



# Wavelength

A Public Safety Communications Journal

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# Digitally Sharing

Information management (IM) technologies abound today and it is the proactive organization that embraces these that are reaping the benefits as they relate directly to public safety communications. These tools offer up such things as the collection, coordination of information and resources and geo-spatial system planning. They are in and of themselves adaptable to incidents involving multijurisdictional or multidisciplinary responses. Cooperation across boundaries is especially desirable as we individually seek to accomplish more with less – IM allows us to optimize communication and coordination.

And this includes two-way communications within and without the organization – structured mechanisms for receiving and sending information. Standard categorizations are needed to route reports to the appropriate position inside or peripheral to the communications centre. Managers should be able to centrally receive and evaluate this event information and the system should help manage this information in real time and keep records of events as they unfold.

Learning from our peers about their use of existing and emerging technologies is one of the steps each organization should consider when making the decision to employ similar infrastructure. Another is thinking outside the box and looking to agencies for answers from resources that heretofore were not considered part of the group. In Australia they've looked underground – to the construction industry that is building tunnels beneath motor and waterways – and to those involved in mining – to learn more, and share information about, events that involve responses by each of the emergency services. In the new world of information management we cannot afford to let any stone go unturned as we seek to embrace the latest technologies to better our support of public safety.

*Ted Harris*  
*Editor-in-Chief*



## NAVIGATOR CONFERENCE

Our mission for the Navigator Conference is straightforward but challenging – to create an outstanding educational event relevant to all in police, fire, and medical communications centre staff. The conference offers three days of pre-conference workshops and five session tracks during the three-day conference itself. There are keynote speakers, a tightly focused exhibit hall, demonstrations, networking and peer-sharing opportunities, and fun events. Conference attendance last year in Las Vegas was 1,200. This year the conference is being held at the Baltimore Marriott Waterfront Hotel in Baltimore, Maryland April 23–25. For more information visit us at [www.navigatorconference.org](http://www.navigatorconference.org).



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Wavelength is published five times per year by Andrew John Publishing Inc. with offices at 115 King St. W, Dundas ON, Canada L9H 1V1. We welcome editorial submissions but cannot assume responsibility for commitment for unsolicited material. Any editorial materials, including photographs, that are accepted from an unsolicited contributor will become the property of Andrew John Publishing Inc.

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Publication Agreement Number 40025049 | ISSN 1709-2574

Return undeliverable Canadian addresses to:

**AJH ANDREW JOHN PUBLISHING INC.**

115 King St. W, Dundas ON, Canada L9H 1V1



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WIMAX interoperability and 802.16 standards have come a long way in their development and attempting to understand all of the applications and capabilities of WIMAX can be a daunting task for anyone without a core understanding of the technologies. This article is intended to provide a high-level overview of WIMAX technology; discuss the components necessary for ensuring an effective WIMAX solution; and explore the future applications for WIMAX and how the technology has matured to this point.

Time Division Multiplexing (TDM) circuits have been the backbone of communications over the past several decades. These circuits which provide reliable and low-delay services for voice, data, and video transport, are migrating towards Internet Protocol (IP)-based packet switched networks. This paper explores the architecture of a Gateway device such as Harris's NetXpress, which can facilitate a smooth transition for legacy TDM applications as the core network is migrating from TDM circuit switched to IP-based packet switched networks.



## Crayonnez-le à votre calendrier

### La conférence de l'exposition de BAPCO

Le 23 à 24 avril 2008

*Business Design Centre,  
Islington, Londres, Angleterre*

### Navigator Conference

Le 23 à 25 avril 2008

*Baltimore Marriott  
Waterfront Hotel, Baltimore,  
Maryland*

### World Conference on Disaster Management

Le 15 à 18 juin 2008

*Metro Toronto Convention  
Centre, Toronto, Canada*

### La conférence et l'exposition de l'APCO International

Le 3 à 7 août 2008

*Kansas City Convention  
Center  
Kansas City, Missouri*

## La conférence et l'exposition de l'APCO Canada et NENA Ontario

Le 15 à 19 novembre 2008

*Westin Hotel  
Ottawa, Ontario*

## Partage numérique

Les techniques de gestion de l'information sont nombreuses de nos jours. Une organisation proactive qui encourage les techniques de gestion de l'information récolte les avantages puisque ces techniques sont liées directement aux communications en sécurité publique. Elles permettent la collecte, la coordination de l'information et des ressources ainsi que la planification géospatiale du système. Elles peuvent être adaptées aux incidents comprenant des réponses multidisciplinaires ou concernant plusieurs zones juridictionnelles. La coopération entre les frontières est souhaitable puisque nous recherchons à accomplir plus avec moins. Les techniques de gestion de l'information nous permettent d'optimiser la communication et la coordination.

Il s'agit de communications bidirectionnelles internes et externes, c'est-à-dire des mécanismes structurés pour recevoir et diffuser de l'information. Des catégorisations standard sont nécessaires pour acheminer les rapports au poste approprié interne ou périphérique au centre des communications. Les gestionnaires devraient pouvoir recevoir et évaluer par un service central l'information, et le système devrait permettre la gestion de cette information en temps réel et sécuriser les données au fur et à mesure qu'elles sont reçues.

Lorsque la décision est prise d'utiliser la même infrastructure, les membres de chaque organisation devraient envisager que leurs homologues peuvent leur enseigner l'utilisation des technologies actuelles et naissantes. Un autre moyen serait de s'éloigner des sentiers battus et de chercher des agences qui ne sont pas considérées comme faisant partie du groupe. En Australie, ils ont vérifié sous terre – l'industrie de la construction des tunnels sous les autoroutes et les cours d'eau – l'industrie minière – pour parfaire leurs connaissances et partager l'information au sujet d'événements qui exigent une réponse de chacun des services d'urgence. Dans le domaine de la gestion de l'information, nous ne pouvons pas nous permettre de laisser dans l'ombre quoi que ce soit puisque nous cherchons à faire place aux dernières technologies pour mieux apporter notre concours à la sécurité publique.

*Ted Harris  
Éditeur en chef*



*It has been three months since I took over as the president of APCO Canada. I have chaired three very productive meetings so far and by the time you read this there will have been three more. The Board of Directors meets monthly by teleconference call and spends two to three hours working through the agenda.*

**A**lthough we only meet once a month by teleconference we are in constant e-mail contact dealing with issues as they are identified. Some of these can be handled immediately while others may take some time due to the need for research. In addition, depending on the issue, if a vote is required the issue is then added to the agenda for the next meeting.

In October last year, some of you were able to attend the APCO meeting. As you know, to vote on issues you have to be in attendance and not everyone is able to travel to our annual conferences, therefore you do not get a chance to participate. APCO Canada offers you a unique opportunity to attend the Annual General Meeting via conference call. We do this by hosting meeting locations around the country. By attending one of these meetings you get to vote on issues, network with other association members, and have the opportunity to make new or renew old friendships.

The spring Annual General Meeting date is Thursday May 15, at 11:00 hr EST, mark your calendars. Locations will be posted on the website and e-mail blasts should have already been sent.

By time you are reading this the Board of Directors will have met face to face in Ottawa and we will have toured the venue for the APCO/NENA 2008 Conference and met with the conference organizers. This year's theme is Partners in

Communications, read on in the magazine for more information. The conference committee has an exciting program and is working to involve all of our partners in public safety. Plan to attend and meet new organizations and see new products. In addition to meeting with the conference organizers, the Board of Directors will spend three days in meetings at which time we will also meet with the members of the Corporate Advisory Council. Our corporate members will have the opportunity to meet the conference organizers, voice any concerns, and bring forward new ideas. In addition to the volunteer conference organizers who make the decisions for a successful conference, APCO Canada has again hired the services of ConventionAll to put the plans into action.

We added two additional days to the agenda in Ottawa and will be reviewing and updating our current strategic plan. It needs to be understood that APCO Canada requires a long-term plan which will provide direction for the next few years. While we know we need this roadmap we know that it must be flexible enough in order to keep up with changes facing our industry.

I look forward to speaking with you are the Annual General Conference, May 15, 2008.

*Donna Anderson  
President, APCO  
Canada*



## Pencil It In

### BAPCO Annual Conference & Exhibition

April 23-24, 2008

*Business Design Centre,  
Islington, London, England*

### Navigator Conference

April 23-25, 2008

*Baltimore Marriott  
Waterfront Hotel, Baltimore,  
Maryland*

### World Conference on Disaster Management

June 15-18, 2008

*Metro Toronto Convention  
Centre  
Toronto, Canada*

### APCO International 2008

August 3-7, 2008

*Kansas City Convention  
Center  
Kansas City, Missouri*

## APCO Canada NENA Ontario 2008 Conference & Trade Show

November 15-19, 2008

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*Voilà près de trois mois que j'occupe la présidence de APCO Canada. J'ai présidé trois réunions très productives jusqu'à maintenant et lorsque vous lirez cet article, j'en aurai présidé trois autres. Le Conseil d'administration tient une téléconférence chaque mois et passe entre deux à trois heures à discuter des points à l'ordre du jour.*

**N**ous ne nous en tenons pas seulement à la téléconférence mensuelle, nous sommes en contact constant par courrier électronique, ce qui nous permet de résoudre les questions au fur et à mesure qu'elles surviennent. Nous pouvons trouver réponse à certaines de ces questions immédiatement, d'autres prendront plus de temps et de recherche. De plus, selon la question, s'il est nécessaire de passer au vote, on ajoute alors ce point à l'ordre du jour de la prochaine réunion.

En octobre dernier, certains d'entre vous ont eu la chance d'assister à la conférence APCO. Comme vous le savez sans doute, pour voter, vous devez être présent. Malheureusement, tous ne peuvent pas assister aux conférences annuelles et de cette façon, vous n'avez pas la chance de participer. APCO vous offre l'occasion unique d'assister à la réunion générale annuelle par conférence téléphonique à différents endroits au pays. En assistant à l'une de ces réunions, vous pouvez voter, faire du réseautage et avoir la chance de connaître de nouveaux membres ou de renouer avec d'anciennes connaissances.

La réunion générale annuelle du printemps est fixée au jeudi 15 mai à 11 heures (HNE). N'oubliez pas de prendre en note cette date. Les lieux de rencontre seront affichés sur le site web et des annonces électroniques ont dû déjà être envoyées.

Lorsque vous lirez cet article, le Conseil d'administration aura eu une rencontre à Ottawa et aura visité le lieu où aura lieu la Conférence APCO/NENA 2008 et aura rencontré les organisateurs. Le thème de la conférence cette année est Partenaires en communications.

Pour plus d'information, veuillez lire la revue. Le Comité a préparé un programme des plus intéressant et souhaite faire participer tous nos partenaires en sécurité publique. Ne manquez pas d'y assister et de rencontrer les membres d'autres organisations et d'apprécier les nouveaux produits. En plus de rencontrer les organisateurs de la conférence, le Conseil d'administration passera trois jours en réunion au cours de laquelle nous rencontrerons également les membres du Conseil consultatif. Nos membres corporatifs auront la chance de rencontrer les organisateurs de la conférence, d'exprimer leurs inquiétudes et d'exposer leurs nouvelles idées. En plus des organisateurs bénévoles qui contribuent largement au succès de la conférence, APCO Canada a retenu une fois de plus les services de ConventionAll.

Nous avons ajouté deux jours additionnels à l'agenda à Ottawa et nous passerons en revue notre plan stratégique actuel et le mettrons à jour. Nous devons comprendre que APCO Canada a besoin d'un plan à long terme qui lui fournira la direction pour les prochaines années. Bien que nous sachions que nous avons besoin de ce plan, nous constatons également que nous devons être assez flexibles pour composer avec les changements auxquels fait face notre industrie.

J'espère avoir la chance de vous rencontrer à notre Conférence générale annuelle du 15 mai 2008.

*Donna Anderson  
Présidente, APCO  
Canada*



*Members are invited to submit a **John A. Smith Bursary Award** request for the board's consideration.*

The John A. Smith Bursary shall be awarded annually to a qualifying individual who undertakes research into, or makes a significant contribution to, the activities, planning, operation, or function of public safety communications in Canada.

Submissions should be made in writing no later than August 31, 2008, to the president of APCO Canada at donna.anderson@apco.ca or to our Ottawa office mailing address: APCO CANADA, 440 Laurier Avenue West, Suite 200, Ottawa, ON K1R 7X6.



*Des membres sont invités à soumettre une demande de la bourse **John A. Smith** pour la considération du conseil.*

La bourse John A. Smith sera attribuée annuellement à un individu de qualification qui s'engage à la recherche de, ou qui fait une contribution significative à, les activités, la planification, l'opération, ou la fonction des communications de la sécurité publique au Canada.

Des soumissions devraient être faites par écrit pas après le 31 août, 2008, au président de l'APCO Canada à donna.anderson@apco.ca ou à notre adresse de bureau à Ottawa: APCO CANADA, 440 Rue Ouest Laurier, Suite 200, Ottawa, ON K1R 7X6.

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## PRESIDENTS COUNCIL REPORT

By Donna Anderson

*As I write this report in early January, I am preparing for our first Presidents Council and the Global Alliance meeting for 2008. This meeting will take place back in Australia during the APCO Australasia Conference and Exhibition February 17-20.*

Representatives from BAPCO, APCO International, APCO Australasia, and APCO Canada will continue talks in areas of mutual interest and concern. With more than 16,000 members around the world, the APCO network exists to serve the people who manage, operate, maintain, and supply the communications systems used to safeguard the lives and property of citizens everywhere. All emergency service agencies work on ways to improve on preparedness and effectiveness and, as such, it is important that these meetings continue to take place.

The work on the Alliance website is still in progress and, once complete, it will be a valuable resource to us all. One of the areas suggested is a database of speakers for conferences. This will help to ensure that we all have access to proven, recommended presenters for our conferences. By having a Global Alliance website, we'll all have access to information and issues that go well beyond our own borders.

As I reported from Australia, in my last article, we will be signing our Geographic Area Memorandum of Understanding document which has just been finalized. This is a further

step to increase membership in the global family of APCO Associations.

Our group continues to develop and move forward on issues that affect global public safety communications. We're making progress in a number of initiatives, and continuing to identify new areas where we can work together.

Won't it be fantastic when the day comes when no matter where you are in the world you can pick up a phone, dial the emergency number that you are familiar with, and become connected to the emergency service agency in the area that you are traveling? This is just one of the issues that we're still discussing.

I know this is a short article, but it is difficult to fill the space when there has not been a meeting since the last report was submitted. The next article that you read from will be a full report on the meetings from Australia and also the following one in England. I look forward to reporting on our progress at that time.

Remember, be proud that you belong to a family of associations who are progressive and looking after the needs of those in public safety communications and those needing our services.



**Check out our  
Website!**

**www.apco.ca**

par Donna Anderson

*Au moment d'écrire ce rapport au début de janvier, je me prépare à assister à notre première réunion du Comité des présidents de l'Alliance globale pour 2008. Cette réunion aura lieu en Australie durant la Conférence APCO Australasie du 17 au 20 février.*

**D**es représentants de BAPCO, APCO International, APCO Australasie, et APCO Canada continueront d'échanger sur des sujets d'intérêt mutuel. Avec plus de 16 000 membres à travers le monde, le réseau APCO est en place pour servir les personnes qui gèrent, opèrent, maintiennent et procurent des systèmes de communications utilisés pour protéger la vie et la propriété des citoyens. Toutes les agences de services d'urgence travaillent à améliorer la disponibilité opérationnelle et l'efficacité. Il est important que ces réunions continuent d'avoir lieu.

Le travail effectué sur le site web de l'Alliance est toujours en cours et une fois qu'il sera terminé constituera une ressource précieuse pour nous tous. Il a été suggéré d'ajouter une banque de noms de conférenciers, ce qui nous aidera à s'assurer d'avoir accès à des présenta-

teurs expérimentés pour nos conférences. Grâce au site web, nous aurons tous accès à l'information bien au-delà de nos propres frontières.

Comme je l'ai mentionné dans mon dernier article d'Australie, nous signerons bientôt notre Protocole d'entente des régions géographiques, lequel vient tout juste d'être finalisé. Il s'agit là d'une autre étape pour augmenter le nombre de nos membres dans le groupe d'associations APCO.

Notre groupe continue de répondre aux questions qui affectent les communications en sécurité publique. Nous faisons des progrès dans un certain nombre d'initiatives et continuons d'identifier d'autres domaines où nous pouvons travailler ensemble.

Ce sera tout à fait fantastique le jour où, peu importe où vous vous trou-

vez dans le monde, vous pourrez prendre le téléphone, composer le numéro d'urgence que vous connaissez et obtenir les services d'urgence dans la région où vous voyagez. C'est seulement un des sujets de nos discussions.

Je sais que mon article est court, mais il est difficile de rédiger quoi que ce soit lorsqu'il n'y a pas eu de réunion depuis que le dernier rapport a été soumis. Le prochain article que vous lirez comprendra un rapport complet des réunions tenues en Australie et en Angleterre. Je me ferai un plaisir de vous communiquer tous les détails.

N'oubliez surtout pas : soyez fier d'appartenir à une famille d'associations progressives et qui s'occupent de combler les besoins en communications en sécurité publique et des personnes qui nécessitent nos services.



**Visitez votre site web**  
**www.apco.ca**

# BUCK® KNIVES



889 SBMF  
Military Folding Knife

## Buck's New Military Knife with Battle-Proven Design

The new 889 SBMF military folding knife is the latest addition to the growing family of tactical models from Buck Knives. This rugged folder is based on the Strider knife issued to elite US military units.

With its battle-proven design by Strider Knives, the 889 has been tested in Iraq and Afghanistan. Engineered for hard use, it's loaded with features: an extra-thick, oversized blade; quad-hole TACCOM™ handle with finger grooves for sure grip; thumb and handle grip-ridges; and thumb-stud/hole for one-hand opening.

This versatile knife has a non-serrated 3-1/2 inch drop-point blade made of 420HC stainless steel and is black-oxide coated. The 4-5/8 inch glass-reinforced nylon handle comes in three battle-ready colors: black, olive drab, and coyote brown. Locked open, the 889 is 8-1/4 inches long and it weighs 4.9 oz.

The stainless steel belt clip has a non-reflective black-oxide coating, is reversible, and comes with extra screws. Buck's advanced Edge2x™ technology makes the blade sharper out of the box, keeps the blade sharp longer, and makes it easier to resharpen. The 889 is backed by Buck's respected 4-Ever Warranty and has an MSRP of \$84.



777 Lumina LED

## Buck's New Lumina LED Gives You Light Right Where You Need It

The new 777 Lumina LED from Buck Knives is one of those ideas that make you wonder why nobody thought of it before. This one-hand open/close liner-lock has an integral, programmed 5-mm LED light that provides great illumination right where you're cutting.

In all settings, the long-lasting light has automatic shut-off after five minutes to conserve the two 3-volt lithium batteries. The LED light itself is water resistant and has no moving parts, so it's not prone to breakage. Average lifetime is 100,000 hours, far more durable than flashlight bulbs, which wear out and break. There are four programmed functions: high beam, medium beam, low beam, and intermittent flash.

The light makes a great added feature to what is already a very solid knife. It has a partially serrated 3-inch drop-point blade, made of 420HC stainless steel. Finished with Buck's Edge2x™ technology, the blade is sharper out of the box, holds an edge longer, and is easier to resharpen.

The ergonomically shaped, molded nylon handle has large lanyard hole, and comes in three colors: red, blue, and smoke. Closed, the Lumina LED is 4-3/8 inches long, and it weighs 3.6 oz. Like all Buck Knives, it carries the century-old company's respected Lifetime Warranty. MSRP, \$60.

For more information about the 889, 777 or other Buck knives,  
call Buck Knives toll-free at 800-326-2825, or visit their web site, [www.buckknives.com](http://www.buckknives.com)

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### Buck Knives Contest

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King Street West, Suite 220, Dundas  
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Contest entries must be received no  
later than Friday, May 30, 2008  
and the winner will be announced in  
the next issue of Wavelength.

# Airport Taser Tragedy Highlights the Need to Bridge A Dangerous and Growing Language Divide

By Louis Provenzano, Language Line Services



*While the tragic taser incident at Vancouver International Airport in October was no doubt the result of a combination of unfortunate circumstances, one element of the situation seems clear: communication, or more precisely miscommunication, played a role.*

**D**istraught and unable to speak to airport staff in English, Robert Dziekanski's erratic actions were left to speak for him, with an ultimate and devastating effect. Today, the Vancouver Airport Authority has already introduced new tools to improve communication with people with limited English, including mobile access to translation services for airport patrons and guests, as well as new double handset telephones that connect to 24-hour customer care in more than 170 languages. With more than 176 languages spoken in North America, it is time for more public institutions, emergency services providers, and private businesses that want a wider audience to embrace language access programs to bridge a growing linguistic divide.

Providing translation and interpretation services in emergency situations must clearly be a priority. While the end results may not always be well-publicized, instances of miscommunication between limited English speakers and police, fire, rescue, and other first responders are all too frequent. To avoid future tragedy,

language services must be provided when emergencies occur. Just as importantly, those that work on the front lines, including police, fire, and medical emergency officials, must be trained to use the services that are available. Finally, the public needs to be educated and involved, so that individuals facing critical situations know how to access help in any language.



Some community-based emergency communications centres have already instituted programs to communicate in multiple languages with limited English speakers. They hire more bilingual staff, and turn to professional language interpretation services, which can provide immediate verbal translation via the telephone in hun-

dreds of languages. But when it comes to emergencies, when split-second decisions make all the difference, it is not enough just to have language access services on hand. What matters is that these services are understood, relied upon, and openly available to the public.

With language tools now readily available and identified, the Vancouver Airport is changing the way that communication will happen. In addition to access to language translation services, the airport is waging an effort to let passengers and guests know what options are available to them. Language identification cards will tell passengers in the 20 most requested languages that free interpretation services are available.

Customer service representatives will carry brochure versions of these cards to distribute to passengers.

In the city of Toronto, public education has become a key component of available language access programs, and this effort should serve as a model for others. In 2004, a Cantonese-speaking grandmother in Toronto faced a terrible emergency when her young granddaughter began to drown in a backyard pool. Because she believed that 9-1-1 would not speak her language, she did not call, but instead went to a neighbour's house for help. The result was devastating, and highlighted the need to let the public understand that Toronto's emergency communications system did in fact

have language interpretation services available. Toronto has pursued a comprehensive and successful public awareness campaign, developing multilingual posters with the message "9-1-1 = Emergency, Speak Your Language," and targeting limited English speaking residents in their own neighbourhoods.

Encouraging these individuals to call 9-1-1 when they have a true emergency is the first step, and public awareness plays a vital role. But what happens when a call does come in, and it is clear that the emergency in question involves someone who does not speak English? At this point in the scenario, preparation and training are paramount.

Emergency call centre dispatchers must be trained to identify the language of the person in distress. If the caller does not speak English, then the dispatchers can use a "key phrase" chart to identify the language in question; they can also use pre-

recorded phrases that can be provided by a telephone interpretation service. At this point, the dispatcher can turn to in-house bilingual staff or professional interpreters to communicate with the caller. If the emergency call is made by an English speaking caller, but involves someone who does not speak English, dispatchers must be trained to proceed accordingly. They must determine the language of the person in distress if possible, and should always alert first responders to the fact that interpretation services will be needed.

In an emergency or crisis situation, the importance of good communication can never be underestimated. As government officials, emergency experts and public personnel seek out ways to improve and solidify their communications processes; they should embrace language interpretation programs, and prioritize public awareness and professional training. Only then can we turn more potential tragedies into real success stories.

Louis Provenzano is president and COO of Language Line Services. Language Line Services helps organizations worldwide quickly and efficiently meet the needs of their community's growing numbers of limited English proficient residents ensuring service availability through critical events. The company delivers a dynamic suite of solutions, in more than 175 languages, including phone and video interpretation, document translation, interactive software-based translation, and interpreter training and certification programs. For more information about Language Line Services' suite of telephone and video interpreting services, document translation, and language testing and training programs, please call 1-877-886-3885 or visit [www.language.com](http://www.language.com).

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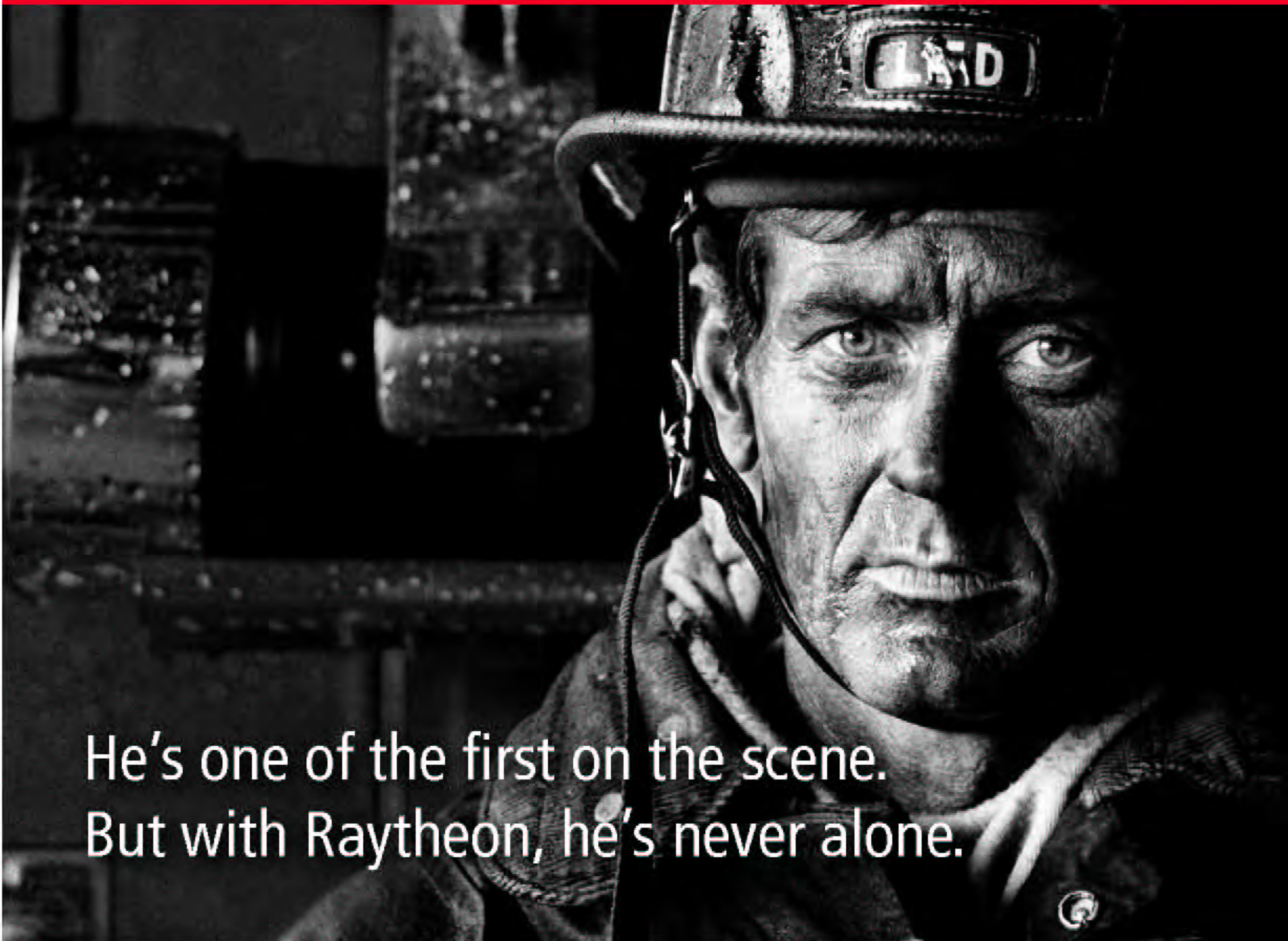
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# The Digital Wave Hits the Mining Industry

*The digital age has made an impact on the mining industry with Australia's first scalable ASTRO 25 digital radio network installed at Newmont's Boddington Gold mine, 130 km Southeast of Perth. Computer Sciences Corporation (CSC) and Motorola combined their expertise to develop the digital migration of the analog radio system that enables critical communication delivery across the mines and operation centres.*

**W**hat's significantly different about a digital system over analogue is the quality of the audio," says CSC principal communications consultant, Murray Wales. "Analog radio systems will start to get scratchy and break up in bad coverage areas or as the signal nears the maximum range. New digital systems maintain signal strength right up to maximum range. The new technology also caters for possible corruption of the signal with an advanced error correction system. No more 'repeat that last message' frustration."

All mines use radio systems to manage operations on and around their sites; coordination and safety are critical to the smooth operation and maintenance of plant equipment. So when Stuart Hedges, manager for Boddington Information Systems contracted CSC to manage the design and implementation of the new IT system, the upgrade of their mine radio system, with two sites and 300 users, was at the top of his list.

"A good radio system is paramount to the safe and efficient operation of the mine site," says Stuart. "The radio system needed to be one of the first systems up and running to provide reliable site-wide comms for the critical, and already underway, construction and pre-stripping phases and be capable of supporting the mine operations for the duration of its life."

Once Boddington and CSC had nailed down business and technical requirements, the CSC engineers



*Memorial sculpture near entrance to the Great Ocean Road in Australia.*

developed the detailed system design and sought the best-fit technology. Requirements central to the solution were flexibility and durability of the technology.

With an expected life cycle of at least 17 years, the Boddington radio system had to be proven, scalable and provide system longevity. Soon to become an open cut mine, coverage would be required to a depth of 620 meters, and cover the mining belt approximately 34 km long, and 10 km wide. As the mine expands, so does the coverage.

Multi-channels would be required to cover the various phases of both the construction and operation, and transparent roaming capabilities between areas of coverage (e.g., mine to village), without the need to change channel on the mobile or portable.

In a coordinated effort, CSC installed

towers, communications rooms, site interconnects, cabling, UPS and LAN on site, whilst another company built and commissioned the digital radio system in its customer system staging facility. "The radio system arrived fully assembled and tested in temporary transport racks and it was a simple process to transfer, unit by unit, into the pre-installed racks," recalls Murray. "The process went without a hitch. The system was powered on and final on-site commissioning was completed in just a few days."

A full site survey followed to test that every operational site location had full signal strength and audio clarity. With the digital radios programmed to receive both analogue and digital networks, the upgrade migration was easily managed.

*Reprinted with permission from APCO Australasia Public Safety Bulletin, Vol 5, Oct 2007.*



## UK recruits hit the road



Britain is seen as an ideal market in which to recruit paramedics because the training and clinical skills match the Australian standard and cultural practices are similar between the two countries.

By Nicola Mitchell

The streets of Britain may seem a long way away from Queensland but for 53 paramedics, distance was no object.

They jumped at the chance to move to the Sunshine State and take up positions with the Queensland Ambulance Service (QAS) at various locations.

The QAS Commissioner Jim Higgins and senior executives decided in early 2006 to pursue a targeted recruitment campaign in the UK.

Britain is the ideal market because the training and clinical skills for paramedics are similar and because of the cultural similarities with Australia.

The first five 'Seachange' recruits have gone through the induction process and began working on-road in April.

The remainder will arrive between now and December.

The induction process covered everything from electronic timesheets to drug use and storage.

Since the paramedic recruits are making substantial changes in their personal and work environments, each

will be assigned a volunteer 'buddy' to help make the transition as smooth as possible.

Their buddies will provide them with advice about things like housing, schools and sporting and family interests.

Two of the new recruits and their buddies took time out to talk to Emergency about how it's all going so far.

Nicky Smith said it was an easy decision to move from Hertfordshire to the Brisbane bayside suburb of Wynnum.

"My partner and I have been to Australia three times previously. The lifestyle attracted us – the ability to go to the beach and be involved in outdoor activities that aren't tainted by the weather," she said.

"It's been very nice so far, I've been very busy since I've been over here. We're having a house built.

"It's obviously different to working on-road here than in the UK. They're not great differences, but over here there are a number of hospitals whereas in the UK

there is usually just one general hospital for an area.

"Also some of the equipment is different. Some working practices are different, as well as some drug therapies. Obviously things like snakebites are also different. We don't get many of those in the UK! There's no stingers either."

Nicky said her buddy Neil Hayes had been a great support.

"He's been helping with loads really, just generally familiarising me with the QAS and general stuff like getting my driver's license, looking at tax, housing and cars, all that kind of thing.

"It's been really good, a great help. Just all sorts of bits and pieces and making me feel welcome."

Neil said he had actually met Nicky before she made the move.

"Now we're a crew together! I've just been helping with general day-to-day stuff, getting her used to different protocols, procedures and equipment," Neil said. >>

"I came over from the UK myself nearly two years ago. I wanted to be a buddy because I know what it's like to be in a new country.

"I'd definitely encourage other people to be a buddy as well if they get the chance."

When Andy Campbell got engaged to a Toowoomba girl, it was obvious what he needed to do.

"I first came to Australia four years ago and travelled around. I was quite glad to meet an Australian girl in Scotland who is now my fiancée. She's from Toowoomba, so it's worked out perfectly for me to come over."

The paramedic of eight years is now working at the Toowoomba Station.

"I wanted to move to Australia for the whole lifestyle. It's a better climate, hot and mostly dry, nice people, a whole different style of living. Back home people spend most of their time in the pub while here it's more barbeques.

"The job is pretty much the same – a sick person is a sick person, you treat them both the same way.

"The vehicles are different and so are a few of the protocols but that's about it.

"Clinically the only difference really is that over here we're treating heat-stroke and snakebites, which you don't get in the UK."

Andy said his buddy Peter Scullet-Dean had been helpful.

"He showed me the station and what is happening. It's nice to have someone to ask advice and not sound like an idiot!" he said.



A group of the UK recruits were introduced some of Australia's less friendly inhabitants – namely crocodiles, spiders and snakes – during a familiarisation session in the Kedron auditorium recently.

Peter works in the education section. "I'm basically a point of contact for him. We catch up every now and then. I helped him when he got here so he knew he wasn't going to be left on his own," Peter said.

"We went out and had dinner when he first arrived and just basically had a chat as to what the service is like. I showed him around the station.

"I think it's important for anyone who's coming in from another country to have a point of contact to help them out because it would be daunting not knowing anyone. I just put my hand up. At the same time, I didn't want to be in his back pocket."

It's hoped a further 50 paramedics will move from the UK to Queensland next year. ■

**"I think it's important for anyone who's coming in from another country to have a point of contact to help them out."**

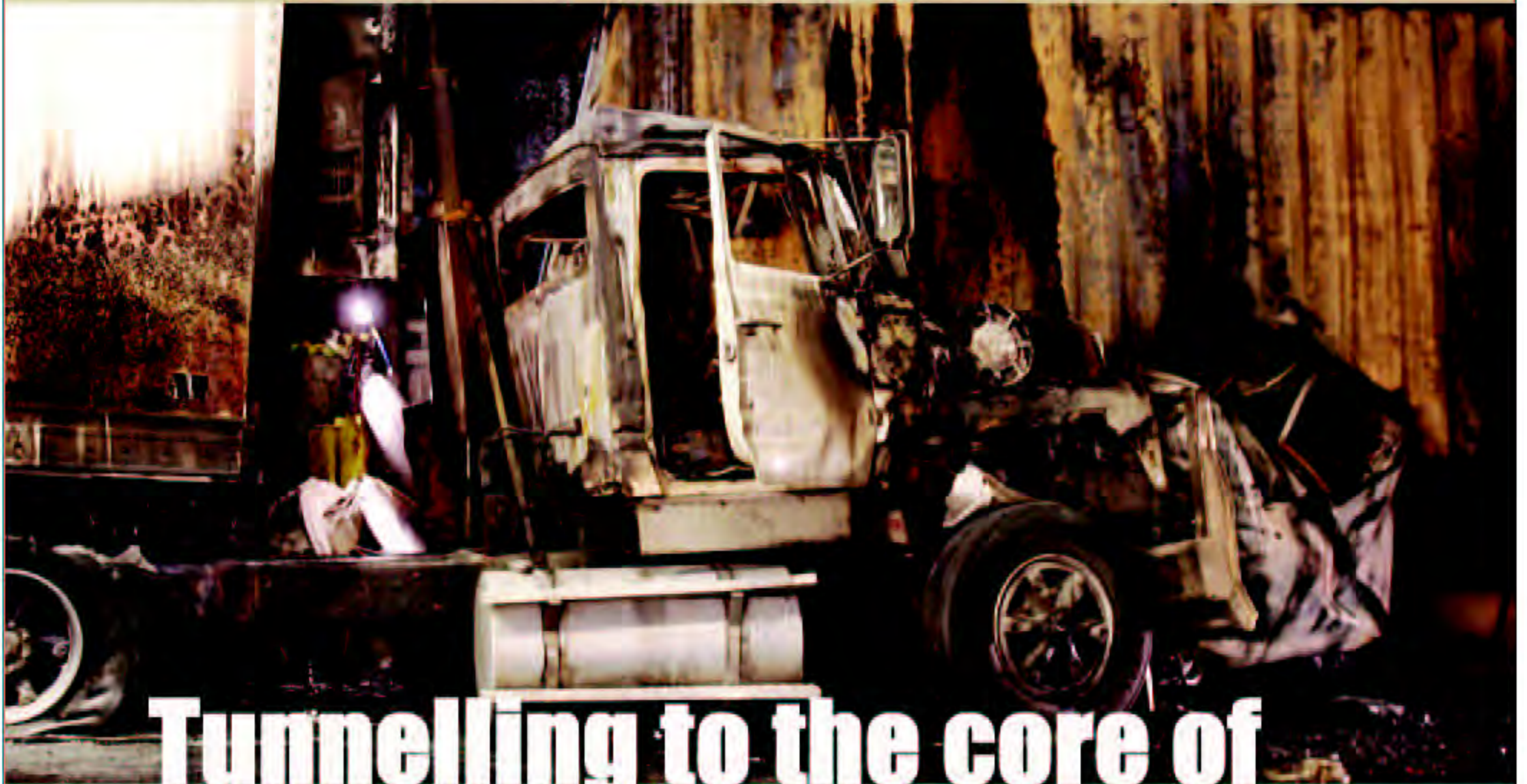


UK paramedic Andy Campbell, who is currently stationed in Toowoomba, said he wanted to move to Australia for "the whole lifestyle".



UK recruit Nicky Smith with her buddy Neil Hayes, who has helped her with everything from getting an Australian drivers licence to organising her housing and tax.

The burnt-out wreckage of a car hangs off the front of a semi trailer inside the Burnley Tunnel in Melbourne, following a multiple vehicle crash which killed three people and paralysed the city's busiest underground roadway. Photo courtesy of AAP.



## Tunnelling to the core of underground safety

By Andrew Berkman

The Romans may have perfected tunnels, aqueducts and catacombs but underground fire safety is still a modern science.

Tunnel fire safety in particular has become a priority for a small group of QFRS officers. It comes as massive machinery is currently working its way under inner-Brisbane as part of the North-South Bypass Tunnel project.

On top of that 5km project there are also plans for a longer tunnel to the Brisbane airport.

"The tunnels that we will have in Brisbane will have particular features which we've requested," said FireCom Brisbane Manager Lindsay Hackett.

"We believe we will have one of the safest tunnel systems in Australia."

Lindsay, Greg Reynolds, Steve McKee, Graham Hanlon and Steve McAlorum have been working with the Brisbane City Council since the plans for the network of tunnels was formalised in 2004.

Tunnel safety, and work being undertaken by QFRS, was highlighted by a tragic accident and fire in Melbourne's Burnley tunnel, which runs under the Yarra River and inner-city southern suburbs of Melbourne, on March 23.

That same day, Lindsay was on his way to a meeting regarding Brisbane's North-South bypass tunnel when news of the Burnley tunnel incident started to filter through.

The collision between several vehicles led to the death of three commuters and the outcomes of investigations and de-briefs will be monitored closely by those involved with the Brisbane tunnels.

"Up until now, we've been taking all our information from incidents overseas where tunnel safety is not as high as it is in Australia," Lindsay said.

"As tragic as the accident in Melbourne was, we now have a physical guide on what happened in Australia.

"All our plans and new safety initiatives are based on fire engineered modelling and what we believe will happen in the event of an incident within the tunnel.

"To assist us in our approval of the tunnel's fire safety features, we now have the opportunity to see how the Melbourne incident unfolded and was dealt with.

"Areas that we will be investigating will include the tunnel traffic response plans, how well their fire safety installations worked, the success of their response plans for emergency

services and how all of these interacted."

QFRS has been involved in tunnel safety for several years and in a major way since the Brisbane City Council tunnels were put to tender in 2005. "

**"All our plans and new safety initiatives are based on fire engineered modelling and what we believe will happen in the event of an incident within the tunnel."**

"We had discussions with the Brisbane City Council into what fire safety features QFRS would require to control a variety of incidents with the tunnel before it was put to tender," said Lindsay.

"Then we met with the two main tenders (BrisConnections and RiverCity Motorway) to review their plans before a decision was made by the Brisbane City Council."

QFRS has since been meeting with the successful tender, RiverCity Motorway, on a regular basis to ensure the safety systems are being incorporated within the tunnel design to provide maximum advantage to the tunnel's occupants including responding crews.

Some of these safety systems include:

A deluge system that the tunnel operators can initially activate to provide fast intervention to fire.

"There has been some discussions about the merits of foam versus water in the deluge system.

"The challenge is that we have to be able to respond immediately without knowing the type of fire we're attacking and water is seen as the best solution," Lindsay said.

Hydrants, hose reels, extinguishers, motorist help phones and warden indicator phones at various intervals.

There is also a radio re-broadcast mechanism within the tunnel that can cut into normal broadcast radio.

Cameras which can pan around and zoom to focus on a particular incident to provide responding emergency crews with accurate information.

"We're looking at possibly beaming that facility into the FireCom in Brisbane to further help us respond with the correct resources," Lindsay said.

Emergency response via the parallel non-incident tunnel and through cross passages which are located every 120 metres.

Evacuation by moving people moving from incident to non-incident tube.

Longitudinal fans to blow the smoke along the tunnel to prevent backlayering.

Smoke extraction via an overhead smoke duct with extraction points at approximately 60m centres.

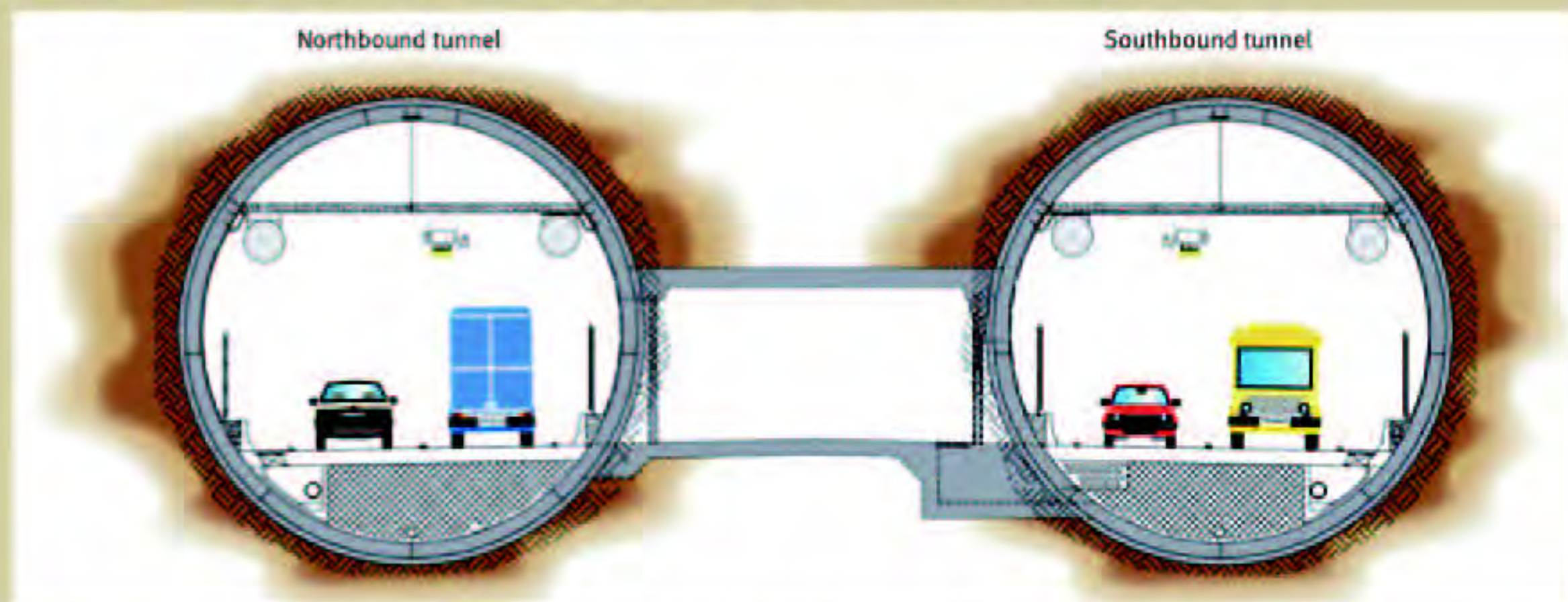
Storage and water facilities capable of handling the deluge system.

"There are also flame traps on the drainage system to prevent an explosion of fuel and water mix," Lindsay said.

QFRS will also be analysing and modifying response plans and training requirements prior to the tunnels open.

**"The challenge is that we have to be able to respond immediately without knowing the type of fire we're attacking and water is seen as the best solution."**

## Protecting tunnel builders



A cross-sectional drawing of the North-South Bypass Tunnel depicting safety features such as longitudinal jet fans, interconnecting cross passages and smoke ducting.

While tunnel safety will be the major focus once commuters start travelling beneath the city, QFRS has already been working with contractors to ensure the safety of crews building the tunnels.

The North-South Bypass Tunnel will be excavated using two massive tunnel boring machines.

Each machine expected to carry 5,000 litres of diesel (as a back-up power source)

and 10,000 litres of hydraulic oil.

"The machine, which measures in excess of two hundred metres in length, has its own inbuilt fire suppression system," said FireCom Manager Lindsay Hackett.

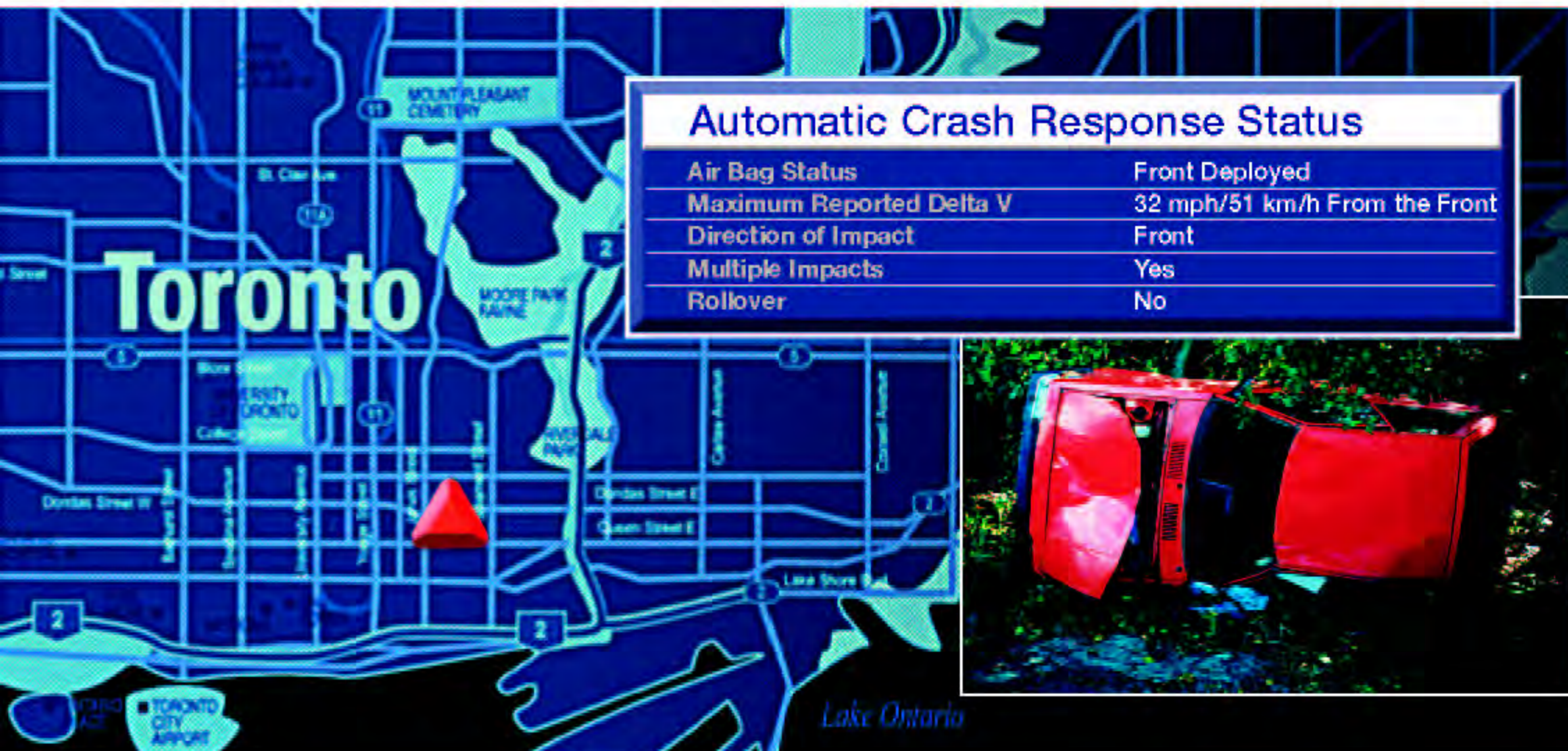
"However because of the distances crews may be required to cover on foot to reach an incident – almost three kilometres in the worst case scenario –

we were concerned that our breathing apparatus wouldn't survive that long.

"The Safety Equipment unit has been analysing these concerns and is investigating the potential for 'fast-fill' points along the tunnel.

"This will allow crews to top up their breathing apparatus cylinders to ensure they can get in and out of the incident safely."

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Automatic Crash Response Status	
Air Bag Status	Front Deployed
Maximum Reported Delta V	32 mph/51 km/h From the Front
Direction of Impact	Front
Multiple Impacts	Yes
Rollover	No

If someone's involved in a collision, **Automatic Crash Response\*** can forward critical details to OnStar Advisors, who immediately contact first responders. Details like direction of impact, which air bags deployed, and whether the vehicle rolled over help predict the severity of injuries to help you dispatch the right resources up front. It can also help you determine the medical facility best suited to treat injured passengers, because every second counts. Automatic Crash Response is available on most 2008 GM® vehicles. To learn more about this service and others that OnStar provides, visit us at [onstar.ca](http://onstar.ca) or e-mail us at [emergencyservices@onstar.com](mailto:emergencyservices@onstar.com).



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# INDUSTRY NEWS

## PANASONIC CANADA INC. RELEASES NEW "7 SERIES" OF BUSINESS-RUGGED NOTEBOOKS READY FOR ANY CHALLENGE FACING MOBILE PROFESSIONALS

**Mississauga, ON – January 17, 2008** – Panasonic Canada today introduced three new business-rugged Toughbook notebooks designed to meet the demands of mobile professionals: the ultra-portable W7; and the light-weight Y7.

Business-rugged notebooks from Panasonic address a growing market need for PCs that are up to the challenges of mobility. A 2007 Harris Interactive poll, sponsored by Panasonic, found that 42% of adult notebook users reported some form of mishap with their laptop, including knocking it against a hard surface (26%), dropping it (21%) or spilling something on it (15%). These findings are in line with research conducted in 2005 by IDC, which showed that dropping while carrying was the number one cause of accidental notebook damage. Liquid spills and falls from a table or desk rounded out the top three mishaps leading to accidental damage.

The new business-rugged Toughbook notebooks are also more durable than any other notebook. They are drop-tested using both the MIL-STD-810F methodology common to rugged notebooks as well as additional Panasonic factory drop tests. Commonly misunderstood, mil-spec testing does not prescribe a specific drop height. Rather, it outlines a method by which units are dropped a total of 26 times, on every axis, onto plywood over steel over concrete. Fully-rugged Panasonic Toughbook notebooks are mil-spec rated to 36" (for both the unit and the hard drive), while the 7 series business-rugged Toughbook notebooks are mil-spec rated to 12" for the unit itself and 30" for the shock-mounted hard drive. An additional Panasonic drop-test requires that 7 series notebooks survive a 30" (just over the typical height of a desk or table) drop to the base of the unit while it is operating.

The unique Panasonic spill-through keyboard design protects against liquid spills of more than 6 ounces (200 cc), and both the lid and base of the notebooks are designed to withstand more than 220 lbs (100 kg) of pressure. In addition, Toughbook notebook hinges are required to pass 50,000 cycles and keyboards are tested to withstand 25 million keystrokes. Panasonic's commitment to quality—at both the component and finished goods level—results in a total of more than 500 checks and tests before, during and after production.

**For more information contact: [www.panasonic.ca](http://www.panasonic.ca). or Trell Huether, Marshall Fenn Communications 416-962-3366 ext. 233, [trellh@marshall-fenn.com](mailto:trellh@marshall-fenn.com)**

## DANIELS ELECTRONICS ANNOUNCEMENTS MANAGEMENT CHANGES

**Victoria, B.C. Canada – January 2, 2008** – The Board of Directors at Daniels Electronics Ltd., a supplier of high reliability Land Mobile Radio (LMR) radio equipment, today announced the promotion of Gerry Wight to the position of Vice President of Sales and Marketing and the promotion of Douglas Bigrigg to Canadian National Sales Representative effective immediately.



Gerry Wight, who has been the director of marketing, will be taking on the additional role of running the worldwide sales operation in his new role as the Vice President of Sales and Marketing.

Gerry will be responsible for the direction, planning and execution of the company's marketing programs, oversee product/service development, product positioning and pricing. He will also assume responsibility for leading the sales force, and our sales channel partners.



Concurrently, Douglas Bigrigg has been appointed to the position of Canadian national sales representative. Doug will be responsible for the planning and implementation of programs to

increase domestic revenues and profits by expanding business with existing customer bases and by developing business with new customers.

"On behalf of the Management team I want to extend my congratulations to both," said Robert Small, president and COO. "Doug is returning to his true passion involving direct involvement with customers and Gerry will continue to support and enhance company activities through key operational and strategic planning initiatives".

[www.danelec.com](http://www.danelec.com)

## MIDLAND RADIO CORP.'S REPLACEMENT BASE TECH III BASE STATION/REPEATER READY TO SHIP IN 36 HOURS AFTER LIGHTNING STRIKE DESTROYS UNITED STATES FOREST SERVICE COMMUNICATIONS BUILDING

**KANSAS CITY, MO** – No one anticipated the lightning strike that burnt the United States Forest Service (USFS) communications building to the ground in Arkansas. "With everything in the building destroyed, getting communications restored as rapidly as possible was a priority," said Claude Gilleland, USFS east service area manager. He contacted Midland Radio Corp. Sales Manager Clyde Keith and he had a P25 Base Tech III fixed base station/repeater built and available for shipment within 36 hours.

The Arkansas Forest Service facility is a work centre for employees and also storage for some tools. Gilleland, located in Gainesville, Georgia, said that once the new station was delivered, it was checked out and then installed in a different facility that wasn't hit by the lightning, about 30 feet from the tower. The replacement base station was an upgrade from the Base Tech II, because the USFS is now mandated to buy only APCO 25-compliant digital equipment. "We can't purchase analog-only equipment if we want to talk with other agencies. For us, it's a requirement," said Gilleland.

"We recognize that response time is critical for the public safety and government agencies we partner with so, with our extensive inventory, Midland Radio is in-stock and ready to ship to meet their needs. And, we feel our customers deserve reasonably priced communications with the best guarantee in the industry – a 5-year warranty on all base stations and repeaters," said Scott Henderson, vice president LMR sales, Midland Radio Corp.

The Base Tech III base station/repeater and other quality products are only available from an authorized Midland LMR dealer. For more information, visit our website at:

[www.midlandradio.com](http://www.midlandradio.com)



## ALUMA TOWER COMPANY, INC. TO EXHIBIT AT WEST 2008

**Vero Beach, FL** – Aluma Tower Company, Inc. will be exhibiting at the largest state-of-the-art defense and technology exposition and conference on the West Coast at the San Diego Convention Centre, February 5–7. The Western Conference and Exposition – West 2008 – co-sponsored by AFCEA and the U.S. Naval Institute, will feature exhibits from more than 400 technology leaders and discussions by leading military experts.

Aluma Tower Company, Inc., is the leading manufacturer of lightweight aluminum crank-up towers available up to 100' combined with trailers and optional shelters to provide mobile units. Insulated shelters are available up to 8' x 12' with optional accessories, i.e., A/C units, electric winch, generators, etc.

[www.alumatower.com](http://www.alumatower.com)



## ERROR VECTOR MAGNITUDE (EVM) TEST CAPABILITY ADDED TO GENERAL DYNAMICS COMMUNICATIONS SYSTEMS ANALYZERS

**General Dynamics** is pleased to announce the availability of Error Vector Magnitude (EVM) test capability with its R2670 and R2625 communications system analyzers.

The new EVM application provides a constellation diagram that gives a clear, visual picture of how close the measured signal aligns with an ideal reference. It works with C4FM, CQPSK, and LSM modulation types, and includes a user-definable tolerance setting which allows the operator to quickly visualize the performance of the transmitter under test.

The software also generates a histogram distribution of the EVM metrics, providing another form of visual analysis of the transmitter's performance over time.

The EVM package includes the EVM software which operates on a host PC, a PC-to-analyzer cable, a USB to serial adapter and a user's manual. The entire package sells for \$950 and can be used with any General Dynamics R2625C model analyzer or General Dynamics R2670B model analyzer equipped with the CM801 enhanced digital hardware module.

[www.generaldynamics.com](http://www.generaldynamics.com)

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## 2008 PSAPS' FINEST AWARDS

By CJ Elias-West, NICE Systems Inc.

**February 4, 2008** – NICE is pleased to announce that nominations are now open for the 2008 PSAPs' Finest Awards. Now in its third year, NICE's PSAPs' Finest Awards Program recognizes individuals in 9-1-1 PSAPs (Public Safety Answering Points) for their outstanding contributions to the field of public safety communications. Awards are presented each year to winners in four categories: Telecommunicator, Line Supervisor, Technician, and Communications Center Director of the Year.

NICE first launched the PSAPs' Finest Annual Award Program in 2006 in conjunction with National Public Safety Telecommunicators Week. Winners of this prestigious award are selected based on their exemplary and specific achievements, depth of knowledge, innovative thinking, involvement and years of service to public safety, and other key criteria.

"Public safety communications professionals play a critical role in the lives of every citizen," said Chris Wooten, president of NICE's Public Safety Global Business Unit. "Individuals who work in PSAP environments are on the front lines when it comes to promoting the safety and security of the public. This program ensures their efforts don't go unrecognized."

Nominations for the 2008 PSAPs' Finest Awards can be submitted online at [www.nice.com/psapawards](http://www.nice.com/psapawards) through June 1, 2008. Winners will be announced at the NICE Systems' Public Safety Summit which will take place at the 74th Annual APCO Conference and Expo in early August 2008 in Kansas City (MO).

For more information on the 2008 PSAPs' Finest Awards, email [Welcome@NICE.com](mailto:Welcome@NICE.com). Submit a nomination online by visiting: [www.nice.com/psapawards](http://www.nice.com/psapawards).

## AEROFLEX RELEASES NEW RF SPECTRUM ANALYZER OPTION AND P25 CAPABILITIES FOR THE 3500 HAND-HELD RADIO TEST SET

**WICHITA, KS – February 14, 2008** – Aeroflex today announced the release of a new RF spectrum analyzer option for the 3500 hand-held 1 GHz Radio Test Set. The new spectrum analyzer option now allows users to see the signals they are receiving. In addition, the 3500 will have P25 parametric test capabilities by summer 2008, making it even more versatile.

Using an advanced Fast Fourier Transform (FFT) algorithm, the 3500 spectrum analyzer option provides an almost instantaneous display of the RF frequency spectrum. The 3500 has the ability to measure signal levels down to -136 dBm, providing advanced signal analysis in a lightweight platform, weighing less than 8.5 lbs. Operation of the 3500 spectrum analyzer includes span ranges of 10 kHz to 5 MHz and an effective resolution bandwidth as small as 19 Hz. Marker functions are available for the user to measure power in a specified bandwidth.

### The first truly rugged, portable radio test set

Based on a rugged design that has been approved by the U. S. military, the 3500 offers a wide range of RF test and analysis tools. Features such as broadband power meter, frequency meter, deviation and modulation Index, SINAD and distortion measurements set the 3500 apart from other portable RF test equipment.

### Project 25 tests enhance the 3500's value

Aeroflex will equip the 3500 with P25 parametric tests, with initial availability in summer 2008.

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# Managing Learning

By Michael Francis King

*As most managers know, continuing education forms the backbone of keeping current with the rapidly changing environmental needs of a modern public safety communications operation. In keeping with this reality, in early 2007, the senior management of the Emergency Health Services Branch of the Ontario Ministry of Health and Long-Term Care committed to providing opportunities for ongoing job related learning and career development for the Central Ambulance Communication Centre (CACC) management group.*

**T**o meet this objective a Management Learning Committee was created to research, source and roll out relevant educational sessions.

For the fiscal year 2007/08 (to March 31), a training/information session was planned for each quarter. During the first three quarters, two sessions were provided in person and one session was held via teleconference. The last session of the first cycle will occur by the end of the fiscal year.

In order to gauge which educational topics would be of greatest interest and need to the management group, a survey was completed to seek input from CACC management on pre-set topics as well as other subject matter that they believed would be helpful. The resulting information was used to design a program and set priorities from an educational perspective for the fiscal year.

Sessions have been held on the following topics:

- Labour Relations, Leadership and Communications
- Collective Agreements Review
- Financial Planning and Management

The March session will focus on the subject of business continuity.

Attendance at the learning sessions by managers is voluntary, however, participation in the sessions is

at almost 100% and feedback from attendees has been very positive.

While the initial sessions have been focused on the management employees in the 11 ministry operated CACCs, it is planned that in the future learning sessions will include all CACC/ACS management staff from across the province.

In addition to the formal quarterly learning sessions, CACC managers also receive e-mails from time to time from the Management Learning Committee with information on a topic of immediate interest or relevance.

The Emergency Health Services Branch values its management team and as such is committed to working with each and every manager to provide ongoing education. Keeping in mind that managers are an important asset and a key part of our organization, we believe in investing in their education by developing this continuing education program for our communication centre leaders.

*Michael F. King, freelance writer and emergency medical services consultant compiled this article with the assistance of Ms. Holly Cooper, coordinator of field services with the Emergency Health Services Branch of the Ontario Ministry of Health and Long-Term Care*

# Understanding RoIP

By Catalyst Communications Technologies

*What's the difference between Radio over IP (RoIP) and Voice over IP (VoIP)?*

**F**irst, it's important to remember that "over Internet Protocol" (over IP) does not mean "over the Internet."

While both these applications can occur over the Internet, they can also operate using the transport protocols designed for the Internet (TCP/IP, UDP, etc.) on private, wide area, or local area networks.

Voice over IP (VoIP) is a term commonly referred to for telephony applications. Today, when you call someone on the phone, you create a "circuit" between yourself and your called party and you can think of this circuit as "dedicated" to you for the duration of the call. The industry calls this a "circuit-switched" connection. It may make more sense to take these telephone calls and make them into data packets – like e-mail – and send them over a shared, packet-based network. The industry, manufacturers, and service providers that are trying to introduce this technology call this application Voice over IP. By using packets, you can also have applications in VoIP like telephone calls to personal computers, since PCs understand packets.

Radio over IP (RoIP) is similar except that instead of being voice communications between two telephones or other devices behaving like telephones, the communication is between a land mobile radio and one of these devices (PC, telephone,

handheld PDA, etc.). When thinking about RoIP and VoIP it's convenient to recognize that both need audio back and forth between the parties and they both need control of the conversation. The audio that occurs in RoIP and VoIP is the same. Both applications take analogue audio – your voice – and translate it into packets, and can also sometimes compress this information to save bandwidth. The technology that performs this function is coder-decoder (CODEC).

The major difference between RoIP and VoIP relate to control. In VoIP telephony, control includes things like dial tones, DTMF (tones used for dialing numbers), and other activities relating to controlling the call. These are standardized, which is why a phone made by Nokia can operate over a network controlled by Siemens switches.

In RoIP, control includes things like push-to-talk (PPT), changing channels, turning scan on and off, and other things you want to do to key up and control the radio.

These are not standardized although some tones for common activities like PPT are common among different radio manufacturers. But the serial digital control of some radios is proprietary and not standardized. Industry standards efforts including APCO 25 and TETRA are trying to standardize these functions.

# US DOT Announces Partnerships for Next Generation 9-1-1 Initiative – Proof of Concept

By Michael F. King

*Progress continues in the US DOT Next Generation 9-1-1 Initiative. We are pleased to announce the selection of PSAPs to participate in the Proof of Concept (POC) portion of the project. The selected PSAPs are:*

- City of Rochester – Emergency Communications Department, Rochester, NY
- King County E-911 System, Seattle, WA
- Metropolitan Emergency Services Board – Ramsey Co. Emergency Communications Center, St. Paul, MN
- State of Montana – Public Safety Services Bureau, Helena, MT
- State of Indiana - Office of State Treasurer, Indiana Wireless 911 Board

These PSAPs were selected from over 50 applicants, using objective criteria developed by the NG9-1-1 team. While the field included many impressive applicants, resulting in a very close competition, the NG9-1-1 Initiative is limited by funding and schedule, requiring the decision to limit participation. The US DOT sincerely acknowledges and appreciates the willingness of all applicants to go “above and beyond” in offering to participate in the POC.

The objective of this Proof of Concept is to test specific requirements, selected from a prioritized list developed by the NG9-1-1 team with input from a variety of 9-1-1 stakeholders. The requirements document, along with all other documents produced by this project can be found on the NG9-1-1 website. The NG9-1-1 POC is expected to begin in April 2008 and will last approximately three to six months. Following completion, data gathered during the POC will be analyzed and used to revise the system architecture and complete the transition plan.

The US DOT NG9-1-1 Initiative is an R&D project funded by the Intelligent Transportation Joint Program Office. For further information on the NG9-1-1 Initiative, go to <http://www.its.dot.gov/ng911/index.htm>.

*Michael F. King is a freelance writer and emergency medical services consultant currently working in Queensland Australia on a private consultancy contract.*

# WiMAX – An Overview of the Technology and Its Capabilities

By Sean Lester, System Solutions Engineer, Tyco Electronics' M/A-COM

## Introduction

WiMAX interoperability and 802.16 standards have come a long way in their development and attempting to understand all of the applications and capabilities of WiMAX can be a daunting task for anyone without a core understanding of the technologies. At the base level, communications officials need to know why adaptive modulation, OFDM, OFDMA and SOFDMA, along with a scheduled protocol, serves to make WiMAX networks efficient, effective, and usable today and well into the future. The progress accomplished by vendors on WiMAX broadband technologies, while difficult and time-consuming, is laying the groundwork for years to come. This article is intended to provide a high-level overview of WiMAX technology; discuss the components necessary for ensuring an effective WiMAX solution; and explore the future applications for WiMAX and how the technology has matured to this point.

## WiMAX Overview

WiMAX technologies are based around the IEEE 802.16 standards. The term WiMAX describes the use of physical and data link technologies to deliver wireless services in fixed or mobile configurations. The specification is intended to provide a wireless wide area network utilizing common communications radio waves. Two service options (fixed and mobile) are available within the current 802.16 standards framework, as listed below:

**Fixed** – Point-to-point services which require dedicated throughput and a strong signal. Fixed services can provide back haul for entities, remote point-to-point connections or even short hops connecting campus buildings. Fixed links are interchangeable with wired links, provided a suitable air link can be created.

**Mobile** – Services in which connections are handed off cell to cell and base station to base station usually at high

speeds (~60 mi/hour) and are commonly used by cell phone data users. This is technically challenging as frequency fading and time-selective interference must be taken into account along with communication between base stations and cells to hand off users. It is common for mobile services to be divided into mobile and nomadic services. Generally, nomadic services include roaming while connected to one base station and nomadic/mobile services generally refers to access points roaming between multiple base stations.

WiMAX is a scheduled protocol, meaning that the base stations, which are centralized control units for the network, manage and control the WiMAX network. Access points, or subscriber stations, cannot communicate with the network until they are recognized by the base station. The base station allocates the times and frequencies the subscriber station can communicate with the base station. Because of this, WiMAX-based networks cannot be overloaded, as is common with other contention-based protocols.

WiMAX allows for Quality of Service (QoS) traffic prioritization and utilizes service flows to ensure that QoS, bandwidth and delay parameters are maintained. Services flows can be used to provide five classes of QoS:

Table 1.

Service	Typical Application
UGS – Unspecified Grant Service, highest priority	T1/E1 Transport
ertPS – Extended Real-time Polling Service	Voice over IP
rtPS – Real-Time Polling Service	MPEG Video
nrtPS – Non real-Time Polling Service	FTP
BE – Best Efforts, lowest priority	HTTP

Source: Wikipedia, 2008

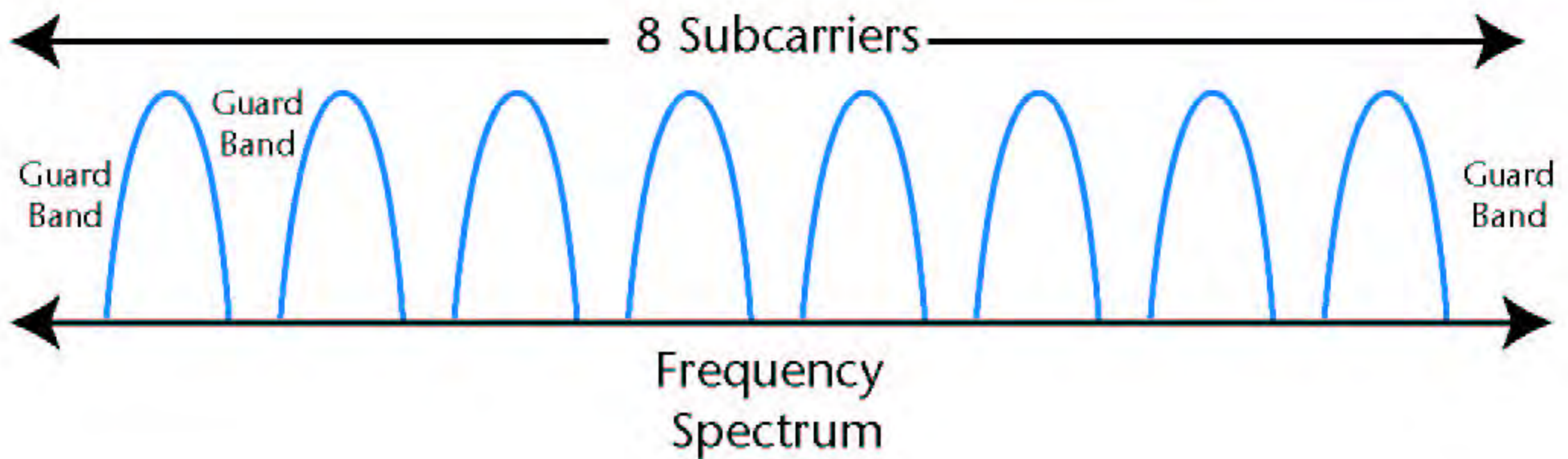


Figure 1. Sample FDM with 8 subcarriers.

Service flows are established between the base station and the subscriber station. A network operator can utilize service flows to design a robust network with various service flows based on end user requirements.

More information is available at the WiMAX Forum's website located at <http://www.WiMAXforum.org>.

### Orthogonal Frequency Division Multiplexing (OFDM)

WiMAX uses Orthogonal Frequency Division Multiplexing (OFDM) to transmit information between a base station and multiple subscriber stations. OFDM offers a number of advantages that make it suitable for WiMAX deployment. OFDM is an extension of Frequency Division Multiplexing (FDM). FDM is a well understood technique and has been employed for decades to combine multiple signals onto a single medium. FDM works by separating frequencies, referred to as subcarriers, over a common transmission medium with guard bands between each frequency. The guard band ensures that signals do not overlap and that they can be easily understood at the receiver. Figure 1 shows a sample FDM system with eight subcarriers. Simply stated, FDM

allows multiple frequencies to be carried over the same communications medium or system.

An example of an FDM system is a cable television network. Each television channel operates at distinct 6 MHz channels along the coaxial cable path.

OFDM takes this FDM concept further by spacing the frequencies closer together. In OFDM, the subcarriers are orthogonally arranged to allow each subcarrier frequency to be detected without interference from neighbouring subcarrier frequencies. This permits many more carriers on a transmission medium which in turn permits greater data rates. In effect, OFDM permits a much more efficient utilization of channel bandwidth. Figure 2 shows a sample OFDM system with eight subcarriers and guard bands between each group of subcarriers.

Wireless environments can be hostile. Two issues that affect wireless system environments are time-selective interference and frequency-selective fading. Time-selective interference occurs when two signals arrive at the receiving antenna at separate times. Since signals arrive at different times there is a potential for signal interference. Multiple subcarriers, since they consist of many

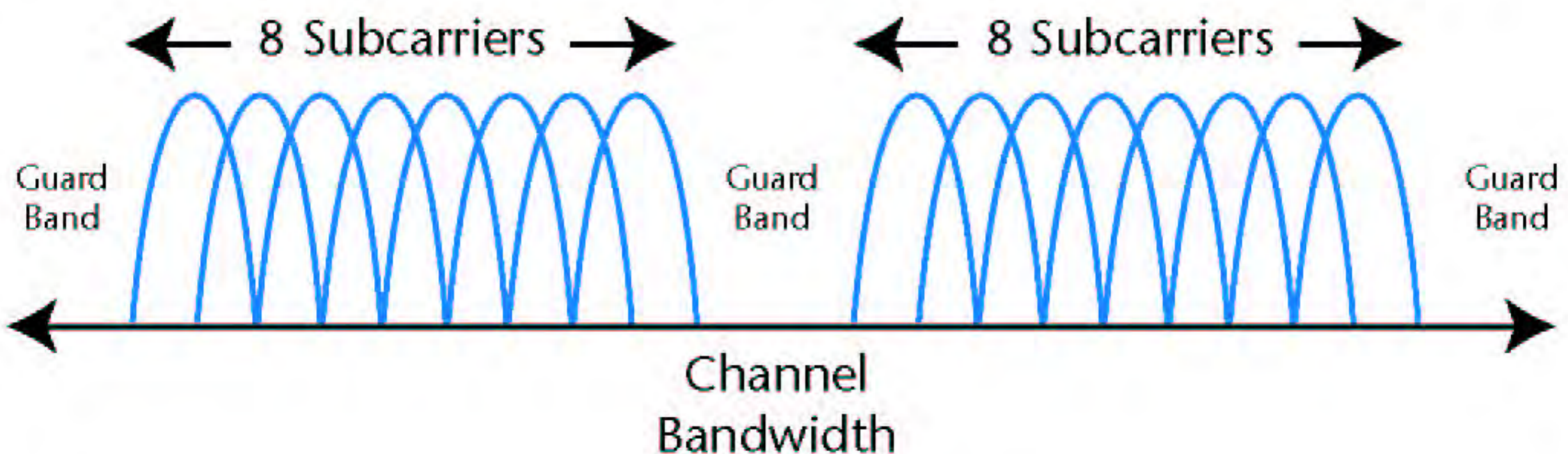
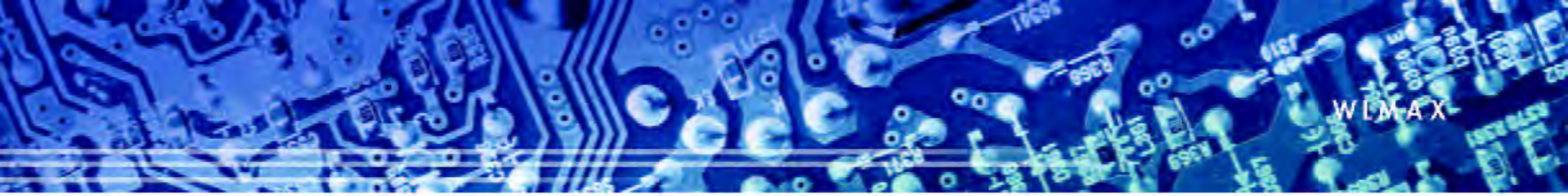


Figure 2. Sample OFDM system with 8 subcarriers and guard bands between each group of subcarriers.



signals, allow OFDM to reconstruct the signal and compensate for interference.

Frequency-selective fading occurs when waves destructively self-interfere as they propagate through the environment. Multiple subcarriers, which consist of many different frequencies, permit OFDM to compensate for frequency selective fading by ensuring the signal can be reconstructed.

### Orthogonal Frequency Division Multiplexing Access (OFDMA)

Orthogonal Frequency Division Multiplexing Access (OFDMA) is a multiple access method based on OFDM and allows simultaneous transmissions to and from multiple users. In essence, OFDMA takes the subcarriers created with OFDM and assigns subcarriers to different subscribers. Further, OFDMA also schedules time slots when a subscriber can communicate with the base station. In effect, the base station simultaneously controls the time and frequency allocation for a subscriber. For example, Subscriber A may talk on subcarrier 1 at time slots 1, 3, 4, and 5. Subscriber B talks on subcarrier 2 at time slots 2, 6, 8, and 9.

OFDMA provides much greater granularity of the available bandwidth and allows multiple subscribers to connect to the WiMAX network. Since OFDMA efficiently uses the available spectrum, a large number of subscribers can be supported on the typical WiMAX network.

OFDM and OFDMA are generally used in fixed access networks such as back haul or dedicated point-to-point links. OFDMA can be utilized for mobile applications, however a technique called Scalable Orthogonal Frequency Division Multiplexing Access (SOFDMA) was developed to manage mobile connectivity similar to cellular networks.

### Scalable Orthogonal Frequency Division Multiplexing Access (SOFDMA)

An advanced form of OFDMA called Scalable Orthogonal Frequency Division Multiplexing Access (SOFDMA) is utilized for mobile WiMAX subscribers. SOFDMA works on the same concepts as OFDMA but differs in the management of subcarriers. In OFDM/OFDMA, subcarriers are fixed and do not change. In contrast, SOFDMA dynamically manipulates the subcarriers based on environmental conditions. SOFDMA permits mobile WiMAX to operate much more robustly, especially at high speed handoffs. SOFDMA can be found in the IEEE 802.16e standard.

### Modulation Techniques

OFDM, OFDMA, and SOFDMA subcarriers can be modulated using techniques such as Binary Phase Shift Keying (BPSK), Quadrature Phase Shift Keying (QPSK) or Quadrature Amplitude Modulation (QAM). These modulation techniques provide a variety of data throughputs based upon the channel bandwidth employed and the strength of the signal and are officially referred to as the signal to noise ratio.

Modulation creates symbols representing data. For example, BPSK can create symbols that represent 2 bits of data while QAM is capable of creating symbols that represent 6 bits of data or more. A better signal to noise ratio of the transmission medium allows symbols representing increased numbers of bits per second to be transmitted. Higher data rates are possible depending on the signal to noise ratio of the signal in the transmission medium. It is important to understand that the number of possible symbols of the transmission medium does not change – simply the number of bits per symbol changes.

To clarify with a simple analogy, modulation techniques can be thought of as languages and the

symbols can be thought of as words. Depending on the language, a single word can have many different meanings. Modulation works similarly by applying different definitions to the symbols, which are “the words.” To carry the analogy further, if two individuals are trying to converse in an overly noisy room, they may have trouble effectively communicating. In response to the loud environment two individuals will instinctively choose to use smaller words and shorter sentences in addition to increasing the volume of their voices. WiMAX works similarly by changing modulation schemes and signal power to match environmental conditions.

The use of OFDMA and SOFDMA modulation technology allows each group of subcarriers to be modulated individually so that different subscribers can communicate efficiently depending on environmental conditions. Using the language analogy above, OFDMA can be thought of as a language instructor in a noisy classroom. The teacher, representing the base station, tells the students, who represent the subscriber stations, what language to speak, when to speak that language as well as at what volume.

### WiMAX Networks

All WiMAX networks share similar characteristics and necessary components. These components consist of an air interface, base station, subscriber station and network management.

WiMAX networks, regardless if they are fixed or nomadic, need a physical wireless air link. From the 802.16 specifications, this can be any frequency from 2 GHz to 66 GHz and channel bandwidth can be from 1.25 MHz to 20 MHz wide. However, the WiMAX Forum, an international, industry-lead standards organization, has claimed that they are willing to work with any frequencies that become available. In fact, the WiMAX Forum recently announced that it is adding the 700 MHz band to its technology roadmap and work

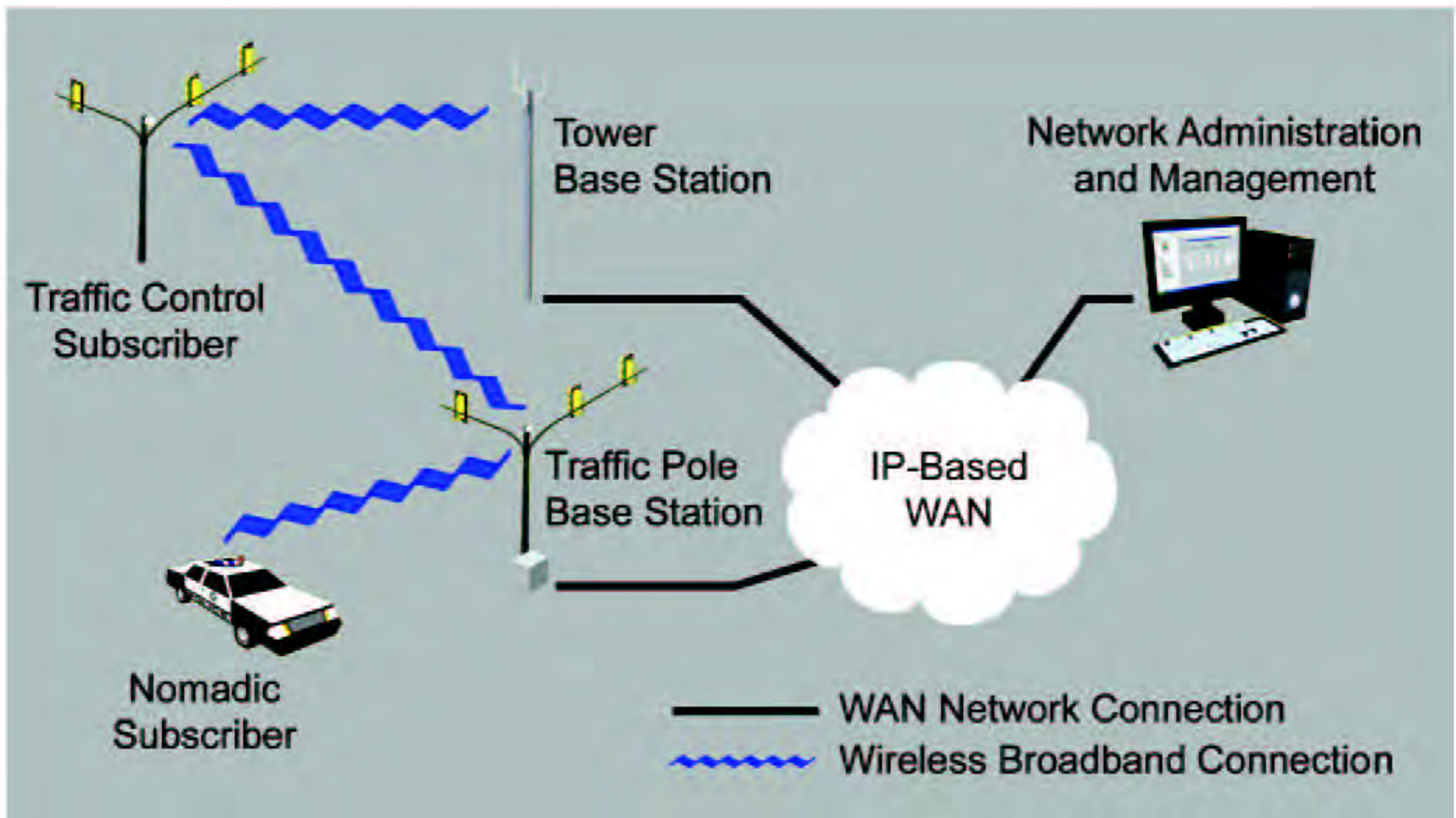


Figure 3. Sample WiMAX network with Nomadic and Fixed clients.

on the certification of the frequency range has already started in the Forum's working groups. Based on the regulations and laws of each country, a WiMAX network can use either licensed or unlicensed frequencies.

Each WiMAX network needs a network or Internet connection, which can be supplied by a traditional land line service or can even be provided by another WiMAX link or other wireless technology.

A centralized base station is required to manage the WiMAX network. WiMAX is a scheduled protocol and the base station manages access point entry into the network and it also controls the dedicated bandwidth, signal power levels, and prioritized traffic. Base stations can handle hundreds of access points and they can interface with the internal network. A well-designed WiMAX network strategically places each base station in order to maximize coverage areas.

Access points, or subscriber stations,

are needed to provide users with access to the network. Each access point has an RF interface to connect to the physical wireless air link. Wireless devices can access the network, such as a cell phone that is equipped for WiMAX connectivity, or via an Ethernet interface. Access points can be mobile or mounted to poles, towers or buildings.

Network management is a necessity to both monitor and maintain the WiMAX network. This is generally accomplished with independent servers. Figure 3 shows a sample diagram of a WiMAX network with fixed and nomadic clients.

### WiMAX Applications

Currently, WiMAX is being deployed around the world to support many different applications. It is an exceptionally versatile standard and features an increasingly diverse level of application support around the world.

Some Fixed and Mobile access

applications include:

#### Fixed access

- Point-to-point links for remote access
- Backhaul links
- Security cameras, MPEG streams
- VoIP traffic to fixed locations
- Traffic controllers

#### Mobile access

- Network data access to mobile CPE devices
- Internet access for mobile CPE devices
- Data access for public safety
  - license checks
  - AVL (Automatic Vehicle Locator)
  - Architectural and engineering diagrams
  - End of shift reports

As with all network services, the



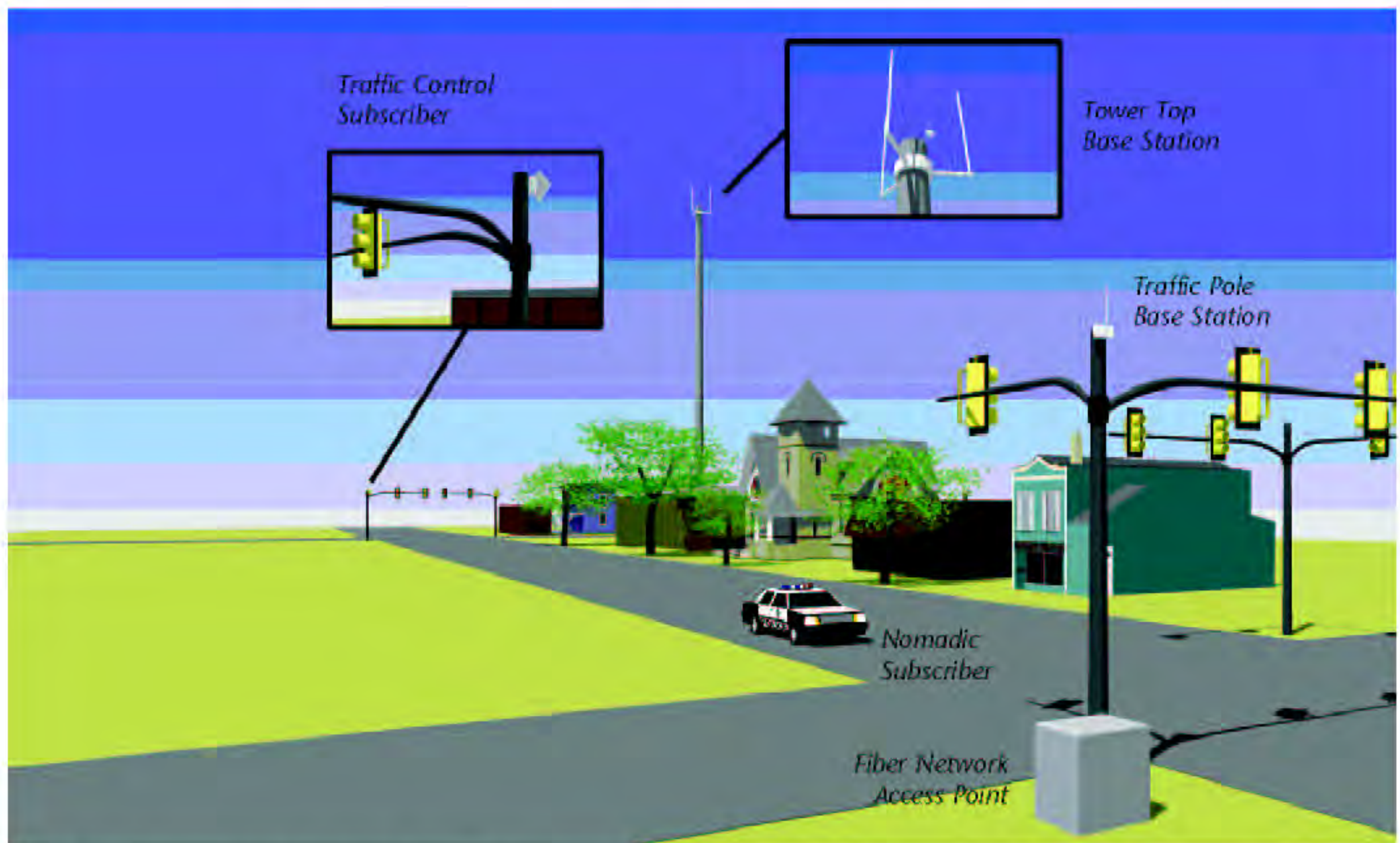
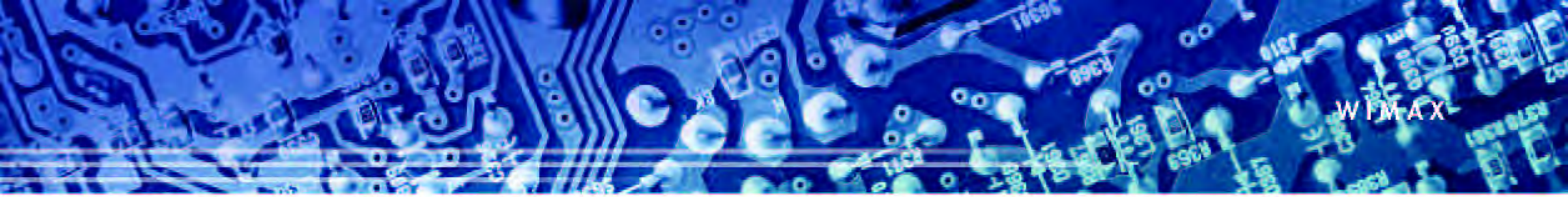


Figure 4. An example of a city-wide network with fixed and nomadic access.

demand for bandwidth continues to increase. Fixed access video and VoIP are becoming standard services on all platforms and public safety agencies and officials continue to demand more bandwidth for their own applications. An example of this is mobile first responders demanding the same fixed access services of ubiquitous voice, video, and data on their devices.

To satisfy these growing bandwidth requirements, the WiMAX Forum is working diligently to enhance the 802.16 specifications to provide future bandwidth growth and capacity. Some of the specification amendments the 802.16 Working Group are pursuing are presented in Table 2.

Table 2.

Amendment	Description
802.16i	Mobile Management Information Base – manages mobile subscribers
802.16j	Multihop relay Specification – extends WiMAX™ reach
802.16m	Advanced Air Interface – Provides data rates of 100 Mbits/sec for mobile applications and 1 Gbit/sec for fixed applications

Source: Wikipedia, 2008

### Conclusion

WiMAX continues to make inroads as a viable networking technology. WiMAX-based networks are increasingly being deployed by carriers, enterprises, and governments around

the world to provide backhaul and last mile access to end users. Like all standards, WiMAX continues to mature and the 802.16 Working Group is working diligently to extend the capabilities of the WiMAX standard globally.

# TDM services over IP networks

By Keyur Parikh and Junius Kim

## Abstract

Time Division Multiplexing (TDM) circuits have been the backbone of communications over the past several decades. These circuits which provide reliable and low-delay services for voice, data, and video transport, are migrating towards Internet Protocol (IP)-based packet switched networks. The primary reason for the migration of these circuits is to reduce the cost of transport and management by having a converged network for all services. Due to the sheer magnitude of the installed legacy TDM equipment, this migration to "end-to-end IP" will go through a transitional phase where some services will continue to use legacy equipment, while the core network moves towards IP. In this transitional phase, there is a need for technology allowing seamless transmission of TDM services across the packet switch networks. The Internet Engineering Task Force (IETF) and International Telecommunication Union (ITU) provide specifications for interoperability to emulate TDM circuits over IP networks. These emulated services can be implemented using a gateway device that provides for inter-working function (IWF) between TDM and IP networks. The primary challenge of the gateway device is to provide the equivalent level of reliability and security of traditional TDM networks. To that extent, the gateway device must be able to achieve an equivalent level of synchronization of TDM circuits across the IP network and cope with packet impairments of the underlying IP network. In addition, the gateway can provide value added services such as echo cancellation, multicasting and IP security.

The remainder of this paper explores the architecture of a Gateway device such as Harris's NetXpress, which can facilitate a smooth transition for legacy TDM applications as the core network is migrating from TDM circuit switched to IP-based packet switched networks.

## Network Evolution

Over the years, TDM-based Wide Area Networks (WANs) have enabled transport of a multitude of user applications including: basic telephony, trunked radio, low to medium rate data services and studio to transmitter links for broadcast audio and video. Figure 1 shows a basic model for an end to end TDM system.

The TDM network dedicates a circuit with a fixed amount of bandwidth for the duration of a session, regardless of its actual usage. For voice applications, these networks have performed well, however, for emerging data intensive applications, these networks do not scale effectively. As a result, IP-based WANs are deployed to allow for cost efficient expansion of capacity and statistical

multiplexing gain for new emerging applications. In addition, IP-based WANs are built on open standards allowing interoperability of equipment from different vendors. To allow for a smooth migration of legacy equipment, the IP WANs will be required to support legacy TDM applications in a seamless manner.

The convergence of TDM traffic into the IP networks has to be well managed for maintaining the performance level of the TDM applications.

For transporting voice across IP networks, Voice over IP (VoIP) technology has emerged at the forefront. While this technology provides the most flexible way of routing telephony calls, it is very complex. The complexity of protocol inter-working between TDM and IP call processing may not be suitable and needed for many applications.

Alternatively, Circuit Emulation Service (CES) technology has emerged as an option to transport TDM trunks containing legacy applications across managed IP networks. This technology is sometimes referred to as pseudo-wire, as it emulates the TDM circuit across a packet network using virtual IP tunnel or path. The primary benefit of this technology is the cost and simplicity of deployment to support all types of legacy TDM applications without the need for complex protocol inter-working.



Figure 1. End to End TDM Network

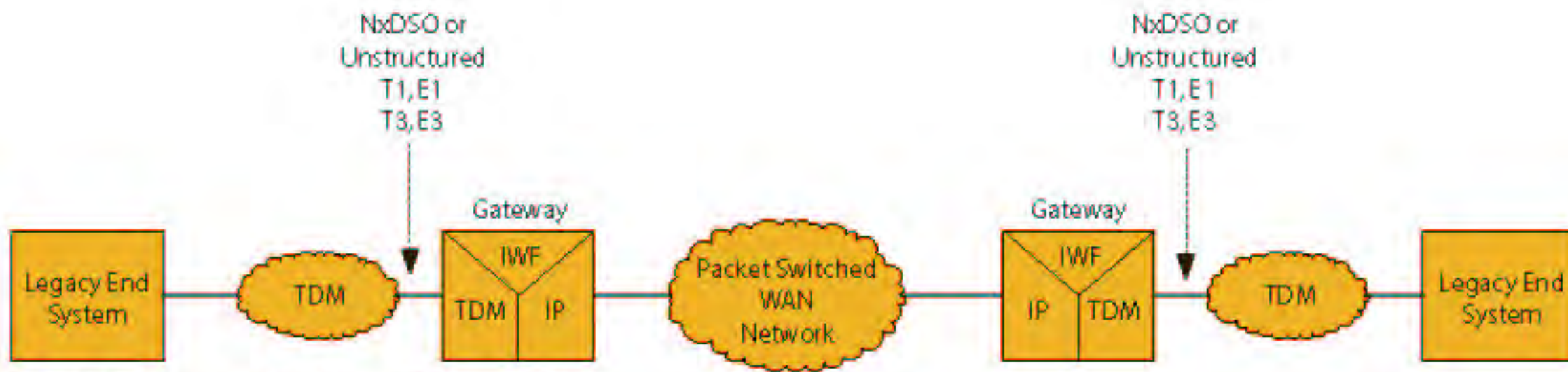


Figure 2 Reference model for CES over IP

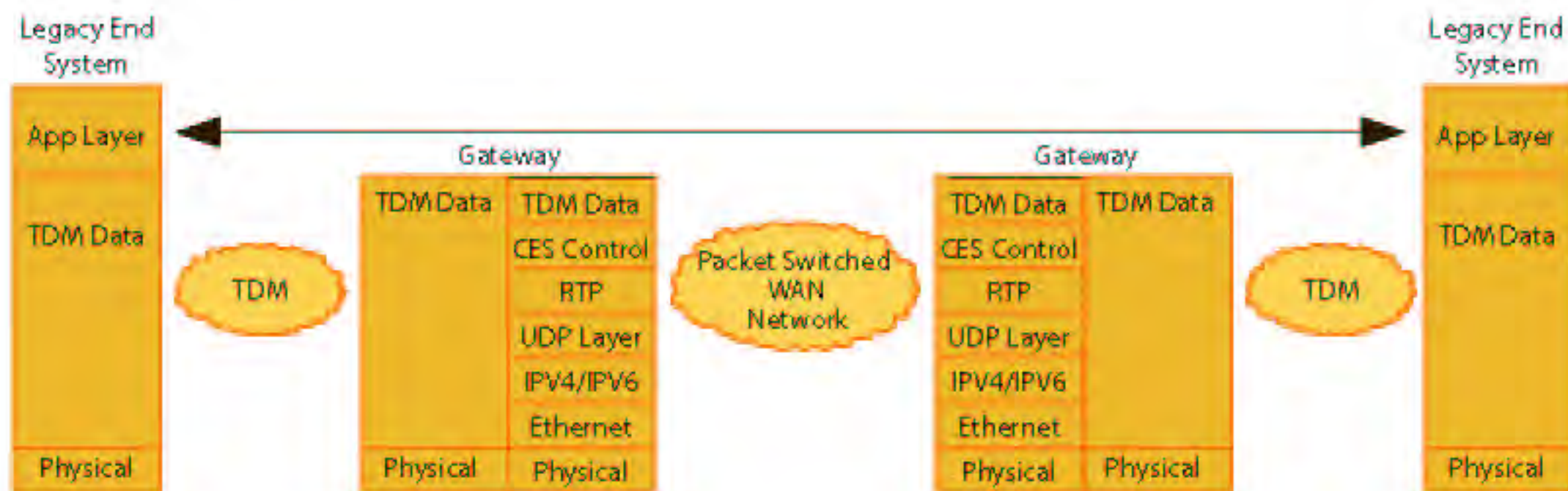


Figure 3. CES protocol encapsulation

Figure 2 shows a reference diagram for supporting Legacy TDM applications over IP networks using CES.

As outlined in Figure 2, the Gateway device supports CES by providing an Inter Working Function (IWF) between TDM and IP. Among standard bodies and working groups, the IETF's pseudo wire (PWE3) working group provides a standard framework for emulating structured and unstructured T1, E1, T3, and E3 circuits across IP networks. This framework provides specifications for traffic encapsulation and functions that are required for successful emulation of TDM circuits across IP networks. Figure 3 shows one such possible protocol encapsulation at the Gateway.

The IWF at the Gateway accepts the TDM data from the attached circuit. This data is either in NxDSO or unstructured format. The IP side encapsulation of the TDM data is done by adding the following layers to the payload.

**CES Control Word:** This layer is used to convey the status of the attached TDM circuit to the far end

for re-generation of alarms and status.

**RTP Layer:** This layer is used for providing sequence numbers for in-order delivery and conveying synchronization information.

**UDP Layer:** This layer, along with the IP layer provides de-multiplexing information to the far end so that the incoming payload can be properly switched to the local TDM circuits.

**IP Layer:** Provides for de-multiplexing and routing across IPV4 or IPV6 networks.

Besides providing for the IWF, the Gateway's architecture must provide functionalities to overcome various challenges introduced by the IP network. The next section describes the challenges that must be overcome within the Gateway.

### Challenges

There are numerous technical challenges that arise from emulating circuit switched services across connectionless IP networks. The performance of the emulated circuits

is expected to be the same as that of current TDM networks. As a result, the Gateway must be architected to overcome challenges posed by the underlying IP network to maintain the same quality of service.

### Achieving Synchronization

A TDM circuit must establish the same TDM clock frequency on both endpoints of the network. A Plesiochronous Digital Hierarchy (PDH) network used to transport circuit emulated services such as T1, has built-in mechanisms, using bit stuffing techniques for transporting timing across the PDH network.

Within a packet network, there is no inherit transport of timing information and packets are discontinuous in time. In a CES application, the Gateway device must also transport timing, establishing the same frequency. The consequence of a long term mismatch in frequency is that the packet queue of the Gateway device at the egress of the network will either fill-up and overflow or empty and underflow. The direction depends on whether the regenerated clock is slower or faster than the

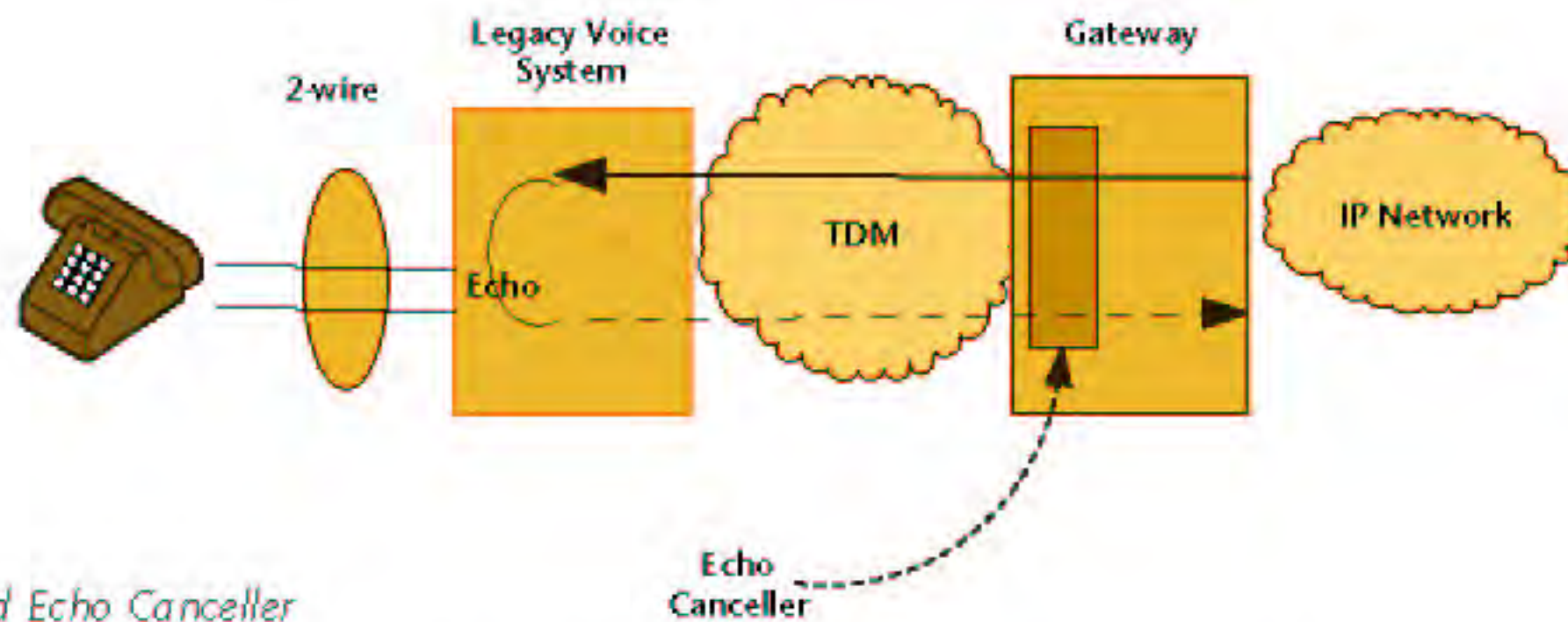


Figure 4. Integrated Echo Canceller

original. This will cause loss of data and degradation of service.

One way to achieve synchronization is to provide a local same frequency clock to the Gateway devices at the endpoints of the circuit emulation. This can be done via GPS receivers, or by linking the Gateway devices to other network devices that recovers a clock traceable to the network clock strata. The disadvantage of such a method is the cost and complexity of this additional equipment.

A variation on the local clock method is for the Gateway device to use Network Time Protocol (NTP). NTP is an IP protocol used for synchronizing the clocks of hosts to servers over packet networks and is designed particularly to resist the effects of variable latency (jitter).

A disadvantage of NTP is the requirement of having NTP servers available to the Gateway devices. Another method of synchronization is for the Gateway device at the egress of the network to employ an adaptive timing recovery algorithm. This algorithm examines the timestamps of the incoming CES packets in relation to its own local reference clock. Based on the timestamps, the algorithm can measure and extract the far-end timing information and regenerate a local same frequency TDM clock. The regenerated clock is a plesiochronous representation of the original. The fidelity of the regenerated clock is impacted by several factors including the packet rate,

the packet jitter and loss within the network, and the quality of the algorithm itself. The advantage of this method is the CES itself is the source of timing with no other overhead and no other equipment required.

#### Managing Network Jitter

The variation in the inter-packet arrival time at the receiving Gateway is caused by the network jitter. The jitter in the TDM networks is of a much smaller scale than that of IP networks. This is primarily because TDM networks provide for fixed end-to-end circuits for the duration of the session, while the paths in the IP Networks are connectionless and statistically multiplexed with other sessions. The amount of network jitter depends on how well the network is engineered and how many "hops" or routers must be traversed. A well engineered IP network can be designed to control the network variation, while an unmanaged network, such as the public Internet, can produce large amount of jitter. The Gateway's architecture absorbs this variation in the delay by providing a de-jitter buffer. The de-jitter buffer adds additional delay to the end-to-end service. Thus, the Gateway must provide for a flexible configuration of this parameter so that it can be optimally engineered to work in a variety of IP networks, from extremely well managed to public Internet.

#### Managing Packetization Delay and Bandwidth

One of the factors in the overall

delay for CES is the transmit delay. The most important element of the transmit delay is packetization (or packet generation delay). The packetization is delay associated with the process of accumulating payload for the CES packet from the TDM circuit. The packetization parameter is configured in terms of number of TDM bytes from which to accumulate the packet payload. A higher number results in longer packetization delay and bigger payload size. In an NxDSO or structured application, the lowest possible packetization is one TDM frame, which contains payload from one TDM frame and will have packet generation latency of 125 microseconds, resulting in 8000 packets/seconds.

The bandwidth utilization of CES is inversely proportional to the packetization delay. This is because each CES packet contains a fixed number of overhead bytes for protocol headers. Therefore, a bigger payload size in each packet will yield better bandwidth efficiency.

The tradeoff between bandwidth efficiency and overall service delay has to be done based on the latency tolerance of the underlying application. To this extent, the Gateway's architecture must support a wide range of packetization parameters to allow for maximum flexibility to engineer CES, based on the type of application transported and the network constraints.

#### Services Implementation

This section discusses the value

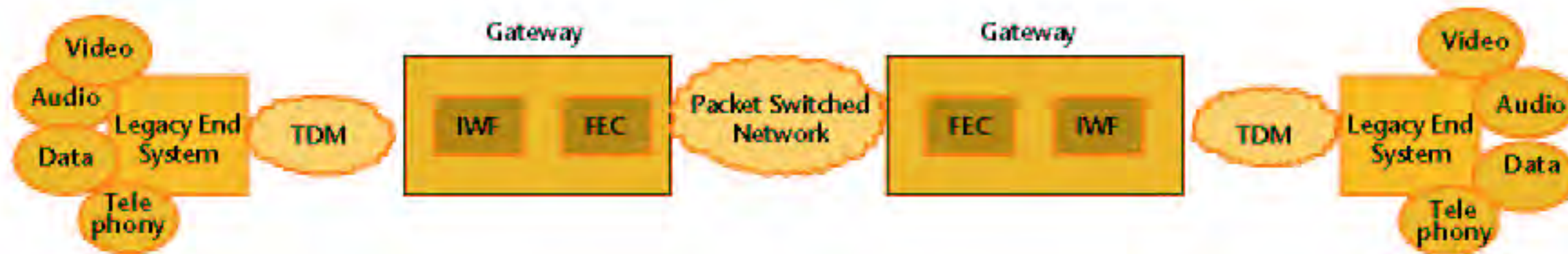


Figure 5. Integrated Forward Error Correction

added functionalities that can be integrated in to the architecture of the Gateway to provide for a smoother transition.

#### Echo Cancellation

The legacy telephony equipment that provide for a hybrid conversion between two and four wire circuits are a source of voice echo. In the scenario where the end-to-end delay is less than 25 msec, the echo may not be perceptible. When this application is transported across the IP network, the additional end-to-end delay may be severe enough where echo cancellation is desirable. Figure 4 shows a reference model for this application.

For certain deployment cases, having an integrated Echo cancellation function within the Gateway that can be enabled based on the underlying TDM application will reduce both, the capital and operational cost of having external echo cancellation equipment.

#### Mitigating Packet Loss

Unlike TDM networks, the IP networks are prone to packet loss caused by various events within the network. The amount of packet loss and jitter are two key attributes of the underlying network and varies based on the network, with the worst case being the public Internet. There are two options for handling packet loss: error concealment or error recovery. The error concealment option is media-dependent and generally does not incur additional delay. This option is best suited for real-time TDM applications. The error recovery is an option

that is suited for applications that are more sensitive to packet loss than delay. The Gateway should integrate an interoperable error recovery scheme that works in a media independent manner in a low or high packet loss network. One option is to use TCP as oppose to UDP for transport. This provides retransmission capabilities. However, using TCP has the following disadvantages:

- It increases the end-to-end delay and use of system resources.
- It does not work with multicast application.
- It has bandwidth throttling mechanisms incompatible with real time data applications.

IETF's RFC 2733 provides the framework for a forward error correction (FEC) that operates at packet level, as shown in Figure 5.

The FEC operates at the application layer by grouping original data packets and sending a parity packet along with the original data packets. At the receiver, the parity packets are discarded if the original data packets are received without error, otherwise the lost data packets are attempted to be recovered from the received data packets within the group and the corresponding parity packet. The RFC specifies multiple modes of FEC operation, where each mode provides for a different degree of protection from packet loss. The FEC modes that provide higher levels of packet loss protection incur more delay and system resources, hence the Gateway must provide for a flexible configuration to allow the user to adequately engineer the FEC pro-

tection based on the network condition through which the TDM trunks are transported.

#### Multicasting

TDM networks provide only point-to-point connection. When legacy TDM application require point to multipoint connections, the user has to setup and manage multiple physical TDM connections from the source to each destination. For example consider the example of Figure 6. The contribution site needs to send the content to multiple radio distribution sites.

The Gateway at the contribution site performs the functions of a multicast source, while the Gateways at the distribution sites act as multicast listeners. By supporting multicasting, applications requiring point-to-multipoint connections can be easily created and managed.

#### Transport security

The TDM networks are perceived to be secure against eavesdropping due to their physical nature. Certain legacy TDM applications, such as tactical communications, are relying on this physical security to prevent unauthorized eavesdropping. When these applications are transported across IP networks, they become susceptible to security threats that were previously not present. The ubiquitous nature of the IP network is not only a threat for eavesdropping, but also for impersonation of a device's peer. Standard security protocols such as IP security (IPSEC) provide for secure IP transport using strong authentication and encryption schemes. Authentication provides

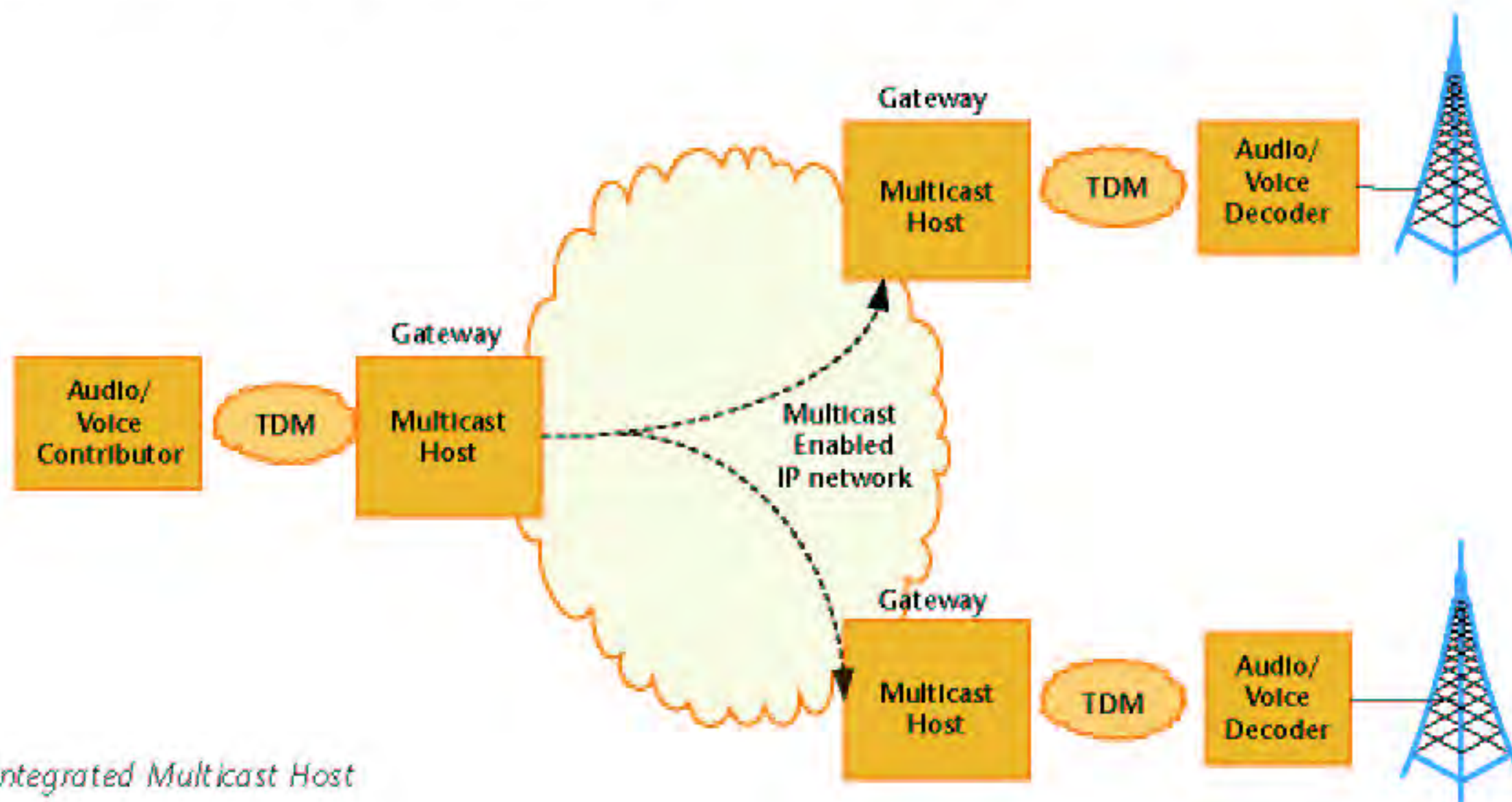


Figure 6 Integrated Multicast Host



Figure 7 Integrated transport security

protection against identity verification and strong encryption algorithms such as AES128 provide protection from eavesdropping. The Gateway's architecture integrates a security engine which allows any legacy TDM application to be securely transported to its destination across the IP network. Figure 7 shows a reference model for secure transport.

Having an integrated security engine not only provides for flexibility in configuring secure transport for TDM services but also reduces cost and risk of having an external equipment or outsourcing the service it to the network provider.

### Platform Manageability

The management plane provides an important element in the operation of IP networks. The manageability of an IP device factors in to the overall operational cost of the IP network and therefore, to integrate within an existing network management scheme, the Gateway must support

standardize interface for management.

The following lists some of the key management functions architected within the Gateway:

- Support of standard protocols such as SNMP and HTTP for configuration and status monitoring.
- Support of management plane security using SNMPv3 and HTTPs. These protocols provide for authentication and encryption of management messages.
- Support of protocols such as ICMP, FTP, Telnet for maintenance and trouble shooting.
- Support of user level access control and protection from common denial of service (DOS) attacks.

### Conclusion

Circuit emulation services allow existing TDM based applications to

be transported across packet switch networks, thus extending the life of legacy TDM equipment and providing for a smoother transition from TDM to packet based networks. The architecture of the CES Gateway provides for a critical element in maintaining equivalent performance and enabling appropriate IP services for legacy TDM applications.

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