TETRA Touch

Nokia TETRA customer newsletter • www.nokia.com/tetra_touch • Vol. 2 - 2003

Norway's TETRA pilot stands the toughest test

Benefit from TETRA data services

CONTENTS 2/2003

The benefits of TETRA data services
– How data communication can greatly improve the efficiency of any public safety organisation.

➔ Read more on page 4

Small cover photo: Adresseavisen

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NOKIA
CONNECTING PEOPLE

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TETRA pilot system in Trondheim overcame its biggest challenge in December 2002. The Fire Department staff share their lessons learned. 7

photo: Adresseavisen

20

Learning the fine points of TETRA – Introducing two innovative solutions for learning the Nokia THR880 radio.

photo: Adresseavisen

Public cellular networks and critical operations – Find out why Emergency Services cannot rely upon public cellular networks during crisis. 28

The new rules of public safety communications

We have entered a new era of public safety communications. No longer is it enough to have traditional radio communications limited to a single local agency. Today's more complex, wide area and multi-agency communications require new technology and capabilities.

Small private radio networks offering only local coverage are inadequate: nation-wide, or operation-wide, service is a must. The required technology can no longer be based just on the terminals, the emphasis has moved to the infrastructure. Cost-effective and reliable operations with the ability to manage and update centrally are crucial for an economical communications solution shared by different agencies covering a wide geographical area. All of which means that we cannot consider radio communications and radio technology in its traditional meaning, but instead we must think about complex and highly capable mobile switching technology. This, in turn, has brought public safety communications closer in concept to the mainstream telecommunications technologies with new vendors in the market.

Unique opportunity for synergy

For many years now, we at Nokia have been developing our TETRA solution to meet the new needs of public safety communications. With a complete set of in-house technologies and experience in mobile communications, Nokia is the best placed company to provide a future proof and reliable solution incorporating the latest innovations. We aim to integrate the most suitable technologies to serve all the different needs of authority communications.

Voice services have always been at the core of public safety communications, but in this rapidly changing and developing world, data services not only add capability, but with their speed, accuracy and reliability, are also replacing more and more basic voice services. Nokia shown it is able to combine these two crucial services for reliable and effective field operations. The vast majority of operational TETRA networks have been delivered by Nokia. Advanced voice services, such as operation-wide group communication, are used today by many Nokia TETRA customers.

The TETRA market is continually advancing

The public safety communications market is opening up in most European countries as well as in the accession states. Governments are carefully studying the different options available, but we believe there is only one conclusion – the unsurpassed functionality of TETRA is the only solution covering the needs of authority communications.

An important recent milestone for Nokia TETRA was the agreement between Beijing Just Top Network Communications and Nokia for building the TETRA radio communications service for the Beijing Olympics. This is an expression of a mutual commitment to develop the Chinese telecommunications services. The TETRA community can expect to see more decisions like this during the coming months.

Matti Peltola

Senior Vice President
Professional Mobile Radio

Benefit from data services in Nokia TETRA

For public safety users accustomed to conventional analogue communications, switching to TETRA-based digital communications opens up an amazing new world of possibilities. Data offers a whole new set of communications tools that can greatly improve the efficiency of any public safety organisation.

While data communications will never replace voice as the main means of contact, it is a powerful complementary service that helps field officers better deal with the increasingly difficult demands they face. The Nokia TETRA System has been developed to provide data services that offer complementary capabilities to efficiently meet the needs of today's users. In some situations data can even replace basic voice calls.

There are three different data services in the Nokia TETRA system: Short Data Service (SDS), Status Messaging and Internet Protocol (IP) based services.

What can SDS do?

Almost anyone with a mobile phone will be familiar with the concept of text messaging. SDS is the TETRA equivalent to this useful mobile phone service, but brings some new possibilities. Routine voice calls that are made every day can be replaced by sending an SDS message, which can be quicker and a more accurate way to provide numbers and other detailed information. For example, a SDS to a police officer with the address of an incident is easy to send as text and eliminates the risk of the address being misheard during a voice call.

An ambulance crew that has picked up an accident victim can send an SDS with the patient's details and symptoms, enabling doctors to be ready to start treatment as soon as the ambulance arrives at the hospital emergency ward. The effectiveness of this technique for sending triage information was first successfully demonstrated in a large scale emergency exercise at Helsinki's Vantaa airport as long ago as 1998.

Or an SDS can be used to send an urgent message to a recipient that is unable to answer voice calls either because the handset is engaged or because of the surrounding environment or situation.

And in a similar way to group voice calls, an SDS can be sent to a selected group of users providing a fast means of giving simple instructions to many people simultaneously. The user simply selects a group from a folder on the handset and sends the message.

SDS messages can also be used as "data pipes" for a wide variety of applications. For example, vehicles fitted with a GPS-based Automatic Vehicle Location (AVL) system can use TETRA SDS for communicating with the Computer Aided Dispatching system at headquarters. Knowing the exact location of available units enables the dispatcher to com-

{ Data communications is a powerful complementary service that helps field officers better deal with the increasingly difficult demands they face. }

mit the nearest suitable unit to an incident, increasing operational efficiency and cutting emergency reaction times.

What can Status Messaging do?

Status Messaging is a very fast and efficient way for units to report their status to the control centre and even to other units. Status messages such as "at the scene", "in transit" and "off duty" are used many times each day. A set of these simple messages is stored in Nokia TETRA handsets which the user can simply select and send instantly. Status messages can be tailored to the needs of each organisation.

To save network resources, the Nokia TETRA system sends status messages as a series of numbers, which use minimal capacity. The receiving radio terminals and dispatcher applications translate these numbers to display the actual text message. Status messages also save capacity by eliminating the numerous voice calls to update each unit's status.

Status messaging can also be used to make callback requests. Often, dispatchers will be too busy taking emergency calls and dealing with many units to interrupt. In such situations some organisations instruct radio users to send dispatchers callback requests instead of calling the dispatcher directly.

Callback requests are also useful for other Professional Mobile Radio users than those working in public safety and security. For safety reasons, bus drivers may not be allowed to initiate calls. Instead the driver can simply press one button, which sends a callback request and the fleet controller then initiates the call.

Location is another essential application that benefits from TETRA status messaging. With the accurate location of units clearly shown on the dispatcher's screen, units can be more efficiently allocated to incidents, finding difficult addresses becomes easier, and the fastest routes can be calculated.

What can IP-based data services do?

The safety and effectiveness of officers in the field can be enhanced tremendously by fast and advanced data access. With Nokia TETRA System IP, users can access e-mail services, perform database queries, and transfer files and images from wherever they are located. Access to fast and efficient data services allows users to obtain precise information on accidents and addresses of incidents, detailed instructions on procedures and important information on potential suspects.

Typically, the amounts of data sent and received by public safety organisations are quite small, because both field units and the dispatcher must be able to assimilate transmitted text and images quickly and react with the same speed. IP is well suited to the kind of bursty traffic that a unit in the field will typically generate.

> TETRA data communications can revolutionise the work of public safety organisations.

Furthermore, public safety organisations have specific needs for wireless data communications. They must be easy to use, have a fast set up time and be efficient, reliable and secure – all of which are met by the Nokia TETRA system.

The applications are truly limitless. A common application for public safety organisations will be to give their personnel access from the field to the organisations' own databases as well as access to publicly available online information. Police officers can send and receive mugshots to quickly identify criminal suspects; check suspect vehicle license plates against police databases; fire and rescue organisations can access information about hazardous substances when dealing with chemical spillages, or they can view online the plans of a building to find the best means of entry.

TETRA data communications can revolutionise the work of public safety organisations. Exact, timely information, sent to and from field units, means much more than accurate data. It means a new way of working that allows organisations to use their available resources where they are needed most, and make the whole service more efficient and effective.

Talking across borders with TETRA

In a Europe of free movement, Emergency Services need to work across borders to guarantee public safety. The TETRA Inter-System Interface (ISI) provides seamless communications across borders and networks, customers should settle for nothing less.

The fight against the growing threats of organized crime and international terrorism demands that European public safety organizations can communicate with each quickly and effectively. The TETRA Inter-System Interface (ISI) is the key to this ability, allowing communications across borders and networks.

Interoperability is a key benefit of the TETRA standard – as well as reaching beyond physical borders and network boundaries, it also allows TETRA users to buy equipment on an open and competitive TETRA market.

The technology is ready for TETRA ISI - the standards are ready and published, and the TETRA Interoperability Profile (TIP) specifications are mostly ready. Operational needs are also known accurately enough to create a working inter-system interface.

Three-country pilot

Belgium, Germany and the Netherlands are currently testing and tuning the operational procedures in the Three-country Pilot project, looking at how well the TETRA standard meets the requirements of the Schengen Agreement. It is also harmonizing the organizational aspects of cross-border radio communication, such as ensuring that numbering schemes match up.

One is not enough

TETRA users demand interoperability for good reasons. To make it work, proper testing and certification is needed involving at least two suppliers. Nokia has already implemented a large part of the ISI functionality in the Nokia TETRA system and is looking forward to agreeing ISI interoperability testing schedules with other system vendors.

To unleash TETRA's full potential as a crime-fighting tool, customers should stay awake and demand that suppliers can deliver interoperable ISI solutions according to the official TETRA MoU TIPs – to maintain TETRA's full potential potential for international co-operation between all countries and networks.

TETRA Interoperability Profile (TIP) is a TETRA specification document that

- clarifies the TETRA standard
- is a bridge between standard editions
- guides implementation
- is a binding document for manufacturers

Scandinavian TETRA in the spotlight at seminar

Public safety projects were again in the limelight at the recent Scandinavian TETRA Seminar in Oslo with several presentations on the Norwegian TETRA public safety project. One highlight was a live demonstration of TETRA voice communication from the conference hall to the Trondheim Fire station, several hundred kilometers away.

Experiences from the Finnish VIRVE network were also presented by Janne Koivukoski, Director of VIRVE Unit, Ministry of the Interior, Finland. The 1200 base station VIRVE network provides nationwide data and voice services for tens of thousands of users.

Opening the meeting, Ray Ginman, Chairman of the TETRA MoU Association, described the global TETRA market in 2003 and pointed to two financial incentives for governments to select TETRA: providing the capacity and security for nationwide, shared networks and the potential to rationalize dispatcher centers. Moreover, said Ginman, TETRA provides features that GSM-based solutions cannot match: exceptionally high voice quality in noisy environments; continuity of group calls even when moving from cell to cell; fleet mapping; extremely fast call set up times; and Direct Mode operation.

Facts and figures

- 12–13 March 2003 in Oslo
- 215 delegates attended
- 17 exhibitors showcasing new products and solutions
- 24 presentations covering both requirements and solutions for public safety communications
- Speakers from Norway, Finland, Belgium, Iceland, Sweden, Denmark, Austria, Holland, and TETRA MoU.

Norway's TETRA
PILOT STANDS THE TOUGHEST TEST

In December 2002, the largest fire in Trondheim for decades led to the city's TETRA pilot system facing and overcoming its biggest challenge.

The RBA pilot network in Trondheim, Norway, is used by the Police, Fire and Health organization, as well as personnel from the Norwegian Defence, Red Cross and the Energy Sector. TETRA Touch spoke to Fire Department staff about the lessons learned.

Experience during the fire

Fire inspector Karl Kristian Hjelseth was in charge at the fire site and had to stay in contact with his fire fighters during the operation. "The TETRA system worked perfectly all the time, providing crystal clear, stable communication to all the TETRA radio users", he says. "A fire scene is very noisy and stressful, but both the radio users and the people working at the 110 dispatch centre could communicate without any problem."

Fire fighters were also satisfied with their Nokia radio terminals: "In particular, the battery life time was mentioned as very positive", Mr Hjelseth says. "Only one of the hand held radios needed a change of battery during the fire. Analogue terminals could not match this performance." Fire crews at the scene used the Nokia THR850 and THR420 portables and the vehicle mounted TMR400 mobile.

The fire in Trondheim was a lesson for the fire department in organizing operational procedures for major incidents. Senior Engineer Sissel Stemland, Leader, Fire Dispatch Center comments: "This was the first time we had used our fleet map application together with the TETRA talk groups and status messages in action. We were very satisfied, but think that we can improve things even further."

She also emphasized the importance of cross-organizational communication: "Not all the rescue services at the scene were using TETRA. Had they been, the officers in charge of different units could have communicated with each other much more easily."

Stemland concludes: "This is the first time that we have had a communication system working perfectly the whole time during a major incident."

Call out over TETRA

The Fire Dispatch Center in Trondheim also alerts the volunteer fire fighters. Previously it used pagers, but will now start to use TETRA status messages instead.

"We see significant advantages in alerting personnel by TETRA instead of by traditional pager", says Nils Petter Bryde, Senior Engineer, Norwegian Directorate for Fire and Electrical Safety. "The 110 Fire Dispatch Stations can immediately see who responds and can communicate with them. In this way, we can plan much more accurately. The volunteer fire fighters are also informed earlier about the incident and can prepare for it before even arriving at the scene. Better control of your resources means shorter response time."

Bryde considers the call out functionality vital for a nationwide TETRA system. "As three out of four fire fighters in Norway are volunteers, we must have a call out function if TETRA is to be selected as the communication system for the fire and rescue services."

The Call Out function is based on the Unit Alert status message in the Nokia TETRA System. When the alarm is received at the Nokia TETRA terminal, it will sound the alarm and alert the user.

"We will not let go of TETRA"

At the annual TETRA seminar in Oslo, Stemland and Hjelseth shared their experiences of the TETRA pilot. "I need to stay in touch with my men at all times and everywhere," Hjelseth said, and used his new Nokia THR880 to call his colleagues in Trondheim over 500 km away. The response was "loud and clear" and so were Hjelseth's final words: "We've used TETRA now for a long time and we never want to let it go!"

Photo: Adresseavisen

VIRVE-day a big success

This year, VIRVE-day attracted more than 230 delegates for the project's annual update. The event was a bigger success than ever in every respect: more delegates from all the user organisations throughout Finland followed the day's interesting programme. During the breaks the delegates had a chance to see an extensive range of products, applications and solutions by 30 developers and vendors – more than at the TETRA World Congress.

A major reason for this wide range of applications is that VIRVE is now ready to use. The network currently has 30,000 users, and many more are due to join the service, said Mr Janne Koivukoski, Director of VIRVE Unit in his presentation. He explained how VIRVE will be brought to the "routine phase" this year. The service exists and the focus is to fully adopt it. According to Mr Koivukoski, the majority of the users today represent the rescue services but also other agencies, such as the Finnish Customs and Frontier Guards, use VIRVE to its full extent. In addition to authority organisations, others, such as energy and security companies, may join VIRVE by special agreement.

Mr. Jouko Kottila, retired office engineer from the Finnish Ministry of the Interior vividly described VIRVE's early days and showed how 99% of the requirements drawn up in the 1980's are now fulfilled. Following this historical perspective, Mr. Markku Österman, Managing Director of Suomen Erillisverkot, the VIRVE operator, shed light on the performance of today's network. Continuous development was done throughout the roll-out period, and now that the roll-out is complete, it is time to move from project to customer oriented approach. It is now all about quality of service – the technology is ready to be put in the background.

All experiences positive

In the afternoon, user organisations described how users perceive VIRVE. Communicating with other organisations was given particular attention, as sharing the service, especially in major incidents, enables faster operations and more reliable responses. Multi-agency cooperation is more effective in Finland than in any other country, and the experiences are all positive.

In addition to sharing VIRVE with other Finnish public safety organisations, the Defence Forces have their own projects in Peace Keeping operations: Lieutenant Colonel Esa Salminen announced that when Finland takes over command of the multinational brigade in Kosovo, Nokia TETRA will be adopted as their communications system. After a thorough study of the other technologies and the existing system based on Tetrapol, TETRA was found to offer the best security and features. TETRA is also an open standard, enabling selection of equipment from several vendors.

Concluding the day, Mr. Rauli Parmes, Director of Unit for Office and Security Services at the Ministry of Transport and Communications, outlined VIRVE's role in a major plan to integrate all Finland's telecommunications systems. VIRVE has been a very successful "testing ground" for a multi-agency service such as that proposed for all Finnish authorities' telecommunications.

The world needs someone to take the lead, said Mr. Matti Peltola, Senior Vice President of Nokia. "Projects such as this are possible, but you always need a pioneer to show how to do it. Finnish authorities with VIRVE are paving the way for the rest of the Europe."

New director
helps VIRVE grow stronger

TETRA Touch recently caught up with Janne Koivukoski, who took over the lead of VIRVE, the Finnish public safety network, at the end of 2002. Here, he shares his experiences of authority communications, as well as looking to the future of TETRA in Finland.

Originally a physicist specializing in radiation technology, Janne Koivukoski's professional career looks like a natural progression to his latest role as the new director of Finland's VIRVE network.

With achievements that have included creating the automatic radiation monitoring system for Finland and creating standards for exchanging radiation information between the Nordic countries, his familiarity with VIRVE goes back to his days as telecommunications manager for the Rescue Services organization, still the biggest user of the VIRVE network.

Success in this led to him being appointed to revamp the administration of Finland's Emergency Response Centers.

TETRA Touch asked him how he came to take up his latest post: "When I left the Emergency Response Center administration project I was selected as Director of the Rescue Services Unit. Shortly after, the VIRVE administration needed a project manager to lead it into the maintenance phase and I was offered the post. I represented the biggest user organization in VIRVE and in my years in the Emergency Response Center project, I'd been working with the other user organizations too."

Koivukoski's experience of planning TETRA for the Emergency Response Centers also made him a natural candidate for the job: "It was a tempting challenge – TETRA technology interested me and I was keen to learn more about its benefits in real-life operation."

The task confronting him over the next few years is to put VIRVE on a steady footing for the future. Budget approvals and planning for maintenance are vital tasks, as is ensuring that there are enough users in the network. The rescue, police and frontier guard organizations will adopt VIRVE as planned, though Koivukoski says it will be more challenging to attract organizations that traditionally have not used private communication systems, such as the social and health services.

Better than planned

Although some people had unrealistic expectations of VIRVE, Koivukoski says the network is now better than originally planned: "I was surprised to find TETRA technology so superior and the high quality of the VIRVE network has also been a surprise." He also has an answer to those who consider VIRVE expensive: "If the users had adopted another technology, or built a TETRA network each, the costs would have been much, much higher."

Unpleasant surprises have been the budgeting and economics. The economic situation in 2003 has been worse than expected. Furthermore, not all decisions could be put to the political decision-makers before the parliamentary elections in March. Although these delays will not affect the operational use of the network, not all the coverage improvements can be implemented when planned.

The TETRA standard was designed for the needs of public authorities and Koivukoski dismisses claims that public cellular networks could be used for authority communications, describing them as "daydreaming".

A long future

He is also proud of VIRVE's status as the first network planned specifically for authority communications: "This been a huge undertaking for VIRVE organizations and Nokia and it has been very rewarding. The network is already very good and will be developed further, and it will live a long time. This is a new kind of network because the infrastructure can and must be maintained."

Koivukoski believes this approach may come as a surprise to many organizations, as it contrasts starkly with previous practice. Before, a radio communications system was bought, then used for 15 years, then replaced, but the TETRA network will be continually renewed so its lifetime will be long. He sees the standard evolving over time and though he thinks its future could be completely different from how we now imagine it, he believes that current elements can be used in the system.

"When organizations truly adopt the system, they will see its numerous benefits and, in fact, understand the superiority of the TETRA standard. As people in Finland and around the world recognize this, TETRA will go from strength to strength."

In his spare time, Janne Koivukoski is a passionate ice hockey fan, having both played and coached in the past. He is an enthusiastic follower of the national ice hockey league.

The Nokia DWSx:
The ultimate in TETRA

The Nokia TETRA system has been driven by the concept of the Virtual Private Network (VPN) and by security. The latest development is the Nokia Dispatcher Workstation Generation X (DWSx), which brings end-to-end encrypted (e2ee) communication to dispatcher stations. With the first TETRA e2ee radio terminals due on the market soon, Nokia TETRA customers will be ready to make their security tighter than ever.

What is end-to-end encryption?

Some organizations will always need the very highest levels of security, even within their own network. The answer to their wishes is TETRA end-to-end encryption or e2ee, which encrypts the speech in a transmitting terminal and transfers it through the air path and the whole TETRA network to the receiving terminal, where it is decrypted. In contrast to air interface encryption, or AIE, e2ee also protects against eavesdropping at base station sites, transmission lines and switches, giving a very high level of protection against interception.

Yet, end-to-end encryption and air interface encryption are complementary, not competing technologies. Usually an AIE with dynamic key is used in all Nokia TETRA networks, with e2ee used on top as an option. Because only AIE also encrypts the signaling, subscriber identifications and messages in the air path, AIE is essential for high security e2ee communication.

New Nokia DWSx: The e2ee dispatcher station

Both e2ee and clear mode voice communication can be used on the new Nokia DWSx dispatcher workstation, which switches to the correct mode depending on the other parties in the call – it also tells the DWSx user which mode is in use, preventing accidental communication in clear mode.

A subscriber with an emergency on his hands can use clear mode to request help in any of his terminal's groups, overriding the e2ee with the Clear Voice Over-ride, or CVO feature – an audible warning is given if a clear mode message is sent to an e2ee talk group.

Users will find it easy to move to DWSx from other Nokia TETRA dispatcher workstations, as it uses the same Microsoft® Windows™ based Nokia DWS interface, cutting the need to re-train.

The system consists of software and PCI cards installed on a PC, a headset and microphone, loudspeakers and a recorder interface for recording conversations.

Standard or special encryption – DWSx masters both

As well as the IDEA based encryption algorithm recommended by TETRA standards, Nokia DWSx can use other algorithms to suit a national encryption scheme – both IDEA based and national algorithm based e2ee users can work together in the same network.

Nokia DWSx uses the Generic Encryption Interface (GEI) to integrate the national encryption hardware module and interconnect the key management tools – the chosen radio terminals must also be integrated with a specific e2ee national scheme.

Whatever encryption method is employed, its security depends on the algorithm used and the encryption keys and their length, as well as effective and systematic key management. The 128-bit key size of the IDEA algorithm makes it impractical to carry out an exhaustive key search. A secret national encryption algorithm may give even higher security, although key management must be just as good as with any other algorithm.

Key management is the key

Keys are changed frequently to make it pointless to attempt breaking one – by the time a criminal has succeeded in breaking one key, the piece of information using that particular key will be obsolete and will not be valuable for criminal purposes.

Users must remember that e2ee communication can succeed only if a subscriber shares the same encryption key with all the others in the call, so key management tools must be common for all the organization's e2ee radio terminals and e2ee dispatcher stations.

Keys will be unique to each organization or group using the network and each dispatcher will only be able to use the keys which allow communication with the authorised talk groups. In addition to private keys for individuals and groups, different groups may share keys for e2ee communication in combined groups, while selected users or groups may have common keys that allow them to communicate between organizations.

security

Nokia's e2ee solution uses two types of key, red and black. Black keys, or traffic keys, are used to encrypt communication, while red keys are used to encrypt the traffic keys and are treated with the highest security.

Red keys are typically downloaded from the key management server into the DWSx over a cable or, in future, smart cards. Traffic keys are downloaded using **over-the-air-keying (OTAK)**, since the data is transferred frequently to a large number of radio terminals in the field. The **out-of-band (OOB)** method using physical media or connections can also be used.

With Nokia DWSx, keys are always flushed or erased when the dispatcher logs out. Key flush improves security when the DWSx station cannot be physically protected all the time and manual flush can be used if the dispatcher needs to leave the DWSx for a short time.

Flexible connectivity

Finding the lowest transmission costs is vital for any operator and the Nokia DWSx station can use several different connection methods to help achieve this. ISDN 2B+D or 1B+D connection is the best for remote facilities, where there may be only one or two DWSx workstations installed.

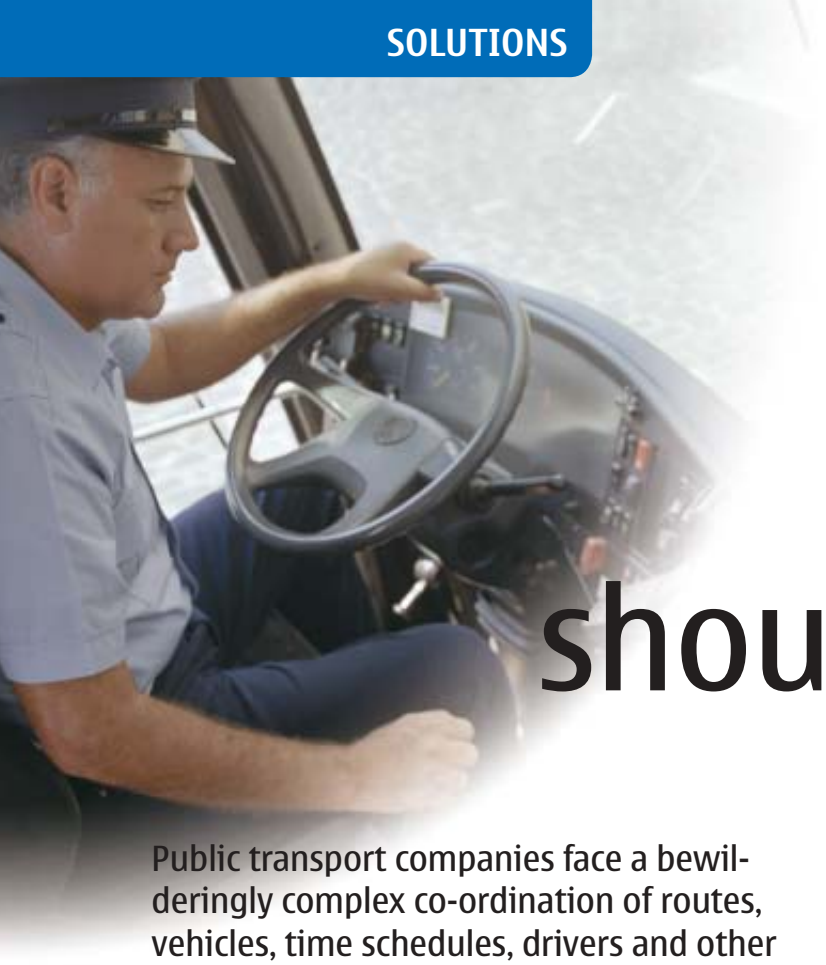
A high capacity E1 connection is more suitable for sites with several units. If the customer already has E1 connections or ISDN Private Automatic Branch Exchange (PABX) network, this will be the most economical option.

Virtual Private Networks improved with Nokia DWSx

One of the challenges of VPN solutions is to guarantee privacy and secrecy between organizations sharing the same infrastructure.

Nokia's innovative methods prevent classified information leaking into other organizations – these include access right profiles based on organization blocks and separating subscriber and group management facilities into organizations' own dedicated dispatcher stations. The e2ee DWSx brings a new dimension to VPNs making it an attractive choice even for the most security conscious organizations.

Nokia DWSx consists of a standard desktop PC with Nokia Dispatcher Workstation (DWS) application software, a set of PCI cards and audio accessories. An interface is provided for audio recording.



Transport should follow the

Public transport companies face a bewilderingly complex co-ordination of routes, vehicles, time schedules, drivers and other personnel. As a standard yet flexible communications system, Nokia TETRA helps public transport companies optimize their operations and give their customers a reliable, predictable transport service.

Increasing costs and growing competition are forcing public transport companies to streamline their operations. Carrying passengers to the right destination at the scheduled time – reliably, comfortably and cost-effectively – are the keys to competing successfully.

To help them do this, these companies need a state-of-the-art radio communications system - Nokia TETRA is ideal because it offers group or individual call, fast call set up and an impressive range of other services that cellular telephones simply cannot support. In addition, control room or dispatching applications can be integrated with the TETRA network.

In touch with your team

A group call in Nokia TETRA is instant one-to-many "conference style" communication, allowing teams to communicate quickly and efficiently – if a driver or a dispatcher wants to talk to his team, he just selects the team on his radio terminal and presses the push-to-talk button, and he is instantly through to everyone at once. This saves time that would be wasted if he called people one by one.

In Nokia TETRA, status or text messages can also be sent to a group, providing a practical way to send information from either the dispatcher to the team members or from one vehicle to other team members.

Nokia TETRA allows a bus driver to be called using only the vehicle number – if the application managing the route and vehicle assignments is integrated into the system, the driver can be called using the route number, or a group call can be made to all the drivers on a particular route.

Talk groups can be fixed or temporary – if an accident blocked certain tram routes, the dispatcher would need to inform all tram drivers on the blocked routes. He or she can easily create a new talk group and reprogram the drivers' radios over-the-air. One group call is then all it takes to keep all the drivers up to date.

Not just voice, but data too

As well as voice communications, public transport needs data communications to receive instructions and report status. Nokia TETRA supports status messages, Short Data Service (SDS) messages and IP data.

Sending simple, predefined status messages is quick and easy. The message is selected from the on-screen menu, the short code for the recipient(s) is punched in and the "Send" button pressed. The message goes to an individual or to a whole group of people instantly and simultaneously.

Responding to a message is also quick – pressing the push-to-talk button automatically sets up a voice call to whoever sent the message.

To send a message that is not on the predefined list, an SDS message of up to 120 characters can be sent direct to the screen of the recipient's terminal.

Where is that bus?

Short Data Service (SDS) messages and IP data can work as carriers for many applications. Nokia TETRA provides powerful and easy-to-use interfaces to integrate radio communication with applications designed for dispatching, control rooms and fleet management.

A typical application for transport companies is Automatic Vehicle Location – terminals regularly send information about their location to update the dispatcher's map application, allowing the dispatcher to see exactly where each vehicle is. Coupled with the use of mobile data, a Vehicle Location System eases traffic handling and provides a better overview of the traffic and schedules of vehicles.

companies TETRA route

Dispatchers could also have simulations of schedules and displays showing critical traffic spots, intensity of delays and connecting routes. The same information can be offered to customers in the buses and trams or at their stops. Sometimes changes to regular schedules are unavoidable. Some applications allow announcements to be prepared for vehicles or routes and then transmit them via the TETRA network to vehicle terminals and speaker systems.

Applications also exist for monitoring and analysing the journey details of each vehicle, including speeds, passenger numbers and routes, producing a complete history of each vehicle's journey. The data and statistics can be used to further improve the transport services.

With an integrated TETRA-based system, public transport companies have the tool to optimize the use of vehicles and drivers, minimize idle time of buses and drivers and reduce out-of-duty driving.

In an emergency

Drivers and passengers will sometimes face emergencies, whether due to accidents or criminal activity. Nokia TETRA helps a driver or passengers who may be in danger with a feature known as Emergency Call. The driver simply presses a special emergency call button on the terminal to initiate the call. The dispatcher will receive the emergency call and take immediate action. If the vehicle is equipped with a Global Positioning System (GPS), the dispatcher can also see the vehicle's exact location on a digital map.

The radio terminal in a vehicle or in the driver's pocket is not only a data terminal and a means for group communication – it can also make normal mobile type calls between TETRA network users and to outside networks such as Public Switched Telephone Network (PSTN) and mobile networks such as GSM. The Nokia TETRA System brings flexibility to call rights, meaning that it can define whom a subscriber can call, both inside and outside the TETRA network.

Nokia TETRA system's voice and data services and its special features can help public transport companies fulfill their mission – to improve their operations and create superb passenger services.

Integrated voice and data benefits Helsinki passengers

Helsinki City Transport operates a fleet of about 700 buses and trams. The company's advanced, integrated voice and data communications system, OHJA, runs over Nokia TETRA and maintains the vital contact with their mobile staff and their eight control rooms.

Every day, Helsinki City Transport (HCT) carries nearly 730,000 passengers. To improve its service, the company decided to modernise its radio communications system, with the aim of replacing the existing system by spring 2002 – it had just 15 months to decide on technology and suppliers and to build the new system.

HCT considered two technologies, GSM and TETRA. A GSM-based solution would have been economical to implement, but operating the system would have been expensive with all voice and data traffic being metered and charged for. Neither could it offer the features that were critical to the company's operations, such as Group Call function.

"Helsinki City Transport decided to choose a private TETRA network, mostly because of the reliability of the system, in unusual as well as normal conditions. The best solution was offered by Seasam House," says Timo Ketola, Director of HCT Tram operations.

Automatically correct routes

The solution – the OHJA dispatching application developed by Seasam House – is used for all voice and data communication for the HCT tram and bus fleets and personnel. The application was integrated with the timetable and maintenance databases of Helsinki City Transport and, for example, automatically sends the correct routes to the corresponding vehicle terminals.

The system also helps to ensure the safety of staff and passengers, through the special TETRA safety feature, Emergency Call. As each vehicle has been equipped with a GPS module, the fleet manager receiving an Emergency Call also sees the vehicle's exact location on a digital map.

In addition, the application helps to achieve real mobility in communications: individual calls can be set up between any two radios, and group calls allow users to talk with a group of other radio users.

Dial a route, not a bus

It also makes managing the services easier. For example, a dispatcher can set up a call to a bus driver by dialling a number that represents the route the driver is working on, so it is not necessary to know which vehicle is on each route. Furthermore, vehicles can be organized into groups that are either fixed or can be formed and modified at any time.

Seasam House Oy will also deliver a passenger announcement application to HCT to produce and control the announcements sent to buses and trams.

Finnish company Seasam House develops software products and solutions that help companies and organizations increase their time efficiency, improve services and enable the widespread use of data systems.

➔ www.seasam.com

Mr Yousuf Ahmed Khan

First phase of Bahrain TETRA network goes live

The first phase of the Kingdom of Bahrain's nationwide communications network, including 19 base station sites, was commissioned by Nokia's value added reseller ATLAS Telecommunications of UAE in January 2003.

State of art technology developed by Nokia will give the Kingdom of Bahrain not only high quality telecommunication facilities, but also a highly secure nationwide system. Using the Nokia TETRA system, the network also includes advanced data services such as Automatic Vehicle Location (AVL) and WAP.

The Nokia THR880 handportable radio, a member of the latest generation of heavy-duty handheld radios, will be supplied as part of the TETRA system. Nokia THR880 has also been deployed in significant numbers with the 'in car' fit, providing users with much greater flexibility.

User feedback to date has been positive, with particular comments made on its voice clarity, coverage (outdoor and in-building) and operational flexibility and control.

ATLAS, the Professional System Integrator for telecommunication services in the Middle East, is the official representative for Nokia TETRA System and terminals in the region.

Mr Naseer Ahmed

No fear of flying – TETRA Air to Ground

Despite its name, Air to Ground has nothing to do with air traffic control.

Its role is to provide airborne users the same TETRA service they would enjoy on the ground. The main challenge for an Air to Ground service is network planning, as the service will never work properly if the network frequencies are not exactly right.

Network planning aims to minimize the interference that a radio terminal causes to other terminals and to base stations, which is something that happens in any cellular networks. However, when a radio terminal becomes airborne, it will experience and cause interference over a much larger area. To overcome this, the network needs air cells, widely spaced base stations that have a preference for serving air terminals. The air terminals themselves should also prefer to use air cells.

Airborne terminals can "see" more distant base stations than ground terminals, which means that not only must air cells be larger than ground cells, but they should also use their own set of frequencies, to minimize the interference caused by the air terminals.

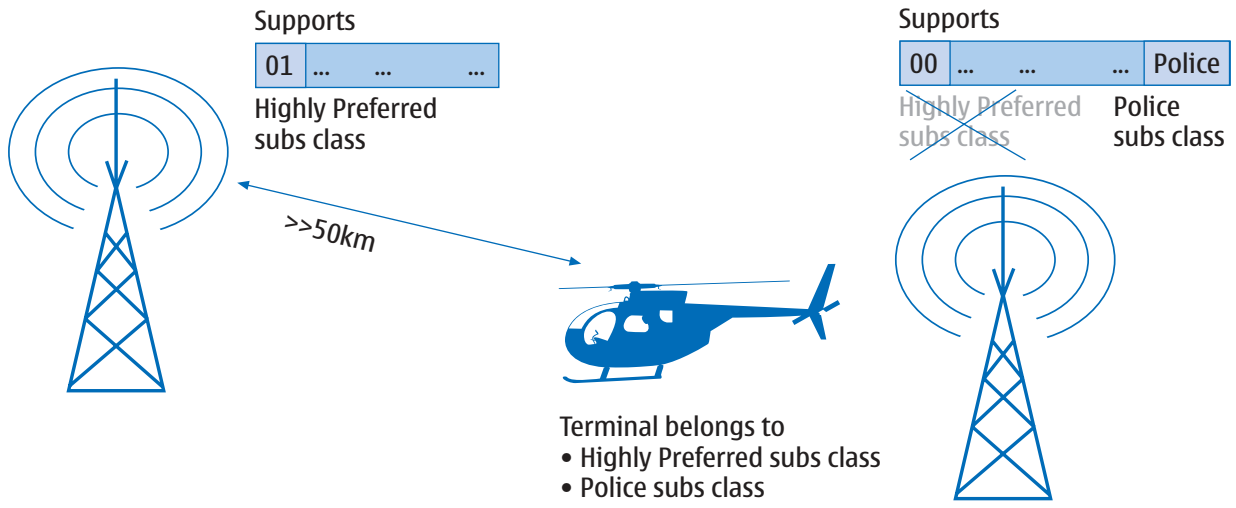
A quick and dirty way to make air terminals and base stations prefer each other is to provision them manually. Programming the terminals to prefer certain base stations is fine for testing, but if the preferred base stations need to be changed, the terminals have to be re-programmed. This would also make it difficult to offer a seamless service across network boundaries, as it would be necessary to program the same information from all the networks that the terminal may access.

The highly preferred way

A better way to indicate air cells is using the so-called Highly Preferred Subscriber Class. Whenever a terminal registers, the base station will tell it which subscriber classes it belongs to, as well as which subscriber classes the base station supports. Air terminals belong to the Highly Preferred Subscriber Class, and only air cells support this subscriber class. Although air terminals are allowed to use ground cells, as soon as an airborne terminal is within the coverage of an air cell, it will register to it, even if there is a stronger ground base station nearby.

Who uses the Air to Ground service?

- **Border guards.** They often use helicopters and need a way to communicate with ordinary talk groups even when airborne. They would also benefit from TETRA data services, for example, to send aerial photographs over a TETRA IP connection.
- **Rescue organizations.** They could exchange information about the patient while in a rescue helicopter.
- **Police.** Airborne traffic police, search party helicopters and police in pursuit of an escaping felon would also benefit from seamless TETRA services.



Nokia TETRA system – making airports better and

With staff from many different airlines and suppliers, airports are a major challenge to any communications system. Efficient voice and data communication functions, enhanced security, exceptional quality of voice and high levels of integration and interoperability make Nokia TETRA the answer.

Airports must be among the most dynamic workplaces in the world, with hundreds of flights and thousands of passengers passing through them every day. This constant change means that a modern airport is a demanding place for a communications network - its hundreds or even thousands of users have many different functions, from airport cargo and luggage handling, to airline maintenance and customer service, to independent contractors providing cleaning and catering.

Increasing flight traffic, coupled with today's economic climate, puts pressure on capacity, service and security requirements of airport radio systems. To cope with these demands, airports need their own independent radio communications to take care of operations and ensure passenger safety in all conditions.

Enhance co-operation without compromising privacy

Airports are prime candidates for sharing a TETRA network among the many companies and organizations working there, yet, as with all users, they will want to know that their communications will be private. The Nokia TETRA system can provide a number of Virtual Private Networks (VPNs) within a single physical network, offering services such as dedicated dispatcher workstations, closed user groups, user-specific service profiles and effective group communications. Yet it also allows these organizations to communicate with each other, improving the efficiency of the whole airport operation.

This set up allows even small companies to get the service and quality that would otherwise be available only to very large organizations.

Special Features for Special Needs

Airlines make no profit while their planes are on the ground. Hence, minimizing aircraft turnaround time is vital to them. More importantly, they need to adhere to schedules, as even a slight delay may make an airplane lose its planned departure window. This is why dealing with arrivals and departures is the key to the whole operation.

Over-the-air groups for efficient flight preparation

A feature of flight preparation is that new work groups are set up routinely to handle each arriving and departing aircraft. In unloading and flight preparation, gate functions, fuelling, catering, cleaning, luggage and cargo handling as well as technical services are all involved. The functions are co-ordinated through the flight number and are controlled by a "red cap", the person responsible for the flight preparation.

With Nokia TETRA, temporary talk groups can be set for each flight, remotely over the air. Group members, who may belong to different organizations, can talk to each other just by keying the push-to-talk button on the radio terminal. Following departure, the talk group is cleared and the people can be assigned to their next task.

Trouble-free maintenance and administration

Runways, electrical devices and buildings are the responsibility of special maintenance personnel, managed and dispatched from control centers. The ability of Nokia TETRA to provide complete dispatching is one of the features that puts professional mobile radio in a different league to public cellular services, helping find the optimum workforce for each operation as quickly and efficiently as possible. Nokia TETRA is designed to support dispatchers in their daily task of remote management of personnel.

safer

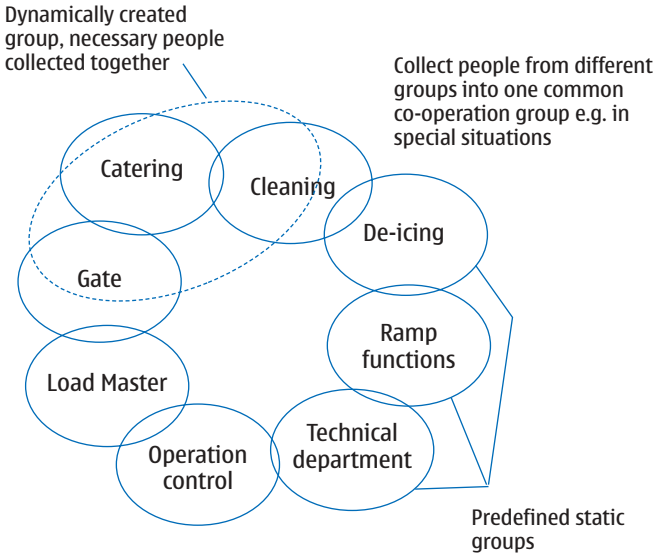
Safety does not permit compromise

At airports, reliable operation of the radio network is crucial. In emergencies, airport personnel's and passengers' lives may be in danger and so no airport authority can compromise on safety. Nokia TETRA provides reliable communications in even the toughest circumstances, with its reliability and operations assured by features such as:

- built-in redundancy
- base station fall back
- direct mode operation

For users, Nokia TETRA provides several features for critical situations:

- priority calls
- emergency calls that can interrupt lower-priority communications
- direct mode that allows radios to communicate with each other in the event of a transmission failure, or when outside network coverage



Security is achieved with features that prevent unauthorized access to the services:

- authentication
- air interface encryption using dynamic keys
- access control features

Everyone who uses an airport benefits from a faster and more responsive communication system. With high reliability and all the control and flexibility you need, the Nokia TETRA system helps airport operators concentrate on what they do best – providing safe, punctual and comfortable travel services for passengers.

Private system, based on traditional analog technology	**One shared TETRA network**
• Until the advent of TETRA, most professional mobile radio users all had their own, closed radio system	• Today's TETRA technology enables organisations to share the same wide area network without compromising their privacy or security
• Difficult co-operation with other organizations	• Efficient co-operation and communication in a shared network
• Uneconomic, overlapping investments and maintenance personnel costs	• Sharing means better economy in all areas - CAPEX, IMPEX, OPEX
• Channel oriented operations and communications	• User and group oriented operations and communications
• Insecure, exposed to eavesdropping	• Secure, no eavesdropping

Sniffing out drugs

Stopping illegal drugs and the damage they can cause starts well before they have the chance to hit the streets, at the border. Customs officers are the first line of defense and one of their most successful tools are sniffer dogs trained to detect drugs.

The Finnish Customs has trained and used sniffer dogs for more than 30 years. They have been very effective – in 2002, Finnish Customs discovered 792 drug-smuggling attempts, with sniffer dogs helping to uncover 608 illegal drug caches.

With 43 sniffer dogs in service, Finnish Customs has at least one dog on duty at nearly every border crossing point. "Our goal is to increase this number to 50 by the end of 2003," says Guy Grönvall, Chief of the Customs' Dog Training Unit.

A successful sniffer dog needs a number of qualities – it must be brave, playful, adaptable and eager to search, and should not be afraid of people or sounds. Usually bought from private kennels at the age of eight weeks, puppies live with a family, ideally with the customs official who will later handle the dog, for six months. When the puppy reaches eight months, it and its handler are ready for the intensive, two-month long course at the Customs' Dog Training Unit in Veikkola, near Helsinki.

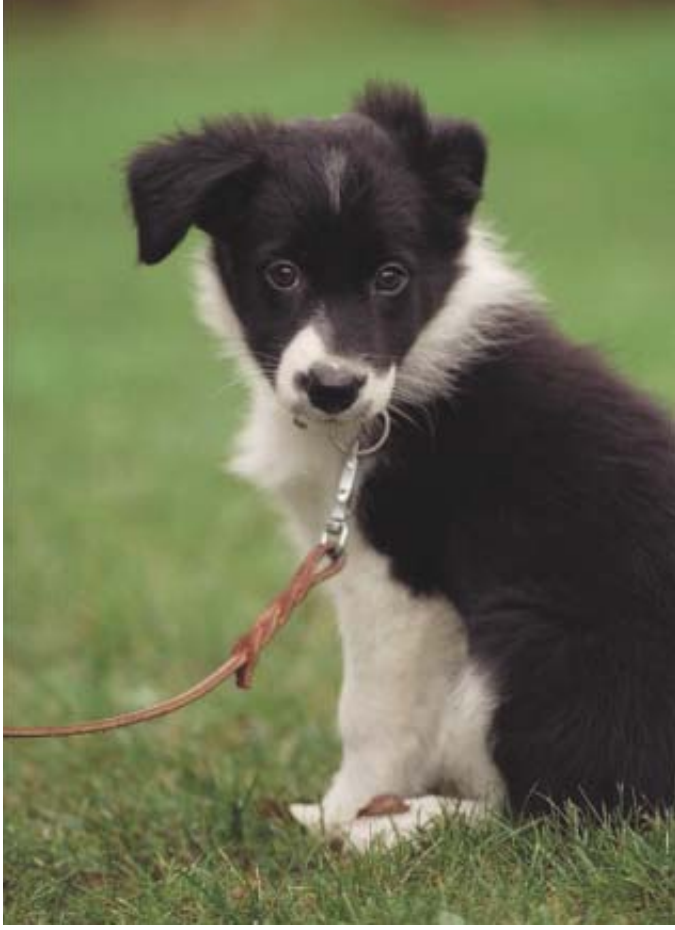
Learning by playing

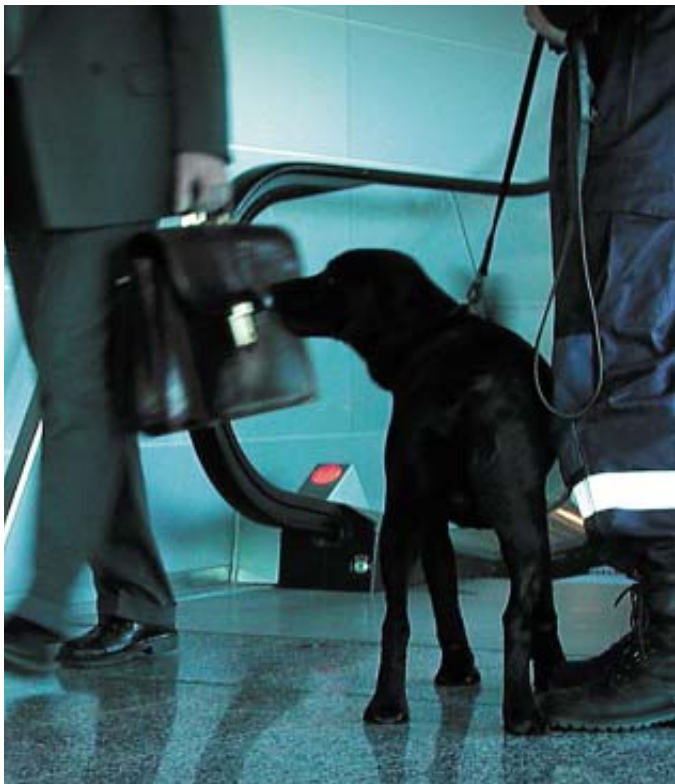
Training sniffer dogs is based on play – the dog will not learn if forced and must see the training as fun. The dog starts off with an easy task: it is shown a cloth bag containing drugs, which is then "hidden" in plain view, and the dog is rewarded with words of appreciation and a pat when it "finds" the bag. Little by little, the tasks get more difficult – the bag will be better hidden, it becomes more airtight, and a cover-up scent is added.

Following basic training, the dog and its handler start living and working together – they will need a year of active duty to develop a good working relationship. A sniffer dog works 8–12 hours a day, of which two to three hours are effective 'sniffing time'. Even this is restricted to 10–20 minute chunks to prevent the dog's sense of smell becoming numb. A sniffer dog can work for up to 10 years in customs duty.

On operations, a sniffer dog thinks of the drugs as its prey, and that finding the prey is fun - it will not become addicted to drugs. The dog knows that if it finds a scent it has been trained to detect, it will get its handler's thanks as a reward. It will react to the scent anywhere, whether the drugs are hidden in a candle or in a cake, and has no preconception about where drugs can or cannot be found.

Sniffer dogs in Finnish Customs have proven to be highly effective at uncovering attempts to import illicit drugs, playing an important role in the prevention of further drug crime.





Finnish Customs benefit from VIRVE

With duties ranging from stopping the smuggling of drugs, spirits and cigarettes to confiscating pirated products or goods violating intellectual property rights, as well investigating and preventing economic crime, Finnish Customs carries a heavy responsibility.

First class communications are vital to the organization and VIRVE, Finland's nationwide public authority network, has proven a godsend to Finnish Customs in its daily fight against crime.

Before VIRVE, Finnish Customs had a limited ability to communicate while on the move – small, existing analogue radio networks gave poor coverage and were expensive to maintain. Officers often found themselves using cellular phones to keep in touch. For these reasons, Finnish Customs was keen to get its hands on VIRVE as soon as possible and were users of the first section of the VIRVE network in the Kymi district.

Close to perfect

According to Arto Pakarinen, Inspector, National Board of Customs, the introduction of VIRVE was very straightforward. "As soon as VIRVE terminals and coverage were available, we jumped at the opportunity", he says. "It was great, and the users took to the system at once. And when the databases that we need to use have been integrated and we can query them using the terminals, the system will be pretty close to perfect!"

One of the distinct features of Customs operations is that their geographical scope is impossible to predict with any precision. Many operations take place in a small area, but a small operation can just as easily blow up into a regional or even nationwide operation. True nationwide operability is therefore vital.

Customs operations often involve not only Customs authorities, but other public safety organizations as well, so the radio system must guarantee full and efficient co-operation between these public safety agencies. To meet this need, operative talk groups that break down the barriers between organizations are in place now, ready for use. "Cross-organizational communication is now very much business as usual," Arto Pakarinen states. "The various public safety officials in the Eastern border-crossing points, for example, communicate with each other over VIRVE every day."

Managing talk groups

The VIRVE network serves the Customs authorities very well. Although many Nokia terminals use the concept of folders to support hierarchical organizations, other terminals use a different approach. "In Customs, we do not operate in a strictly hierarchical manner, which is why we prefer the way talk groups are managed in the Nokia THR850 phone," says Arto Pakarinen.

Jan Österlund, Senior Detective, National Board of Customs, Finland, suggests other features that could help users improve the way they manage their groups: "Folders can be protected by a password, and I think that it should be possible to define passwords for single talk groups as well. In addition, the ability to be able to open password-protected talk groups remotely would be useful. For example, the leader of the group or operation could open the necessary talk groups or folders for the users with a text message invisible to the recipient. This would better support small units who do not have an extensive dispatching organization."

Currently, Finnish Customs uses about 190 terminals, with the goal of 500 terminals available for Customs control officers by the end of 2003. Customs relies on training services provided by terminal vendors and other authorities: "A huge plus for Nokia is that their VIRVE terminals have such a simple user interface that minimal training is needed," concludes Pakarinen.

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Training for TETRA needs special planning

Achieving a smooth changeover from an old communications system to a new digital radio network requires excellent training – good, efficient and innovative.

Even staff with a great deal of experience in radio communications must be thoroughly trained to use new tools. In addition, TETRA technology allows operations that were previously impossible, meaning that the very way the organization is managed can be changed.

The national VIRVE training committee, which has members from all user organizations, started planning a flexible and cost-effective training scheme in early 2001. Today, TETRA/VIRVE training packages up to five days in length are available at the Rescue Academy, Police Academy, Frontier and Coast Guard School and many more. Training covers everything from using the terminals to managing the communications in the network – dispatching – as well as courses for the trainers.

Basic training can involve using MediaMaisteri's Nokia THR880 tutorial (reviewed below), which introduces the most important functions of the newest TETRA handset. Another training tool has been created by the Finnish Frontier and Coast Guard School and a software house called TETRASIM. This covers all the functions of the Nokia THR880, allowing users to get to grips with the handset without disturbing real traffic in the VIRVE network.

Click to learn – e-learning the Nokia THR880 radio

Designed for many different uses by a range of authorities, the THR880 requires proper training if it is to be used in the most effective way.

An interactive training package for the Nokia THR880, produced by Mediamaisteri Ltd, allows people to learn the use of the terminal both in the classroom and as part of self study. The training package can be tailored to follow each user organization's communication guidelines, terms and practices and can be made available in several languages, including the voice feedback and the phone's display texts.

Mediamaisteri Ltd is a company specializing in developing e-learning solutions and offers consultancy and graphic design services as well as high-quality content for web-based learning. It also participates in research, evaluation and development in the field of e-learning.

➔ www.mediamaisteri.com

Mediamaisteri Ltd

Virtual terminals introduce the fine points of TETRA

TETRA terminals provide many extremely useful functions and to get the most out of them, particularly in a real emergency, users must be fully trained in their use. Users of the Finnish VIRVE network can now use a simulation tool to help them get to know their TETRA terminals.

Planning the training was a demanding task, since in the Helsinki metropolitan area alone, it had to be provided for 17,000 public safety officials.

Challenges of training

As a rule, public authority personnel are trained to use the TETRA terminals in a one-day training session. This is sufficient for the user to learn to manage in everyday situations. However, to handle demanding cross-organizational communications confidently, a short training session is often not enough.

In addition, using real terminals in training is problematic. Terminals have to either be borrowed from the field, or some terminals need to be purchased and dedicated for training, which can be costly. Furthermore, how can the trainees practice realistically without disrupting operations in the live TETRA network?

Simulation tool to the rescue

In the winter of 2002, the committee responsible for planning the TETRA training for VIRVE decided that a simulation tool would be the answer and asked the school for the Finnish Frontier and Coast Guard to develop it. The objective was to create a simulation of the entire TETRA network, from managing the users and organizations, to operating the terminals.

TETRASIM developed a concept that includes a computer-based dispatching simulator and a three-dimensional simulation of a TETRA terminal, complete with audio capabilities.

With the TETRASIM tool, a novice TETRA user can learn to use the functions of the terminal, from the basic to the most complex interactions, just as if they were connected to a real-life network, but without risking disruption to real operations.

Using simulations means that self-directed training is possible practically at any time, and anywhere, provided there is a PC available with a connection to the simulated network.

Second Lieutenant Timo Silvennoinen is responsible for TETRA network and terminal training in the school of the Finnish Frontier and Coast Guard and pays tribute to the TETRASIM training tool. Silvennoinen says: “The tool is very tangible, safe to operate and very cost-effective in introducing the TETRA terminal features and methods of communication to public safety officials, without engaging a large number of real terminals.”

The new version of the training tool, featuring a simulated Nokia THR880 Handportable should be on the market by the end of May 2003. A simulation tool for training dispatchers in the use of Nokia Dispatcher Workstation (DWS) is planned to be available by the end of 2003.

➔ http://www.tetrasim.com

TETRASIM

GPS accessory launched for Nokia THR880 radio

The accuracy of GPS location information transmitted over a TETRA network is now easy to add to the Nokia THR880 handportable radio in the form of the innovative Savox Track-Mate GPS accessory. Connecting directly to the handset's accessory connector, the GPS device is easily carried along with the radio. The Nokia THR880 radio can still be used as normal for voice calls and messaging with the GPS device connected.

A TETRA network dispatcher can define the operation of the GPS device over the air. Location information can be transmitted at specified time or distance intervals, or the dispatcher can request the location of a specific unit when needed. Knowing exactly where field units are helps command and control personnel to assign the nearest available unit to the scene of an accident, improving the accuracy, efficiency and reliability of responses.

How does it work

The location information is transmitted as SDS messages in the TETRA network. The Track-Mate is also capable of recording the location information when not connected to the radio, for example in a pocket, for tracing the whereabouts of a single unit during a working shift. The collected data can be processed later by a software tool that is available as an enhancement to the Track-Mate.

The Savox Track-Mate GPS accessory has been launched by Fastrax, a developer of industry-leading GPS receivers, and SAVOX Communications Ltd, a technology provider, designer and manufacturer of hands-free solutions for demanding use.

According to Savox Ltd, the Track-Mate can operate for up to 30 hours when location is transmitted at certain intervals. On continuous recording or transmission, the operation time is about 6.5 hours. A desktop charger is also available. In addition to the Nokia THR880, the Track-Mate is compatible with the Nokia TMR880 mobile radio. In vehicle use, the Track-Mate is connected to a vehicle holder.

➔ www.savox.com

Nokia THR880 radio – how do you want to wear it?

A range of clothing attachments for the Nokia THR880 handset's wearable active holder has been launched by Finnish company Fanttiset. The Nokia holder adds much convenience for field officers. It securely attaches the handset to the user's uniform in a convenient position that makes it quickly available and allows hands-free operation without the need for an extra speaker and microphone. The handset is also held in the best position for radio reception without restricting the user's movement.

Fanttiset's new attachments extend the usefulness of the Nokia wearable active holder by enabling it to be fixed to different types of uniform and in different positions. The attachments can be made in the same material as the uniform and require no modification of the clothing. As an alternative to the wearable active holder, a pouch made from the same fabric is also available.

Braces mounting – the radio is carried comfortably under protective clothing. The radio holder with detachable attachment part is fixed to trouser braces.

Three attachment versions are available:

Epaulette mounting – suitable for jackets, coats or uniforms with epaulettes. Press studs fix the attachment to either the left or right epaulette. The handset with its holder is placed in a detachable part that is easily moved from one epaulette to the other by a zip fastener.

Shoulder mounting – sitting snugly around the wearer's shoulders, this attachment is fixed in place with velcro tape. As with the epaulette attachment, the radio can be worn on both sides and is easily moved with a zip fastener.

Nokia – the leading telecommunications supplier in China

With more than 20 offices, eight joint ventures, two R&D centers, and nearly 5,000 employees, Nokia is clearly committed to long-term development and preferred partnership in China.

Using its innovative technology, Nokia has continuously strengthened its market position in the country as a leading supplier of mobile and broadband network systems and mobile phones. Within China, Nokia is the largest exporter in the telecommunications industry.

To date, Nokia has delivered all the operational TETRA networks in mainland China, Hong Kong and Taiwan, with more service launches to follow during 2003.

Nokia delivers China's first 800 MHz TETRA IP system

China's first 800 MHz TETRA IP network is being supplied by Nokia to Tianjin Public Security.

Expected to be operational in late 2003, the network will cover Tianjin's urban area, providing advanced IP packet data to enhance security communications. It will be interconnected with Tianjin Water Conservancy Bureau's TETRA network, also from Nokia.

"The new TETRA network will not only provide highly efficient voice communications, but also the data communication needed to further develop the customer's data information system," says Topi Kinnunen, Director of Nokia Professional Mobile Radio APAC.

Nokia will deliver a complete TETRA solution, including switching equipment, base stations, dispatcher stations and handsets. Network implementation, commissioning and project management, as well as technical support and training will also be supplied by Nokia.

Nokia TETRA copes with heavy load in Hong Kong

Nokia TETRA has shown it can deal with vastly increased traffic loads while still maintaining its normal service in an operational network.

In tests carried out by Hong Kong Police technical teams, extra equipment such as radio terminals, mobile data terminals, and GPS receivers generated around 400 position updates in the Automatic Vessel Location (AVL) system every minute. This amounted to more than 570,000 updates every 24 hours in addition to the normal daily operational traffic generated by the Hong Kong Police Marine Unit.

In addition, during a five hour test period, more than 300 IP messages, varying from 4kB to 30kB were compressed and sent over the TETRA air interface between terminals and messaging workstations. As well as this extra traffic, the Nokia TETRA system continued to handle all the routine voice traffic in the network, with no discernible effect on performance.

Following the heavy load test, the system also passed a reliability test conducted over four consecutive weeks, providing indisputable proof that Nokia TETRA is robust, reliable and can survive in even the most extreme circumstances.

Nokia to build China's largest digital trunked network

China's largest digital communications network is to be built for the Beijing municipal government. Using the Nokia TETRA system with an IP backbone, the shared network will cover Beijing, nearby areas and parts of the main highways. Scheduled for completion by 2006, it will support up to 200,000 subscribers.

Nokia and Beijing's Just Top Network Communications Company Limited have signed a contract to build the first phase of the network, listed as one of the top 60 major projects for the Beijing municipality this year. The Beijing municipal government's shared network will enable secure communications services for the Chinese government.

The network will use Nokia's latest TETRA switching equipment, the Nokia DXTip, as well as base stations and dispatcher stations. Services to be provided are the Network Deployment Package, which covers implementation, commissioning and project management; the Nokia technical support package, which maintains post-network roll-out; and a package of training services to help develop staff skills.

Beijing's new network will also serve as an important platform for both dispatch information and wireless communication for another key project for Beijing, the Integrated Emergency Response Service system. The network offers a general data platform for government organizations in Beijing and can be used to build a VPN (Virtual Private Network) for each organization.

Mr Wang Jiyao, president of Beijing Just Top Network Communications Company Limited shakes hands with Mr Topi Kinnunen of Nokia.

We answer your questions:

Call set up time

Fast call set up is one of the many advantages that TETRA networks have over GSM and WCDMA. Customers and users frequently ask questions about call set up time, so here we take a look at what it means and how the Nokia TETRA System has minimized it.

What is call set up time?

For the user of a TETRA terminal, call set up time is the time between pressing the push-to-talk key and being granted the speech item – being allowed to start speaking.

Fast call set up time was one of the main requirements when developing the TETRA standard.

Technically, call set up goes through ten stages:

1. User presses PTT
2. Mobile processing time
3. Random access
4. First message (U-Setup) to base station
5. Transmission from base station to switch
6. Processing in switch (database search, reserving traffic channel)
7. Transmission between switches (if needed)
8. Transmission from switch to base station
9. First message to receiving mobiles (D-connect)
10. Voice coming from receiving terminals' loudspeakers

Why are call set up times different in different vendors' TETRA systems?

This is because the TETRA standard defines only the air interface – it leaves the other parts of the system to the manufacturer.

How long is the call set up time in the Nokia system?

Call set up time is less than 300 ms as a rule, and **always** shorter than 500 ms in the Nokia TETRA system, mainly achieved by cutting the duration of steps 4 to 9.

This time is guaranteed for all networks and for all groups, even if the talk group has a large number of members, and even when a group call can span an entire nation with over a thousand base stations, as in Finland's VIRVE network.

Group communication

The benefits of TETRA voice services were featured in a previous issue of TETRA Touch. Group communication is probably the most important voice service and here we answer some typical readers' questions about this vital aspect of TETRA.

What is the difference between a group and a channel?

Talk groups are independent of frequencies, also known as channels. A talk group is defined by its members and area, and no specific channel is reserved for it. When someone in this talk group wants to communicate, a channel is selected for it from a pool. This is what trunking means, and it uses resources much more effectively than reserving one channel or frequency for each group.

How are groups made?

Dispatchers define talk groups using special software installed on their workstation. The dispatcher first selects a number for the group, as well as a text-based name that acts as a mnemonic. He then selects the members, radios or dispatchers, and adds them to the group. He also selects the area for the group.

The group numbers are configured to the radios by connecting them via a cable to a PC running the configuration software.

Can I define new groups after I have configured the radios?

Radios can always be reconfigured, but they must be taken out of service to do so. The best way to define new groups for the radios is to send the definitions to them over-the-air. We call this feature Over-the-Air Groups – when a new talk group is created, it is sent automatically to the member radios over the air interface.

Who can define and send new groups?

Talk groups are defined using a dispatcher workstation, with each dispatcher having certain user rights – some have the right to change groups, while others are allowed to create and delete groups. In addition, certain dispatchers are allowed to see and operate on particular user groups, while others are not. This ensures privacy between organizations, or even between departments within an organization.

Can groups be removed from the radio?

As well as being added, groups can also be removed over-the-air. Even when a group has been configured into the radio using the configuration tool, all types of communication, including SDS and status messages, can be disabled by removing the radio from the group.

PLANNING – the vital TETRA ingredient

TETRA networks are spreading fast all over the world, throwing down a challenge to both operators and vendors to get the planning right.

Customers of TETRA networks are typically used to analog wireless communication systems and expect the new network to be easy to plan. However, planning a TETRA network is not straightforward. Why is this and what are the vital aspects that need to be decided in the early stages?

Don't forget that a TETRA network is meant to be used by organizations that require much more stability, quality and availability than GSM users – their work demands that there are no gaps in coverage nor any unscheduled outages.

Yet, TETRA end-users will also compare the service to the availability offered by their own GSM network. This means that TETRA users will expect to have a connection in difficult locations: a fire crew could easily find themselves in an unpopulated area with no coverage, while a police officer would also expect indoor coverage in the basement of any downtown building. TETRA coverage is expected and should be available everywhere, at anytime.

Planning flexibility is needed

Also, unlike other networks, the radio resources needed for a single voice call can vary wildly and planners should take special care of the traffic profile and group distribution expected in the network. The behavior of users is also unpredictable and planners need to stay flexible.

As well as the normal over-the-air signaling that any wireless network has, some TETRA features, such as AVL and group management, generate additional signaling and must be planned for from the very beginning.

Most TETRA users depend on their vendor to plan the network. This can make life tricky for the vendor, as the design of the network is often based on politics, and most network elements, including switches and base stations, end up being installed in existing facilities, regardless of how difficult it makes the planning or even implementation.

Finding the solutions to ensure the best radio coverage and to build the most reliable transmission architecture, with all the restrictions and difficulties, doesn't make a TETRA planners' job easy, but does make it both challenging and rewarding.

Tunisian cities gain TETRA coverage

Tunisia's nationwide TETRA network has been extended to cover the country's largest cities – Tunis, Bizerte, Nabeul-Hammamet, Sousse-Monastir and Sfax – enabling their public services to benefit from advanced digital communications. The network currently serves several utility, transportation, maintenance and customs transit companies.

Bus and tramway services in Tunis, as well as electrical companies, ports and airports have all indicated an interest in the TETRA service. Other potential customers are expected from the tourism industry, logistics and transport, agriculture and fishing, oil and gas prospecting, phosphate mines and construction companies.

Supplied by Nokia and rolled out with the help of the company's support services, the network's advanced voice services are complemented by end-to-end IP data functionality. Network operator l'Office National de Télédiffusion (ONT), with the support of LSAT, the local Nokia Mobile Phone distributor, aims to provide advanced IP data services, such as fleet management, Automated Vehicle Location (AVL) via web interface, database queries based on TETRA WAP, intranet access and IP file transfer. The next application to be implemented will be a barcode reader to support logistics management.

Nokia TETRA handsets THR600 and THR850 are provided by LSAT who has also supported the project from the beginning.

Aachen pilot tries out Nokia WAP

Advanced Nokia WAP applications are currently being tested in a pilot project in the German city of Aachen, holding out the prospect of them being chosen for a new public authority network planned to cover the whole of Germany.

Nokia WAP was chosen for the project because it clearly stood out from all other contenders. As well as being impressed by the performance of the solution, the project management found that Nokia terminals were the only ones available with an integrated WAP browser. The project team were also keen to test WAP over TETRA, as transfer via TETRA means that there are no additional costs for the use of WAP.

Using a Nokia Active Server (WAP server) and Nokia THR850 terminals, the project is throwing up a number of practical lessons in the everyday use of WAP applications.

WAP good for short messages

The project has shown that WAP via TETRA is ideal for transmitting short messages and pictograms – although, compared to GSM and UMTS, the data rates make it unsuitable for large data packets, it is suitable for database requests, such as enquires about car registrations, which need only short answers. Connecting to databases via requests from a TETRA terminal can help reduce the load at the network control station.

A wide range of applications is available on the pilot project. Internet services such as e-mail, data transfer via FTP and web browsing have already been implemented and a PC with corresponding server software is included in the network. Terminal emulation software, which can be run on a PC or notebook, is used for interrogating databases. Images are transferred via external webcams and notebooks, and GPS co-ordinates can be transmitted from vehicles and displayed in map format. Data transfer is optimized using ONApro middleware.

The project management team is keen to research and test as many solutions as possible which could meet the performance requirements of the nationwide network. The most important applications for the national network are expected to be database interrogation, transfer of text, image and map files, paging, GPS positioning data and status messages.

Laptops too cumbersome

The project has also investigated the feasibility of using a laptop computer as a WAP browser, compared to a WAP enabled radio. Although in tests the typewriter keyboard of the computer makes it easier to input commands and messages, in everyday use it isn't practical to have a notebook connected to a radio device – a radio with an integrated WAP browser has the advantage that it can be carried around all day, allowing requests for data to be made at any time. A further advantage for police officers and other security personnel is the fact the radio can be more readily concealed.

Although no firm decisions have yet been made, the experiences gained and problems encountered during the project will be discussed with manufacturers, with the aim of finding a WAP solution suitable for BOS, the German national TETRA system currently being planned.

Presidential audience for first Balkans TETRA call

Nokia's Veli Sundbäck looks on while Bulgaria's Deputy Prime Minister Nikolay Vassilev makes the call.

The first TETRA call in Bulgaria has been witnessed by the presidents of Bulgaria and Finland.

Bulgaria's Deputy Prime Minister Nikolay Vassilev made the historic first call, speaking to Colonel Valery Grigorov, Director of the Border Police National Service. Finland's Minister of Foreign Trade Mr. Jari Vilén also took part in the call, which was witnessed by President of Bulgaria Mr. Georgi Parvanov and the President of Finland Mrs. Tarja Halonen.

"Today is an exceptionally important day – the first TETRA network in the Balkans is now a fact," commented Veli Sundbäck, Executive Vice President of Nokia Corporation Oy. "Nokia invested the best of its know-how and technologies in the project – the best solutions that will enhance the security of Bulgaria and will bring the country closer to European structures."

The network was financed by the European Union through its PHARE programme, with the aim of making the future external borders of the European Union more secure.

The eight dimensions of TETRA security

A TETRA network's security depends on a wide range of measures – not just its availability, not just end-to-end encryption, nor any other single aspect. Rather, complete security is the sum of many elements from eight dimensions: physical security; network elements and architecture; services; operation and maintenance; preparedness; information security; personnel safety; and competence. We can only be sure we have complete security when all the elements in these eight dimensions are in place and in operation.

Physical security

A network's physical security is the responsibility of the network operator who must ensure that the critical network elements are protected against the normal rigors of nature, against exceptional environmental conditions and against physical attack. Alarm systems must be in perfect working order, allowing as fast a response to a situation as possible.

Network elements and architecture

A large part of network security is decided at the planning stage, when the network's topology is decided, or when the system software is designed.

Some of the vital work done at this crucial stage includes guaranteeing an uninterrupted power supply for switches and base stations, ensuring adequate redundancy in the network and giving the network enough capacity to serve its users. Planning the network to consist of autonomous areas ensure that losing one part will not affect the other parts of the network. And using multiple methods for synchronising base stations is just as important.

Services

Services can also contribute to network security. These can include prioritization mechanisms and base station fallback. Stolen terminals are an increasing problem in many countries and it is vital that the system has a way of meeting this challenge. Discrete listening, ambience listening and jamming detection are further special security functions forming part of the TETRA standard.

Operation and maintenance

Operation and maintenance of the system is another key to security. O&M systems and routines must be well thought out and established, and when repairs are needed, handling of spare parts becomes important. Upgrades are another consideration. The latest versions often have new features and functions to improve safety and security, but the operator must manage system upgrades without compromising security in a live network.

When the network operator is not one of the organisations using the network, it is vital that the technical management of the network is separated from its operative management.

Competence

Even the safest network will become vulnerable if the users do not have adequate skills. Training must be comprehensive and there must be a well thought out organisation in place. User interfaces count just as much and should not be neglected.

Preparedness

Although the routine use of the system can be learned quickly, personnel must be prepared for exceptional incidents and crises. When more manpower is needed, volunteer organisations may be called on to participate in operations and they must be constantly prepared.

Personnel safety

TETRA provides a powerful function to safeguard personnel – the emergency call. Nokia's three-dimensional (3D) emergency call will always reach a recipient because, even if the first and second target is unavailable, the call will be connected to a pre-defined third emergency target, such as a 112 or 911 emergency center. The user will not be left without help.

Information security

When security is mentioned in connection with TETRA, the first thing that comes to mind is usually encryption to ensure that TETRA communications cannot be eavesdropped. This is an important element of security, but at least as important is that the encryption keys are administered in the safest possible manner. And when a commercial operator manages a TETRA network that is dedicated to public safety, it is vital that the operator can see and manage only the technical elements of the network. Or to maintain information security in shared networks, users in one Virtual Private Network (VPN) must not see the user groups of another – easiest ensured using organisational layers.

Public safety organisations and their users depend upon total security for their communications. Indeed the high security enabled by TETRA is one of its main selling points. But it is vital to ensure also the not-so-obvious aspects of security, otherwise operations could become compromised and worse still, user confidence in the network could be shattered.

Public cellular networks no good for critical operations, says report

Public cellular networks cannot be relied upon to provide reliable communications for the field command activities of Emergency Services during a crisis or even at other times. This is the conclusion of a recent white paper from the TETRA Memorandum of Understanding (TETRA MoU) which looked at the ability of these public networks to support the "mission critical" communications needed by Emergency Services.

The paper specifies three main reasons why this is so:

1. **Public mobile networks do not fulfill all public safety requirements.**
2. **Public mobile networks are developed to meet the demands of consumers, which are very different from those of public safety organizations.**
3. **Public cellular networks cannot provide guaranteed coverage, access, or resilience, not only during disasters but at other times as well.**

This is an important finding because as public mobile phone networks have offered increasingly sophisticated services, public safety agencies have started to use them more and more in their daily duties. This flies in the face of convention whereby agencies have used their own private mobile radio systems to guarantee the safe, reliable operation of their networks.

The TETRA MoU paper found that public mobile networks are inadequate for Emergency Services use. Particularly during emergency situations, it revealed that these networks fail to support access, availability, extensive coverage, including out-of-infrastructure Direct Mode communication, graceful fallback, all-informed voice communication or high-level security.

The practical evidence is clear

The paper also looked at recent disasters and incidents, showing how these public networks could not provide adequate service to the Emergency Services during the events. The examples include:

- non-environmental disasters, such as the terrorist attack on the World Trade Centre on 11 September 2001, or the aircraft that crashed into the Pirelli Company building in the center of Milan in April 2002
- environmental disasters, such as the storms in France in the winter of 1999, or the Kobe earthquake in Japan in 1995
- major failures of the public network infrastructure, such as the Orange network failures in the UK in 2001 and 2002, or the fire at the telephone exchange in Reutlingen, Germany in 1998.

In reports about these events, the same damning phrases recur: "networks suffered severe damage and congestion, which created problems for emergency workers," "cellular communications in the region were ineffective and unresponsive," and "Emergency Services were seriously affected by the problems, with the public mobile networks becoming overloaded".

Based on the investigation of technical data and factual information, the report concludes that Emergency Services need dedicated radio communication networks to operate effectively. In addition, Emergency Services need to operate with each other as well as any other parties involved.

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1 2 3