrate into all existing business processes and business applications. The key will be that they must accommodate multiple-vendor technological environments deployed in the enterprise and must be innovative enough to enhance internetworking beyond simple collaboration to a virtual work environment. If implemented intelligently, such solutions can dramatically improve business performance. For end users, the strategy delivers flexibility with an integrated business communications infrastructure that allows employees to respond more quickly.

The takeaway

No technology is worth implementing if there isn't a valuable takeaway. For unified communications, it's the convergence to a unified common platform for communications and collaboration. The convergence is seen as being a measurable metric for reducing capital expense (capex) by bringing together communications and collaboration services with business processes. Capabilities such as real-time presence awareness, web conferencing, voice, video, unified messaging, telephony and voicemail capabilities will be accessible to workers through a common, consistent and familiar experience. To be truly effective, solutions must span multiple convergence points, including bringing together multiple-vendor networks, leveraging IP telephony and fully supporting unified communications platforms.

Moreover, a converted framework of unified communications and collaboration must be comprehensive, yet flexible enough to adjust to users, existing computing and telephony investments, and core business processes beyond just capabilities and solutions. Effective solutions must be agile enough to adapt to user preferences by integrating into the environment within which users are most comfortable operating, or into the environment that's best suited for a given task. Solutions must span a continuum that includes environments

centered on documents, email, real time, applications and the web.

UC and carriers

The wireless telecommunications carrier's role in unified communications remains a bit murky, but Verizon and AT&T are sensing opportunity. The focus is on control and responsibility, along with ROI. Because unified communications will be married to Wi-Fi, there is a lot of posturing over who will control this segment of small-cell systems. Contributing to the uncertainty is that small cells and small networks come in various flavors. Some will be Wi-Fi only; others will combine Wi-Fi and licensed spectrum. Some may use only licensed spectrum. Most will be some combination of 3/4G, LTE and Wi-Fi.

Carriers like the control they have over their spectrum and abhor the fact that they cannot control Wi-Fi. Because Wi-Fi is the de facto data network within unified communications, carriers will come to the table, albeit begrudgingly. There is just too much money at stake, as evidenced by the commitment to Wi-Fi made by AT&T.

Conclusion

Soon, the Internet will be a network of things, not computers. Some may be virtual beyond our imagination. For that to be possible requires a single platform that can play host to whatever the mind can imagine and the technology can create. Today, it's unified communications — who knows what it will be tomorrow. Meanwhile, unified communications soon will deliver a single user experience across business applications and across communications and collaboration tools to allow a user to access the same interface whether it is to place a call through a softphone, send an IM, look up customer information in a business application, or collaborate on a complex project. ∎

WIRELESS HISTORY FOUNDATION

2013 Wireless Hall of Fame Dinner

2013 Honorees: Craig Farrill, Kris Rinne, George Schmitt, and Senator Mark Warner

The Fairmont San Jose

Tuesday, October 15, 2013
San Jose, California

Register now at

https://wirelesshistoryfoundation.ticketbud.com/2013-wireless-hall-of-fame-awards

product showcase — lightning protection and surge suppression
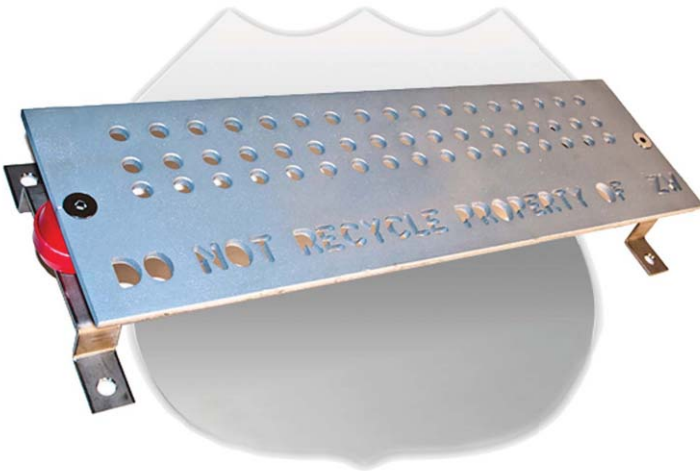
Equipotential Grounding Bars

The value of metals in today's market makes copper-based grounding bus bars regular targets for theft. The theft of such hardware generally means that the site must be brought down for repair, which directly translates into a company's bottom line. **Alltec's** series of TerraBar bus bars are designed to mitigate such theft in the electronics-based infrastructure. This series of busbars has engraved and cut messages to deter theft by identifying the busbars' owners, making them harder to turn over and identifying them as stolen property. Typically, messages can say, for example, "ABC Steel Bar – Do Not Recycle" or other specific messages and feature custom hole patterns. These bus bars have helped to significantly reduce and often eliminate break-ins and theft of critical equipment. Alltec can apply this custom program to the unique needs of energy, telecom, manufacturing, and many other installation's engineers, contractors and owners. **www.alltecglobal.com**

Low-PIM, DC-short Coaxial Protector

PolyPhaser's TUSX series consists of DC-short, ultra-low-PIM coaxial RF protectors and is engineered for high power of combined signals operating between 300 MHz and 1.4 GHz. Features include a maximum surge current of 40 kA, a 26 dB return loss, a DIN female protected side connector, a DIN male surge side connector, an insertion loss of less than 0.1 dB and an RF power capacity of 2.5 kilowatts for the combined signal. The protectors are weatherproof when installed.

www.protectiongroup.com

Varistor-based Lightning Arresters

The VAL-MS-T1/T2 lightning arresters from **Phoenix Contact** offer a higher level of surge protection in an affordable package. The arresters are rated for Type 1 lightning strike events with a measured 10/350 µs test current (I_{imp}) of 12.5 kA or Type 2 surge events with a measured 8/20 µs maximum discharge surge current (I_{max}) of 50 kA. The varistor-based Valvetrab T1/T2 provides maximum surge protection in an easy-to-use DIN rail-mount base. All arrester plugs, including the N-PE spark gap, are pluggable and have a thermal disconnect device triggering the visual and the integrated remote monitoring contacts, allowing continuous monitoring of the varistor's health. The lightning arresters can be used in DC applications such as FTTA/telecom, Wi-Fi networks, photovoltaic industries or AC single and multi-phase networks — even where significant voltage fluctuations are to be expected. A unique locking mechanism reliably keeps the connector in the base element, even when subjected to high lightning currents or vibration. The locking mechanism can be released with single-handed operation to perform isolation measurements or other checks.

www.phoenixcontact.com

product showcase — lightning protection and surge suppression

Surge Protective Device

The **Liebert** SS Series surge protection device uses SAD/MOV array technology for transient suppression voltages. The unit incorporates Liebert's interceptor technology for safety and performance coordination of all surge and fuse components. The device's modular design allows for flexibility and ease of servicing. The device also features 160-kA surge current capacity for increased reliability and real-time system monitoring. The series meets product performance and safety standards defined in the American National Standards Institute's ANSI/UL 1449 3rd Edition and the UL 1283 standard for electromagnetic interference filters. The product is cUL-listed. It meets standards Motorola published in 2005 in the book *Standards and Guidelines for Communication Sites*, also known as the Motorola R56 manual. Two different units are available, one for Type 1 hybrid surge protection that offers 20 kA of SAD protection and 160 kA of MOV protection, and one for Type 2 MOV-only surge protection that offers 160 kA of MOV protection. **www.liebert.com**

DC Pass Lightning Protection

The Times-Protect LP-GTR series of DC pass RF lightning and surge protection products from **Times Microwave Systems** has been further expanded for higher power-handling needs. With the addition of the LP-GTR-N-35 series, the entire product range with either the type N or 7/16 DIN interface will now handle 50 watts, 210 watts or 550 watts. Designed to pass direct current for applications requiring power to be supplied to the electronics, the LP-GTR series protects DAS and tower-mounted electronics. **www.timesmicrowave.com**

Lightning Surge Protection

Raycap has enhanced the performance of its flagship Strikesorb 40 surge protective device product line, which protects vulnerable electronic equipment against electrical damage caused by overvoltage events and lightning strikes. The maximum impulse current specification that the SPDs can withstand has been increased to 12.5 kA (10/350 µs) direct lightning, per the IEC 61643-1:2005 standard. All products in the Strikesorb 40 product series have been successfully tested and certified as Class I surge protective devices per the IEC 61643-1:2005 standard. **www.raycapsurgeprotection.com**

Remote Radio Head Lightning Protection

Raycap's IS product series, which protects the mobile networks using a distributed base station or remote radio head configurations, features the DC-based Strikesorb 30-V1-HV, which is a Class I surge protective device capable of withstanding multiple direct lightning strikes and operating safely in 48-volt DC systems, diverting the current to ground and away from sensitive equipment on the tower or in the base station. The unit features a lightweight, aerodynamic design that combines electrical protection with power and fiber-optic cable management for outdoor installation on rooftops or tower-tops. It is recognized to the UL 1449 3rd Edition safety standard. **www.raycapsurgeprotection.com**

Surge Protection Solution

Emerson Network Power offers the PowerSure CM series surge protective device to combat electric power line disturbances such as high-voltage transients that can disrupt or damage sensitive electronic equipment. The unit can be installed in any location within the AC power system. It is rated for UL Type 1 locations and is housed in a weather-resistant enclosure. Available in voltages from 120 volts to 480 volts, the device comes in single-phase and three-phase versions. An optional DIN rail-mounting bracket is available. Protection status includes LEDs and status relay contacts for remote indication. **www.emersonnetworkpower.com**

Surge-suppression Lighting

SPX offers the advanced Flash Technology Vanguard LED series of obstruction. Incorporating a new flashhead and control box and designed with surge suppression in mind, the unit exceeds the FAA's required 3 kA rating of surge protection by being built and tested to withstand surges up to 20 kA. The system is available in white or red formats and can be equipped with onboard Wi-Fi. It is also available to meet avian protection compliance regulations. **www.spx.com**

Broadband Lightning Protectors

Complementary to existing LTE lightning protectors that have been designed to serve partial LTE frequency bands only, **Huber+Suhner** has introduced three protectors that cover the LTE bandwidth of 698 MHz to 2690 MHz. Features include hybrid quarterwave gas-discharge tube technology, direct current continuity, band-pass filter technology and quarterwave shorting stub technology, return loss and high stability against lightning pulse incidents. All three connectors can be installed via bulkhead or with extra screws. The frequency range includes traditional cellular, public safety, WiMAX, WLAN, ISM and GPS bands.
www.hubersuhner.com

Gas-discharge arrestors

The SurgeGuard PTR T1 series from **Nextek Lightning** is based on a multiple gas-discharge tube design with serviceable replacement elements. The arrestors measure 119 millimeters x 45 millimeters. They have DIN 7/16 female to DIN 7/16 female connectors and can protect against a maximum of 100 kA of lightning energy. The T1 series products can be specified with a range of GDT voltages from 90 volts to 1,000 volts to accommodate various RF power levels. Additional features include RF performance, a typical low return loss of 1.20 and a typical insertion loss of 0.10. The SurgeGuard T1 series provides a 100x multiple-strike capability at 10 kA and more than 100 kA (8 x 20 μs) one-time surge capability.
www.nexteklightning.com

advertiser index

September 2013

101

agl

Previous Page | Contents | Zoom in | Zoom out | Front Cover | Search Issue | Next Page

Qmags
THE WORLD'S NEWSSTAND®

professional directory

Put the power of *AGL* to work for you with a professional card ad. Call Mercy Contreras at (303) 988-3515. *mcontreras@agl-mag.com*