WaveLength

9/11 Revisited

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It is the fall of 2010 and the challenges facing public safety communications are increasing and the future of communications in the coming decade remains undefined; even the experts are divided on what the next decade will bring. Some things seem clear, 9-1-1 and communications will need to move into the IP-based world in all our communication endeavours as the world very clearly moves from the landline telephone system to a largely mobile and digital world of communications. Our systems will need to grow and adapt to meet the changes in expectations of the public. This transition, while seeming dramatic is simply the next step in evolution much like the rotary dial phone was replaced by the touch tone.

Discussions around texting today are all the rage and imparting the knowledge that texting 9-1-1 is simply not an option today is met with incredulity, blank amazement and a wondering look of "Why not?" The effort and work that went into creating a robust, redundant, and enhanced 9-1-1 system for largely immovable landlines pales by comparison to what will be required in the digital age when everything is mobile – magnitudes stagger the imagination. Historically you could count on one, and in rare cases, two phone lines per residence. Today cell phones and electronic communications devices will be measured at 1.5 times the number of people which by all estimates are 2.5 times the number of residences. Our world is changing and we need to prepare to change with it.

We will have to work with our communication providers to find a way to do for texting what we did for landlines. That seems eons ago, but in reality occurred only a few decades back. No, it may not be transmitted with priority, and it certainly doesn't provide the speed and interaction of a simple phone call, but it is a widely accepted method of communication for the public and sooner rather than later we will need to implement a strong solution.

Texting, while the talk of the town today, actually pales beside the questions being raised about the broadband requirements for public safety. Does anyone know how much bandwidth public safety will need this year, next year, or for the next 10 years? The public safety requirements are a true unknown, be sure it will be needed and most likely, however much is set aside will inevitably not be enough. This is the time of the looking glass regarding the requirements for public safety bandwidth for the next 10 years. Make no mistake, we are competing for the future lifeline of public safety communications and it is a limited resource and a key component to the evolution of telecommunications for everyone. This is the time for public safety as a united entity to work with our local provincial, territorial, and federal governments to identify and secure dedicated bandwidth for public safety. We will need this in the future and we better start now in getting it set aside because the one thing I can promise is that no matter how much is set aside for public safety, it eventually won't be enough. This is not the time for squabbling or short-sightedness, this is when we must all come together and speak loudly and unanimously about the public safety need for broadband.

Thank you for the past year it has been a challenging and invigorating year during which it was my pleasure to serve as president of this association and I look forward to continuing to work with APCO over the coming years in our combined effort to develop and improve upon public safety communications

Curtis Brochu
President, APCO Canada

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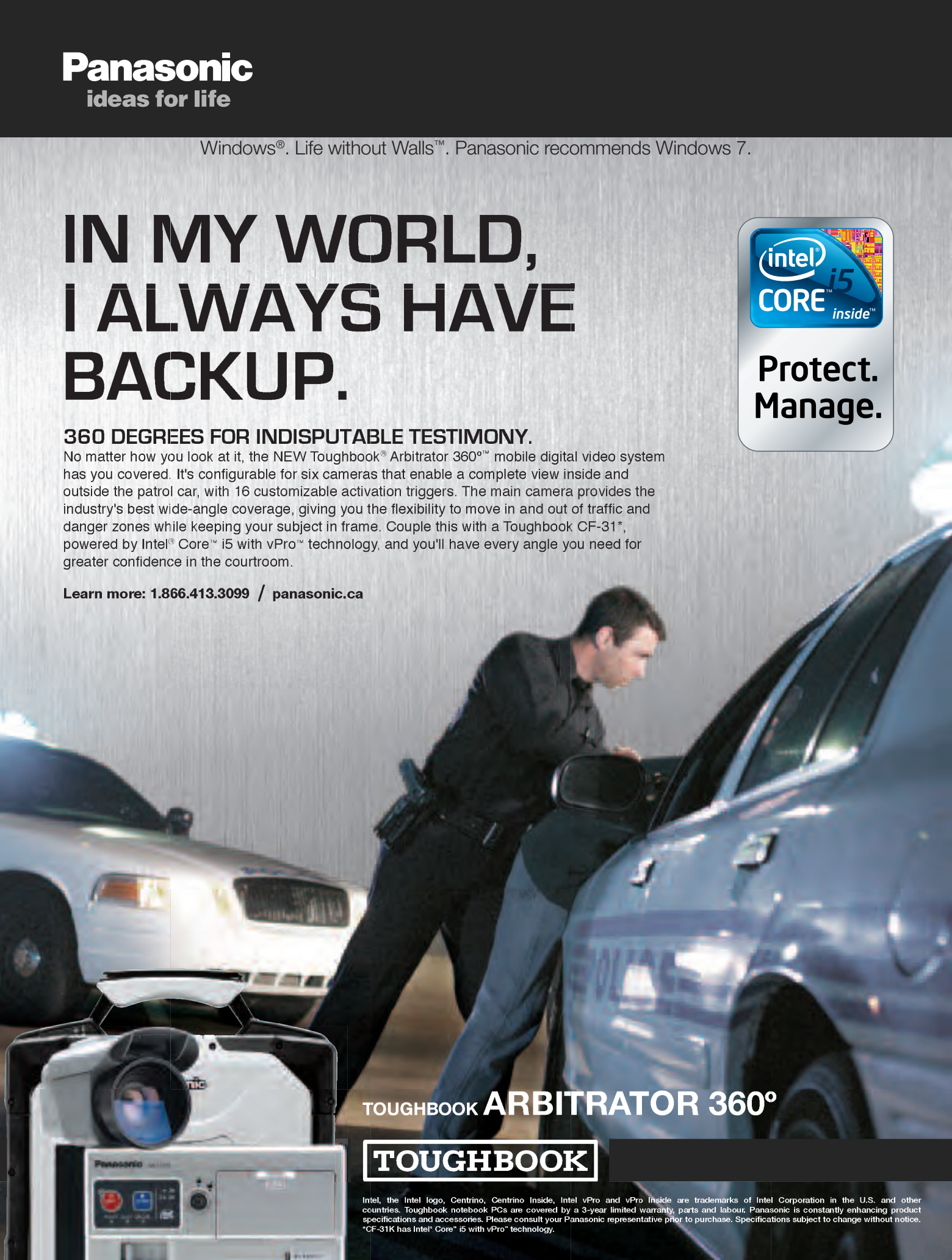

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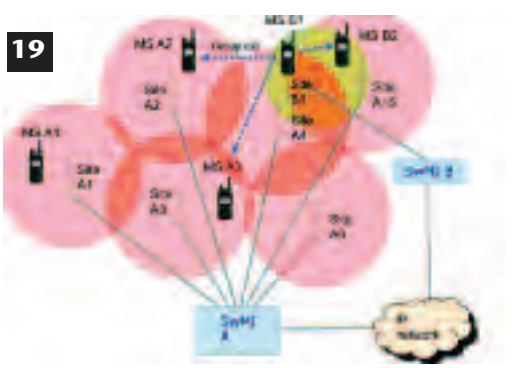

Cover photo by Paul Dixon

Pencil It In

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April 13-14, 2011
Business Design Centre.
Islington, London, UK

APCO International
August 7-12, 2011
Philadelphia, PA

APCO Canada Conference 2010
November 15 - 18, 2010
Fairmont Hotel
Vancouver, British Columbia

The Fourth Canadian Public Safety Interoperability Workshop
December 5 - 8, 2010
The Fairmont Empress
Victoria, BC

IN THE NEWS

Paradigm Services to Lease Full Military X-Band Capacity from Telesat Across the Americas and the Pacific

15-year contract that delivers the first commercial X-band coverage over Canada, the Americas and the Pacific Ocean, including Hawaii.

Paradigm Services, part of Astrium Services' Telecoms division, announced today that it has entered into a 15-year contract with Telesat, the world's fourth largest fixed satellite services operator, for the full X-band payload on Telesat's Anik G1 satellite.

Astrium through Paradigm Services, currently provides state-of-the-art seamless milsatcom services to the UK Ministry of Defence, the US Department of Defense, the Canadian Department of National Defence and many other international armed forces and Government Agencies, combining its own satellites with capacity leases to meet all milsatcom requirements.

Eric Beranger, CEO of Astrium Services, said: "Our decision to commit to the full X-band payload on Anik G1, and the resulting long-term partnership with Telesat, shows once again our innovative approach to new market opportunities that has been crucial to our continued success."

"For the first time, the Canadian Department of National Defence and US Department of Defense users will be able to procure Pacific and Atlantic X-band capacity from the same source through our One-Stop-Shop approach."

Demand for X-band services from civil and military agencies around the world is growing as governments continue to increase their use of commercial satellites. Anik G1 will be the first commercial satellite with substantial X-band coverage of the Pacific reaching out to Hawaii. The characteristics of the X-band frequency make it the ideal choice for naval platforms, allowing high data throughput with lower rain-fade margins compared with Ku or Ka-band.

Anik G1, scheduled for launch in the second half of 2012, will operate from 107.3º West and will utilise a 3-channel, global beam, X-band payload covering Canada, the Americas and the Pacific Ocean. In addition, Anik G1 will include 16 transponders in extended Ku-band over Canada, 24 C-band and 12 Ku-band transponders over South America.

The Anik G1 X-band payload has a global beam performance comparable to that of the Skynet-5 fleet of three spacecraft and will enhance Paradigm Services' existing X-band capability to provide coverage in areas that were previously unsupportable. The payload is fully NATO compatible and will therefore be able to support the entire current customer base.

Stephen Marschilok Named President of Harris Corporation's Public Safety and Professional Communications Business

Harris Corporation an international communications and information technology company, has named Stephen Marschilok as president of the Public Safety and Professional Communications (PSPC) business unit of Harris RF Communications. PSPC provides advanced communications solutions for public safety, federal, utility, commercial and transportation markets.

Previously, Marschilok was president of the U.S. Department of Defense business unit within RF Communications, where he also served as vice president and general manager. Before that, he held various leadership positions including vice president and general manager of International Government Systems, managing director of UK Operations, and director of International Sales. Marschilok began his career with Harris in 1981 as a software engineer.

"Steve's strong leadership delivered great success in our U.S. Department of Defense and international businesses. He is very capable of leading our team in addressing the tremendous opport-unities in public safety and professional communications markets," said Dana Mehnert, group president, RF Communications. "Steve has played a pivotal role in the growth of our business and I am very pleased to have him step into this key position."

Marschilok has a bachelor's degree in computer and systems engineering from Rensselaer Polytechnic Institute and a master's degree in electrical engineering from Rochester Institute of Technology. He is a member of the Armed Forces Communications and Electronics Association (AFCEA) and the Institute of Electrical and Electronics Engineers (IEEE), and was a Harris corporate representative to the UK Defence Manufacturers' Association.

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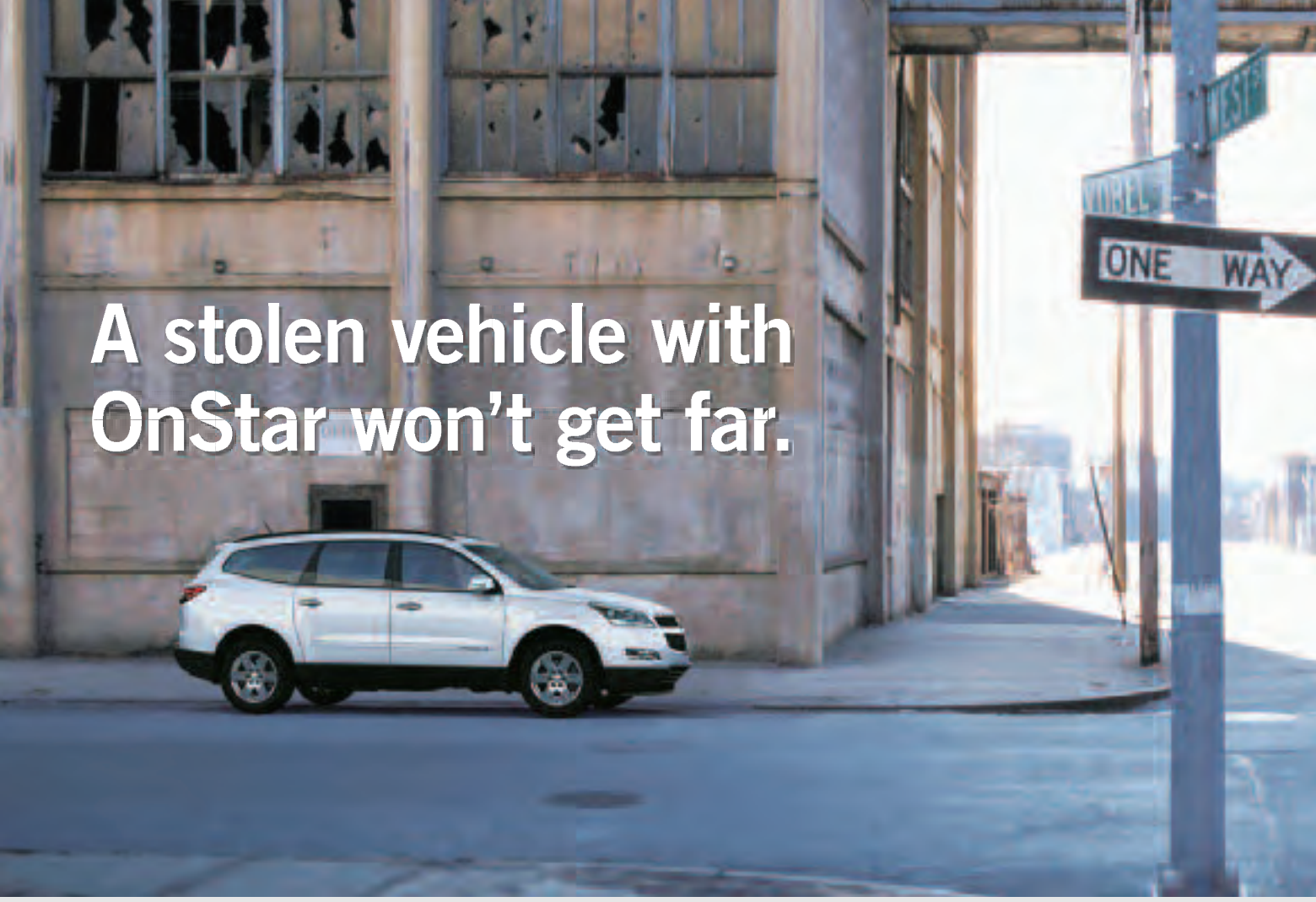

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9/11 Revisited

The events of the morning of September 11, 2001 and the hours and days that followed are burned into the memories of the public safety community in such a way that time will not erase.

Article and photos by Paul Dixon

Visiting New York in the summer of 2010 afforded an opportunity to look back at what had been and get a feel for the future. One legacy of 9/11 is as a macro study of posttraumatic stress disorder (PTSD), triggered by a single event that has affected many thousands, even millions, of people. Like a stone cast into a pond, the ripples spread out and like an emotional tsunami, exacted a toll that continues today for many.

9/11 will always haunt New York City. The wounds to the infrastructure of the city have been largely healed. The buildings around the site that were devastated on that day have been repaired, new subway stations have been built in the ground below. After years of acrimonious wrangling construction finally began on 1 World Trade Center in April 2006, with completion scheduled for 2013. 1 World Trade Center will occupy the footprint of the North Tower. Six more buildings will complete the site, along with a cultural centre and the September 11 Memorial and Museum. The memorial is slated to be dedicated on September 11, 2011.

Today, much of the tourist attraction feel is gone from lower Manhattan. In the months following 9/11, millions made the pilgrimage to New York and lined up for hours to get a first-hand look at the site from a viewing stand constructed at Church and Fulton streets, beside St. Paul's Chapel. Every day, tens of thousands of visitors were carried through and around lower Manhattan on tour buses and boats, all the while harangued by guides recalling the events of 9/11 with all the solemnity of a Super Bowl half-time show.

The "Miracle on the Hudson" is the tourist theme for now. If you wondered about the disappearance of double-decker buses from around the world, you may be relieved to know they are all now in New York, transformed into rolling billboards hawking the opportunity to re-live the six minutes of US Airways flight 1549 as a 90-minute boat ride or two-hour bus tour. There are three major international airports within 15 kilometres of Times Square and large commercial jets are always overhead, yet today they draw little, if any attention from the pedestrians that pack the streets below. One wonders how long it took

NYPD presence in Times Square, mobile command post on site 24/7.

Fence around St. Paul's Chapel covered with fire department memorabilia from around the world. *Photo taken June 2002.*

WTC viewing platform reflected in the façade of the Millenium Hilton. *Photo taken June 2002.*

for people to stop looking up.

St. Paul's Chapel stands as it has since 1766, the oldest building in continuous use in New York City. As the church that George Washington and his family worshiped at, it received flocks of visitors long before 9/11. Amazingly the building was unscathed by the collapse of the north tower, literally across the street. Even headstones in the small cemetery, some so old the inscriptions are largely illegible, were undisturbed that day. In the days after, the iron fence that surrounds the block the chapel and cemetery occupy was festooned with thousands pieces of clothing left by visitors and sent from around the world – fire department jackets, shirts and caps. Today, the chapel is a public shrine to the memory of 9/11, largely due to the efforts of volunteers drawn from the congregation. The chapel showcases memorabilia from the day alongside the pew used by the Washington family. The clothing from the fence has been carefully stored away to be part of future displays.

In the cemetery behind the chapel stands the Bell of Hope. Created by England's Whitechapel Foundry, creators of the Liberty Bell and Big Ben, the bell was presented to the people of the City of New York by the lord mayor of London and the archbishop of canterbury on September 11, 2002. It has been rung on September 11 each subsequent year as well as being rung on March 11, 2004 to mark the Madrid train bombings and July 7, 2005 to mark the London bus and subway bombings.

In the summer of 2010 the New York City Fire Museum on Spring Street in SoHo opened a special display to both the fallen and the survivors of 9/11. Located in the rear of the refurbished 1904 firehouse that is the museum, the twin towers would have been visible through the special glass roof over the exhibit area. The rooms contain official FDNY photos of all 343 firefighters who perished as well as an extensive display

NYPD permanent substation in Times Square.

NY Fire Department Museum 9/11 display.

FDNY Engine 55 – names of firefighters from Engine 55 killed on 9/11 posted behind front passenger door.

Construction site June 2010 with picture of One World Trade Centre.

of personal protective gear that was retrieved from the site and a large number of tributes from around the world.

In addition to the personnel that were killed that day, FDNY also lost more than 50 front-line apparatus and a like number of support vehicles when the towers came down. As a stop-gap, reserve apparatus long past retirement age were brought back into service and a number of other American fire departments put off delivery of new apparatus to allow manufacturers to supply New York. While Seagrave has been the FDNY supplier of choice for many years, there are still a number of "one-off" pieces of apparatus throughout the department that serve as a reminder to those who know. FDNY units now display the names of those killed from their particular firehouse on the side of the apparatus cab as a very public display of tribute and remembrance.

Streets and parks in neighbourhoods across the five boroughs of New York and throughout the tri-state area of metro New York to have been re-named to honour the firefighters, police officers, and paramedics from those communities who died on 9/11. It has been said that one could travel the more than 22 miles from one end of Manhattan to the other by only using the streets that had three or four blocks renamed in this manner.

NYPD has more than 38,000 sworn police officers covering the five boroughs with a population of about eight and half million people. That works out to one police officer for roughly every 223 citizens. By contrast, Canada's largest 10 cities average a ratio of one police officer for every 581 citizens (StatsCan 2009).[1] Dealing with large-scale public events has been NYPD's stock in trade for many years, from the annual New Years Eve in Times Square festivities, free concerts in Central Park, and seemingly a parade a week down Fifth Avenue. Before 9/11, NYPD had less than two dozen police officers engaged in anti-terrorism duties. Today, that number is grown to more than 1,000 – a direct result of the return of Ray Kelly to the position of police commissioner at the end of the Giuliani administration. The anti-terrorism bureau today gathers intelligence at a level unheard of for a municipal police force. Inspection teams do frequent on-site inspections of major infrastructure and public places, while Hercules teams, patterned on military special-forces teams, are on duty 24/7. Traveling around the city in unmarked black SUVs, the teams will appear literally without advance warning to conduct spot checks at subway stations, transit hubs, or major attractions such as the Empire State Building. After the Moscow subway bombings of March 2010, Hercules teams armed with automatic weapons routinely rode New York subways, providing a deliberately high profile presence.

As cities across North America are feeling the effects of the economic crises of recent years, the price tag for providing fire and policing services is placing an increasingly onerous burden on local governments. It is no different for New York, just more so. City statutes enacted this year limit parades to five hours maximum duration and shorten their routes by 25% in a move to save $3.1 million in police overtime and other city expenses. To put this in perspective, the 2010 Puerto Rico Day parade in June 2010 drew more than 2 million along its abbreviated route on Fifth Avenue. The fire department is in an on-again, off-again struggle with firefighters and their union to rein in mounting sick leave and the resulting overtime. Hundreds of positions could be eliminated if the city is successful in removing a fifth firefighter position from 60 engine companies, with an estimated saving to the city of $20 million annually.

Under the light of the many enquiries that started immediately in the wake of 9/11, it quickly became apparent how the lack of a cohesive strategy for joint operations had played a pivotal role in the events leading up to the collapse of the buildings. One media observer had likened the police and fire departments

as two 400-pound gorillas in a room, with no one at City Hall posessing the political will to force them to work together. In January, 2002 FDNY and NYPD made some preliminary moves to improve coordination. Liaison positions were established with one another's headquarters, a committee of senior chiefs was created to resolve operational issues, FDNY chiefs began to fly on police helicopters in certain emergencies, and testing began to determine whether FDNY could use NYPD's communications system to enhance radio communications. Direct phone lines were installed between NYPD, FDNY, and EMS dispatch centres enabling direct communication.

FDNY is moving towards a trunked digital UHF radio system, but is facing the same negative feedback from users that has plagued many fire users as they transition from VHF to UHF; voice quality, clarity, and building penetration issues. The new buildings at the World Trade site will feature in-building radio repeaters, but there are still hundreds of buildings in New York City that pose huge communications challenges.

In May 2004, Mayor Michael Bloomberg announced the city was adopting the Citywide Incident Management System as the city's program for responding to and recovering from emergencies. Using established ICS protocols, the system establishes roles and responsibililties for city, state and federal agencies performing and supporting emergency operations. NYPD is the primary agency until such time as it is determined there is no criminal event or activity, with overall responsibility for site management. FDNY is the prime agency for life safety operations and decontamination. By all reports, following this protocol when responding to the 2008 crane collapse in mid-town Manhattan and the 2009 crash of a small aircraft into an apartment tower on the Upper East Side enabled NYPD and FDNY to work together seamlessly as well as integrate with a number of other city, state, and federal investigators.

Paul Dixon is a freelance writer and photographer.
He can be contacted by e-mail at:pd.dixon@shaw.ca.

Bell Of Hope – inscription reads "Forged In Adversity – September 11, 2001"

Displays of photos, personal prayers and other mementos left at the site in the months following 9/11 – now inside St. Paul's Chapel.

Proper GIS Implementation Can Improve Dispatch Center Accuracy & Reliability

By Nathan D. McClure III, MPA, ENP, and Steven E. Loomis, FAIA, LEED® AP

The implementation of wireless Enhanced 9-1-1 has provided the impetus for many public safety dispatch centers to implement computerized mapping.

While location information from wired telephones is typically provided in tabular form, location information from mobile devices, such as cellular telephones and automatic vehicle location systems, is typically provided as geographic coordinates (latitude and longitude). Consequently, there is a need for computerized mapping in order to convert the latitude and longitude information into a format that can be used by the dispatchers. While there are some relatively inexpensive mapping programs available, they generally are not suitable for public safety purposes. The accuracy of the programs can be problematic. In addition, the programs are generally not designed to work in a networked environment. The result is that these programs generally are not sufficiently reliable for public safety operations.

Integrating the dispatch centres' needs with a high quality Geographic Information Systems (GIS) can provide many benefits for the public safety community. Many governmental agencies are finding multiple ways to use GIS. They are also finding that sharing information between agencies can reap many benefits. For example, information on the public water supply can also be very useful to the fire departments. Jurisdictional boundary information is essential in determining the proper response. Information on new streets and developments is essential for a prompt emergency response. With a GIS, the data is shown in a series of selectively displayed layers. Only the relevant layers are displayed for the user. Since the creation of an accurate base map is an essential and time consuming activity, many communities are finding that the sharing of the base map to be an effective strategy.

The implementation of a shared GIS can significantly improve the accuracy and reliability of the dispatch process when combined with Enhanced 9-1-1 and other technology such as an Automatic Vehicle Location System. An interface between the Enhanced 9-1-1 system and the GIS sends the location information to the GIS. The GIS, functioning as the CAD Geofile quickly verifies the location and provides the recommended response. The map display feature can be especially helpful when the caller or the call taker is unfamiliar with the location.

The GIS can also be of great value in supporting crime and event analysis, especially if the GIS is also interfaced with the Records Management System (RMS). The GIS can correlate information on various types of incidents and provide a visual display, plotted on a map to improve analysis.

Many emergency communications centres must maintain multiple data bases in order to provide all of the required information. Keeping the various databases coordinated is a major challenge. The Master Street Address Guide (MSAG) is used to route the calls to the correct center. The CAD GEOFILE is a data base consisting of the address ranges and boundaries of each street segment. It also identifies the recommended response order for that segment. For example, unit 123 might be the designated first unit to respond; 122 the second; 124 the third, and so forth. When an incident location is entered into the system, the location information is compared to the data base. If the address is valid, the system will then recommend the units to respond. The more sophisticated systems are capable of recommending responses based on the nature of the incident and the availability of the responders. For example, if unit 123 was not available, the system would recommend unit 122 if that unit was available. If the nature of the incident was such that more than one unit required, many systems are capable of making that recommendation.

Governmental entities are finding that computerized Geographic Information

Systems are a valuable tool to identify streets, boundaries, infrastructure elements, property information, and other location based information. GIS is rapidly becoming a valuable tool for public safety agencies in general – and public safety dispatch centres in particular.

Nathan McClure III, MPA, ENP, is an associate and public safety consultant at AECOM (Lynchburg, VA). He has more than 40 years of public safety communications experience, included 17 years as the director of a consolidated 9-1-1/dispatch center and eight years as an emergency services coordinator. In addition, he has more than 21 years experience as a volunteer or paid-on-call firefighter and medical first responder. Nate is a past-president of APCO International. His current engagements include design and renovation of existing centers, assistance in implementation of NexGen 9-1-1, consolidation, and relocations and cutover planning assistance. He can be reached at nathan.mcclure@aecom.com.

Steven E. Loomis, FAIA, LEED AP, is an assistant vice president and the Projects Director for Justice and Public Safety with AECOM (Virginia Beach, VA). In his current position, he is responsible for the firm's public safety projects, including space and master planning studies, renovations, additions, and new ECC/EOC designs. He has more than 20 years of professional architectural practice, where he has promoted programming, planning, and design focused on public safety issues. In the past ten years, he has completed a number of new public safety operations centers. He can be reached at steve.loomis@aecom.com.

Somebody Has To Die:

Leadership Guide to Enduring Customer Service

By Sue Pivetta, President, Professional Pride, Inc.

"Somebody Has To Die" was originally the title of an article promoting simulation training in our comm centres. However, a comm centre director called and said, "You are so right, someone here has to die." This wasn't really what I had in mind. He was frustrated over numerous customer service complaints. He asked if I could develop a course on customer service for call takers?

Our ensuing conversation revealed he wasn't really clear what the term "customer service" meant in public safety communications! After all, *losing* a customer in this profession wasn't quite the same as *losing* a customer in business. Our customers can't find another 9-1-1. He wanted training to teach call takers to be **NICE**. Is it about being nice? Well, nice is always … nice but, the answer is no, it's not really about being nice. Customer service is about serving. The problem to be solved in the profession is who is being served anyway?

Now let's look at the word service. How do you best serve your caller? Of course that depends upon their NEED. A call taker is responsible for serving the need. If your caller is hysterical, the call taker would use repetitive control, intensity of will, and a strong parental voice – to serve their need for an expedient response. Being intense, stern, or firm does not mean being unempathetic, hardhearted, rude, or controlling; however, this might not resemble nice.

What about Rude or Abusive Callers

Serving a need takes a great deal of skill when our "customer" is rude, abusive, using obscenities, or being uncooperative. Under these circumstances it is only natural to be defensive and self protective while chastising the caller and refusing to serve if they don't straighten up … right? Not right, not even close to right – wrong, very, very wrong.

When Serving Yourself You Cannot Serve Another!

When listening to a call taker "fighting" back for the right to be respected and gain cooperation – you are witnessing self service. And serving self is simply a misunderstanding of the actual work. It is up to leadership to clearly define what service is and dispel any myth that callers have some duty to be anything but callers who have a need.

Leadership Role in Customer Service

Leadership has the duty to know more than the people they lead. Leadership serves the people they are intended to

lead. If there is a need within the ranks, it is up to the leader to fill that need. This is true for helping the call takers to understand their role, what serving is, and what self service means. But then the leaders must then provide their people with direction and tools to do their work. This will be difficult if the theory, methods and understanding of customer service is a fuzzy area Leaders can "UNfuzzy" this concept of service by using 9-1-1 calls to demonstrate the extraction of NEED of the rude callers and the NEED of the rude call takers.

For any job or work to get done, tools must be given to the person performing the work. Leaders can indeed provide their call takers with customer service tools. Those tools are what people who provide great customer service have and do use continually because they understand the nature of SERVICE and the nature of the work without feeling victimized by it. It is up to the leaders in the work to ensure a clear understanding of the nature of the work of emergency communications while offering tools used in order to make the work EASIER during those most difficult situations they face. The following are just a few of the tools.

TOOL: Understanding "The Rules" Theory

What is anger? Briefly, one part of anger is when you feel someone else has violated the RULES. Call takers who become angry at callers who use profanity, don't cooperate, or are abusive have a rule – something like: "Callers should be ……." The reality is callers shouldn't be anything, they could be many things, but generally they can be frightened, angry, frustrated, and are using their own "tools" to get what they want. Those tools might be inappropriate such as profanity, name calling, and so forth.

TOOL: Ignore the Inconsequential

The job is to send, this tool recognizes that below the caller's abusive behaviour is an actual need, acted out. The professional skill comes with using this tool for getting past the anger, defusing the controlling behaviour. Words are just words. Call takers can "serve" even the abusive caller by ignoring the inconsequential language or attitude by calmly getting to what the caller needs, which is generally a response, answer, understanding, or sometimes to vent.

TOOL: Becoming the Curious Observer

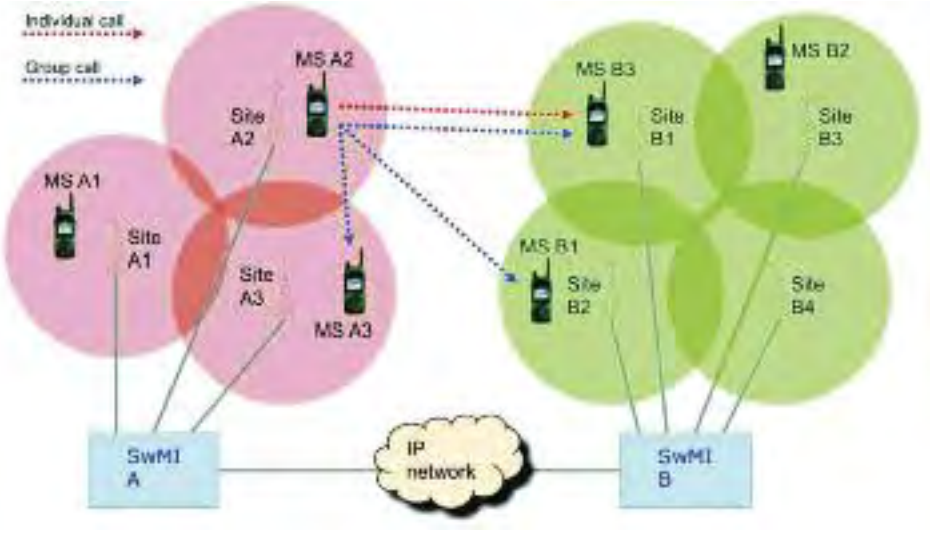
Abusive or obscene callers are again using the tools they've always used in life to get what they want. The same goes for the caller who seems to be very, very cooperative, "Yes ma'am! Whatever you want sir!" In lieu of becoming offended, hurt, or feeling disrespected, call takers can use a little switch in the back of the brain to become the curious (even amused) observer. This allows the call taker to simply step back and say, "Hmmm, how curious that this person could be so abusive to someone trying to help." And within the thought process the call taker could say in their own mind; regardless and nevertheless my job is to serve this person, what is it they NEED?

Conclusion

These are just some of the tools named and explained for those who do not have a clear understanding of the service role of the emergency communications professional. With tools the call taker can put into practice methods of overcoming the seemingly natural impulse to defend when "attacked." However, these so-called tools are indeed "so-called" unless through training or retraining, clear and definitive demonstrations of the successful use of the above tools are presented. I have also found providing examples of a call taker being self serving (once defined as self serving) is all it takes. Your brave and dedicated professionals will appreciate the clarity about the concept of customer service. Opening a clear dialogue and discourse will instil an enduring understanding of service and no one will have to "die."

Sue Pivetta is the president of Professional Pride, Inc and can be found at her website www.911Trainer.ca. Sue worked as a comm centre supervisor, implemented a 630 hour college vocational program for 9-1-1, and has worked internationally training and consulting on training and motivation and morale. She is the author of many training products and books, to include Customer Service 9-1-1, a workbook and PowerPoint presentation for trainers on the tools described above.

The Power of ODINI



Scenario 1: tactical patch, cross-border cooperation of public safety officers

The On-Demand Intelligent Network Interface (or ODINI for short) is a solution to interconnect Private Mobile Radio (PMR) networks, both fixed and mobile, that support group and individual-oriented communications. ODINI is an interface based on a modern IP-based network architecture, which allows for integration of legacy, current and new radio networks, telephony and PC-based applications to support interconnection of voice and data calls. This whitepaper explains the usage cases for ODINI, the functionality offered, and the added value of ODINI in comparison to other solutions.

Virtually all network solutions for professional mobile communications are based on proprietary system architectures. Although the air interface may be

compliant with an open standard such as TETRA, the internal interfaces are not open for integration of products from other suppliers. End-users requiring seamless nationwide coverage cannot use equipment from multiple suppliers and therefore have to depend on a single supplier for all TETRA requirements. This results in a vendor lock-in, which unfortunately prevents system expansions, interworking between different networks and future migration to newer technologies.

The ODINI initiative is an attempt to remove the barriers of closed system architectures. Similar to the multi-vendor IP equipment market, ODINI allows interoperability between PMR systems, including TETRA networks, on the basis of open standards.

ODINI has been developed in close cooperation with end users and independent system integrators. A significant number of end-users have been consulted, and a large number of interactive meetings have been held with public safety agencies around the world in order to establish the requirements and find possible solutions for PMR network interoperability. Without exception, all end-users have confirmed the need for open solutions.

The development of ODINI has received the attention of major European partners, which has resulted in joining a European funded program referred to as Heterogeneous Networks for Public Safety (HNPS). This program allows Rohill to develop ODINI as a real open standard with the help from universities, industrial partners and end-users.

The objective of ODINI is to create an ecosystem of products and services in a multi-vendor environment. The truly open architecture of ODINI is emphasized by publishing the draft ODINI standard as an open specification, and making the ODINI gateway software available as open source.

Challenges

During the meetings with end-users and system integrators it became clear that there are very diverse requirements for interoperability. The first challenge is to allow interoperability between different PMR networks during events and incidents. Even multi-agency networks do not always provide interoperability. For example, security personnel or private fire brigades working on a private PMR network cannot communicate with public safety officers working on a nationwide network, even when both user groups use TETRA-based radio networks.

Although the public safety networks should be kept under strict control of control room personnel, it would be helpful to allow the control room operators (dispatchers) to communicate directly with user groups in the private networks, or to "patch" communication between user groups in both networks during the incident.

The second requirement comes from the need to integrate different networks of the same end-user. Often there is no or limited interoperability between the PMR network, the data network (LAN, WAN) and the telephony network. This means that information available in the police station cannot be retrieved by the police officer on the street or in the car. This may be solved by installing an overlay mobile data network, but a higher level integration based on middleware could also solve this dilemma in a network-independent fashion, whereby coverage does not have to be guaranteed for all networks on all locations.

As mentioned before, vendor lock-in is another challenge experienced by end users. Proprietary architectures do not allow system interoperability of base stations and dispatcher work-stations from other vendors. Although this particular problem is almost impossible to address, it is certainly possible to interconnect networks based on available system Application Programming Interfaces (APIs) in order to expand the coverage of existing networks.

Another practical problem faced by end-users is the inflexibility of existing infrastructure solutions to perform software upgrades step-by-step, to adapt a region specific configuration, or to find solutions for redundancy in order to achieve high availability. The top-tier TETRA infrastructure suppliers have promised to solve a number of these dilemmas using the TETRA Inter System Interface (ISI).

Although this interface is now completed as a TETRA Interoperability Profile (TIP) and initial tests have been successful, there are quite some limitations found in the ISI. These include the high cost, the fact that it relies on almost obsolete technologies (E1, ISDN Primary Rate), and that it supports roaming, individual voice calls and SDS transfer only. Group calls, which more than 80% of the users within the public safety user groups rely on, are not supported!

Scenarios for Interoperability of PMR Networks

Three different scenarios are identified for system interconnection. Not all scenarios may be applicable to all end-users. Whether or not the mentioned scenarios are useful strongly depends on the end-user organization and existing networks in place.

Generally speaking, the earlier the end-user is in the process of planning and deploying TETRA networks, the more scenarios may be applicable. Additional scenarios may be applicable for interconnecting networks; the listed scenarios should be regarded as examples of real-life scenarios experienced by end-users.

Scenario #1: Tactical Patch

The tactical patch scenario can be interesting for two applications. The first application is cross-border cooperation of public safety officers, which can also be two different regions in a large country. This scenario is shown on page 17 (Scenario 1: tactical patch, cross-border cooperation). One example of cross-border cooperation is a coordinated effort to raid a criminal organization operating in different

countries. Instead of using GSM and fixed-line phones, it would be preferable to allow police officers in different countries to use TETRA terminals to communicate as one team. In a more hierarchically driven organization, the officer in charge may have the supervision and only stay in contact with a foreign police force, or the supervision may be performed from one control room only. In any case, the tactical patch is useful to allow transparent communications between two (or more) normally unrelated talk groups within two separate networks. Obviously, group calls are most important in this scenario. Individual calls may be applicable as well, but should be regarded as special calls while it is required to know the terminal number in the foreign network.

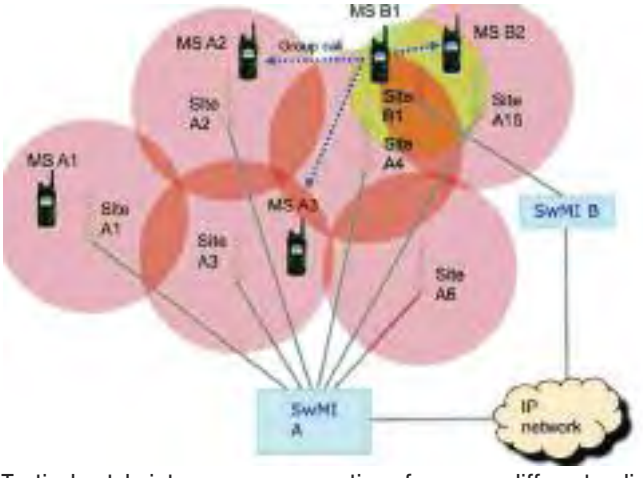
This number can overlap with existing numbers, thus requiring a kind of prefix in order to dial directly. The second tactical patch scenario is to interconnect overlapping networks from different organizations. This scenario is shown below. Inter-agency cooperation is applicable to users working in different radio networks, which need to communicate with each other during an incident or event. Authorization for cooperation is typically granted by the officer in charge within the control room of the regional or nationwide network. Some examples of inter-agency cooperation are:

- Cooperation of private fire brigades with their public counterparts during a large-scale incident or disaster. Private fire brigades are typically deployed by airports, tunnel operators and large industrial plants.
- Communication of security personnel with public safety officers in the control room during incidents. Applicable to sports stadiums, airports, shopping malls.
- Communication of armed forces to police officers. Military personnel operating on a private system within a military base or compound can interoperate with public safety officers during events or incidents.
- Communication between fire brigades, (nationwide or regionally operating) police and medical services during a large-scale incident or disaster. This scenario is applicable only if these agencies operate their own networks.
- Connection of a rapid deployment system to the regional or countrywide network to scale up capacity during a large-scale incident or disaster. In this scenario both networks are supervised by the same user group. Group calls are basically the only means of communication in these scenarios. Also in these cases, the tactical patch connects two (or more) normally unrelated talk groups within two separate networks.

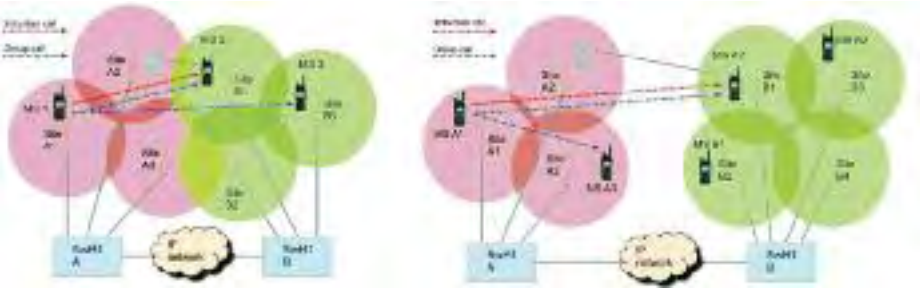
Scenario #2: Expand Coverage

Expanding coverage of an existing radio network by deploying additional networks requires multiple radio networks to act as one single radio network. This is a challenging scenario, as all current radio networks are based on proprietary architectures, and thus cannot be integrated easily. This scenario is illustrated in Figure 3 (left).

The need for this scenario is obvious, as it provides choice for the end-user when there is a need to expand coverage or capacity. The end-user does not rely on the original supplier only, thus avoiding vendor lock-in and improving competition. For TETRA network interoperability, the terminals should be able to work in both networks without reprogramming. This means that the



Scenario 1: Tactical patch, interagency cooperation of users on different radio networks



Left to right: Scenario 2, expanding coverage of an existing radio network. Scenario 3, migration to other network.

Mobile Country Code (MCC) and Mobile Network Code (MNC) shall be equal for both networks, and also the same subscriber database is shared in both networks.

In practice, this is possible only if the networks are operated by the same agency. Apart from the need for subscriber database synchronization, also support of a rich set of functionalities is expected. This includes group calls, individual calls, text and status messaging, roaming, handover, packet data gateways, encryption, authentication, and supplementary services such as calling line identification, talking party identification, pre-emptive priority and so on.

Scenario #3: Migration to Other Network

The third scenario is about operation of radios in foreign radio networks. This is illustrated in Figure 3 (right) – migration to other network. This scenario is very similar to how roaming of a mobile phone to a foreign cellular network works. When moving the radio outside of the coverage area of its home network, it starts searching for other radio networks. When the foreign network indicates that migration is supported, the radio terminal will attempt to register on the foreign network as a visitor.

Using an authentication-based handshake mechanism, authorized radio terminals will be granted access as visitors to the foreign network. In TETRA this scenario is referred to as migration instead of roaming. The objective of this scenario is identical to the TETRA Inter System Interface (ISI). But because the ISI is currently limited to support of individual calls and SDS and status messaging only, the aim of ODINI is to support all functionalities which are important to end-users of mission-critical radio networks.

A real-life example of this scenario is cross-border operation of public safety officers. When an offender is crossing the border during a car chase, the police can continue communicating while driving into the foreign country. Obviously, the jurisdiction should allow this type of scenario, but with the focus on international collaboration to combat crime, there is certainly a trend to allow cross-border operations.

The Solution: Integration Based On IP

ODINI aims at supporting the listed practical scenarios by means of an open solution. Although some interoperability solutions already exist, they are often too limited in their functional scope, are based on proprietary solutions, or are based on (almost) obsolete technologies. ODINI is ambitious in respect of supporting different scenarios and providing a wide range of functionalities.

However, the focus is on simplicity by eliminating unnecessary mechanisms, which are often found in telecomms standards. In addition, ODINI is based on existing, proven IP networking standards, which eliminates the need to define and validate the lower layer protocols.

Current state of IP technology The Internet Protocol (IP) has evolved into a set of standards, which now also addresses the requirements for mission-critical networks. An excellent example is Multi-Protocol Label Switching (MPLS), which allows deployment of a true nosingle- point-of-failure network when redundant paths exist in the backbone network.

Switchover to redundant paths is almost instant by using traffic engineered tunnels. Another trend is using the User Datagram Protocol (UDP). This protocol allows real-time transport of speech and time-critical data packets. When used with the proper user protocols, very fast and robust communication channels can be built. IP Multicast is yet another emerging method to distribute group-oriented speech and call-related events. IP Multicast saves bandwidth and allows massive scalability of networking systems and devices. On Local Area Network (LAN) level, the Differentiated Services (DiffServ) QoS architecture is applied, which is using the Differentiated Services Code Point (DSCP) implementation in IP routers, IP switches and computer operating systems to allow selection of Quality of Service (QoS), which can be translated into different requirements for forwarding IP packets in a heterogeneous IP network.

Together with MPLS, implementation of DSCP enables the deployment of multi-services IP backbones, which provide reliable transport of any type of IP traffic through a single network, ranging from office networking, VoIP telephony, CCTV up to telepresence with high-definition video.

ODINI uses these open standard based products and solutions to provide mission-critical availability, robust and fast operation, scalability and efficient use of network resources. Cisco and Alcatel-Lucent are two prime examples of manufacturers with a rich portfolio of ODINI-enabling equipment. ODINI can thus reap the benefits of these technologies without diverting to proprietary solutions.

Alcatel-Lucent MPLS-enabled Router

The ODINI protocol ODINI is a user-level protocol, defining the interaction between nodes based on peer-to-peer relationships. In contrast to client-server protocols, ODINI does not define a hierarchy in operation. Although this may sound unpredictable in terms of control, this concept provides less dependency on network resources, improving resilience when system or link failures occur.

The core of the ODINI protocol is both simple and elegant. Push-to-Talk (PTT) operation is supported by a smart algorithm offering the best possible user response, even when high delays are present in networking links. In addition, robust operation is guaranteed, even when intermittent link failures occur. This makes the protocol suitable even to run over the public Internet through VPN connections, or through satellite

links. The call-oriented messages are derived from existing telecommunication standards. This means that these are based on proven, well-validated protocols, running over a modern IP-based backbone instead of using synchronous communication links offered by SS7 or ISDN-PRI.

The Extended Markup Language (XML) is used to encapsulate the ODINI messages. XML provides a well-defined, extensible and open method to transport messages over IP networks. The flexibility of XML allows the ODINI protocol to be expanded and refined without losing backward compatibility.

The Future of ODINI

The ODINI protocol is very flexible and powerful in terms of applications. Currently, ODINI fully supports the tactical patch scenarios for group calls. On short term, support of individual calls and the scenarios for expanding coverage and migration to other networks will be supported by protocol extensions. Note that implementation of ODINI is not limited to one air interface protocol only: also networks with different air interfaces (TETRA, TetraPol, APCO-25, DMR) can be interconnected by means of ODINI.

Interoperability between Networks and Devices based On ODINI

In the longer term, ODINI will also provide interoperability between devices operating on IP-enabled mobile networks. Today, these networks are not robust enough for mission-critical applications. But with the implementation of fine-grained Quality-of-Service, for example within the WiMAX and LTE standards, it is expected that TETRA functionality can be made available on terminals without sacrificing call setup delay and robust operation.

In principle, ODINI is already capable of this, but further definition of typical TETRA services over IP through ODINI is necessary to provide identical services in order to emulate the rich functionality of TETRA.

The ODINI Ecosystem

ODINI can be regarded as a middle-layer protocol, supporting different scenarios with one common requirement: mission-critical communications. As explained before, this market is currently dominated by companies promoting proprietary solutions. To avoid another proprietary solution to the listed scenarios, Rohill has decided to take a dramatically different approach: the ODINI protocol will be published with no restrictions on disclosure, and open-source software will be made available to interested parties in order to stimulate deployment of ODINI.

The rationale behind this approach is simple: Rohill believes that this is the most effective method to open the markets which are currently tightly controlled by a few large suppliers, as well as to create an environment in which best-of-class products and services can be combined and re-used in multiple projects.

The ODINI ecosystem is based on Commercial Off The Shelf (COTS) products in combination with software-based solutions from third-party suppliers. It is obvious that the Rohill TetraNode product is ODINI compliant, but it is not expected that Rohill can or will supply solutions to interconnect other brands of radio networks.

This is enabled by ODINI partners, who have the expertise and access to the market to develop and supply these products. System gateways are necessary to make a third-party infrastructure compatible with the ODINI protocol. By means of the system gateway, it is therefore possible to support one or more scenarios for network interconnection. Supporting multiple scenarios often requires access to multiple interfaces in the third-party radio network. For example, speech calls are supported through existing dispatcher interfaces, while migration requires a (simplified) TETRA ISI, and extending coverage requires subscriber provisioning and call diversion capabilities.

(The exact requirements for interfacing to ODINI gateways are outside the scope of this whitepaper.) Based on the open ODINI specifications, any supplier can develop a new or customize an existing dispatcher solution for operation within an ODINI network.

The simplicity of ODINI allows fast implementation without the worry to understand and support multiple supplier-specific interfaces. Rohill can offer readily available solutions based on the LDS 'Chameleon' and LDS 'Gecko', which can operate in ODINI mode instead of interfacing with the native TetraNode TIG protocol.

Voice and data logging is enabled by capturing voice and data within the IP network through the ODINI protocol. The logging server can attach to an ODINI group in order to receive speech, data and call-related events. If individual calls within the radio networks are also transferred out of the infrastructure, it is possible to also record these voice and data calls.

Rohill supports this with their TetraNode Voice-data Logging Server and Client solutions, which provide efficient storage of speech, SDS, status and location reports. The distributed database server is an optional component within the ODINI ecosystem to provide reference database records in order to support roaming and individual calls between radio users operating within different networks. Although the routing information is cached in the system gateways as well, the distributed database server is essential to quickly get a system up and running again after equipment or link failures occur.

The telephony gateway supports a number of scenarios for tight integration of radio networks with VoIP telephony. Using the telephony gateway, users within the fixed and mobile telephone domain can access dispatchers as well assubscribers within the radio networks, and even talk groups within one or more radio networks.
Possible applications also include Public Safety Answering

Point (PSAP) networks (112, 911).

TETRA client

A TETRA client application is part of the ODINI roadmap in order to provide powerful TETRA functionalities on devices connected through mobile IP networks. As stated before, the current mobile IP networks are not really capable of providing mission-critical services, but it is expected that this will improve in the coming years. Interoperability of ODINI through mobile IP networks opens up interesting use cases, such as:

- Group-oriented communication, including support of selected and scanning groups. The ODINI protocol ensures robust and low-delay operation of PTT and speech transfer;
- Priority and pre-emptive emergency calling, including the ability to override existing voice calls;
- Transparent End-to-End Encryption between TETRA terminals and mobile phones operating on commercial networks.

Conclusions

The goal of the ODINI initiative is to open up proprietary solutions of mission critical radio networks. End-users can benefit on short term from a wide choice of applications within the ODINI ecosystem and enjoy increased competition and wider choice of interoperable radio networks.

ODINI is access network air interface independent. This enables integration with existing PMR networks. Also end-to-end mobile IP services are supported, which makes TETRA more future proof by offering TETRA functionality through mobile IP networks.

ODINI benefits from recent developments of IP networking standards. Solutions are now available to build true no-single-point-of-failure IP backbones which can carry any type of IP traffic, including ODINI speech/data.

Finally, the decision to embrace open protocols and open source is the key to wide participation of the industry, system integrators, academics and end-users, increasing the chance that ODINI will become a true open standard without reliance on one single company.

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