TETRA Touch

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An insight into the future

One of the pleasures of working for Nokia is the insight I get into the many different and fascinating advances in telecommunications, both on the networks side and in the fast-paced world of mobile phones and terminals. Nokia is at the forefront of the development of many different communications technologies, not just TETRA.

This is a clear strength for Nokia TETRA because it enables us to fertilise the evolution of our public safety and security offer with techniques that many rivals may be completely unaware of. Our vision for the future of PMR is based on integrating many technologies.

Nokia solutions today lead the world in capability and enable users to do more than they would have thought possible just a few years ago. In the same way, the systems that we will offer in the future will bring advanced features that will transform the way that many PMR users work, making their days more efficient and more cost-effective.

At Nokia we are committed to bringing the latest and best developments from all the many different communications technologies into the public safety and security arena. The possibilities are almost endless and over the coming months we will be telling you more about what you can expect in the future.

Ever more capable new technologies and platforms are fast approaching. Just watch this space!

Matti Peltola
Senior Vice President
Professional Mobile Radio
Nokia

www.nokia.com/tetra

TETRA WORLD

CUSTOMER WIRE

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Why
TETRA is so vital to us all

As a leading supplier of Profes-sional Mobile Radio and TETRA systems to over 150 networks in more than 45 countries, Nokia closely co-operates with many authorities and has a clear under-standing of the needs of public safety users.
Here, TETRA Touch describes how digital communications can play a central role for all public safety organisations.

Public safety and security services widely adopt the latest technology to help them achieve their goals. Look at the impact of new techniques such as genetic fingerprinting to help clear up previously unsolved crimes; advanced thermal imaging and audio detection to help locate people trapped under collapsed buildings; and medical mon-itoring to help keep patients alive in the field.

Yet in the area of communications, many countries' public safety infra-structure is based on outdated ana-logue technology that is a legacy of the past and may not provide the effective-ness and responsiveness that are so essential to meet today's threats.

This is surprising because effective communications underpins nearly all the activities of all the public services. The main demands on the emergency services' communications systems are personnel safety, effective operations, cost saving and secure and reliable ac-cess to information the instant it is needed. In addition, today's world de-mands much closer cooperation be-tween the different emergency servic-es, which inherently means better in-ter-agency communications.

Only TETRA can meet the challenges

There is a growing number of ever more sophisticated mobile communications technologies aimed at the consumer. Could these systems be used effective-ly by public safety services? The short answer is no. A dedicated technology like TETRA is essential – an open stand-ard, designed for public safety use and offering features dedicated to the spe-cial needs of the emergency services. Furthermore, TETRA is proven in use with several police, fire and emergency forces.

Many countries' public safety infrastructure is based on outdated analogue technology that is a legacy of the past

The TETRA standard offers the best technological basis for building public safety, multi-agency systems. One of the key benefits of TETRA is that it is an open standard, which gives the greatest choice of equipment from a wide range of suppliers and helps to maintain a healthily competitive market. Nokia is a strong advocate of TETRA and develops its products in accordance with the openness principle, enabling a true multi-vendor environment.

TETRA offers public safety organisations powerful features tailored to their needs, including high security and reliability, dispatching, group calls, priority calls and direct mode operation. The current Nokia TETRA System also provides advanced features such as Automatic Vehicle Location (AVL), Global Positioning System (GPS), Computer Aided Dispatching (CAD), Graphical Information System (GIS) and interfaces to legacy systems such as call taking.

In addition, field personnel can use TETRA text-based data services to access and retrieve information from existing police and other databases, such as criminal records, vehicle registrations, medical records and chemical hazards.

All these features can significantly improve operational efficiency and make better use of limited resources for all the public safety services.

Meets future demands

As Nokia is one of the world's leading mobile communications companies, we are in the best position to take advantage of mobile IP technology development.

For example, the Nokia TETRA System already implements IP data and voice services using a TETRA IP packet core, in architecture similar to that of 3G cellular networks, being launched around the world over the next five years. The use of TETRA IP will enable powerful new applications, such as user/group configuration, real-time user tracking and distributed network management.

The Nokia TETRA System architecture can also be scaled up to provide for several hundred thousand simultaneous active instant voice users, to meet the future growth needs of even the biggest countries and multi-agency usage.

Investment today in an integrated public safety communication system based on TETRA will achieve enormous improvements in the effectiveness and responsiveness of all the emergency services. More effective crime fighting brings immeasurable savings for society and increases citizens' safety. Close co-ordination between all public safety agencies will help to save more human lives during rescues. The payback for the whole of society is considerable.

TETRA offers access to medical records and chemical hazards databases.

TETRA offers the best technological basis for public safety, multi-agency operations.

Text-based data services to access and retrieve information from police and other databases.

TETRA offers medical monitoring to help keep patients alive in the field.

TETRA
– the best technology

The number and sophistication of different mobile communications technologies aimed at the consumer continues to grow. Could these systems be used effectively by public safety services? No, is the short answer. A dedicated technology like TETRA is essential – here's why.

Today's world of globalisation and technology allows criminals to cross state borders, demanding that law enforcement agencies work together and communicate with each other, both nationally and internationally.

Old analogue mobile radio networks are open to eavesdropping and offer outdated functions, posing a major risk to both public safety and the personal safety of emergency service personnel. Analogue radio networks also do not cater for cross-border communications, while criminals use technology to disregard geographical or cross-border limits.

Public authorities hold extensive databases of information about people, vehicles, guns and so on, yet the old communication systems do not integrate with these databases, seriously hindering the work of police officers.

Some technology not aimed at public safety

GSM was designed to provide cellular telephony and messaging services for volume civil use and provides a good quality telephone service that is both robust and secure. GSM is based on a traditional cellular call model, where calls are initiated and terminated and the radio and system resources are reserved for the call's duration. Based on dialed number, call establishment is made by network signaling taking a few seconds. Obviously such set-up times are unacceptable in the event of an emergency.

The Union Internationale des Chemins de Fer (UIC) in 1993 chose the GSM standard as a basis for its future digital mobile system at a time when the TETRA standard was just being established. This led to the specification of the GSM-R (GSM for railway) standard and the introduction of Voice Broadcast Calls, Voice Group Calls and Priority features (Advanced Speech Call Items, or ASCI features) as new services in GSM.

GPRS has been designed to provide packet data services, giving flexible access to the Internet and to Intranet based mobile data and WAP services. Packet data provides a virtually always-on connection to a data server, allowing the establishment of a packet data connection within a second.

Public safety professional mobile

for the task

radio is different from cellular services because a shared radio channel is constantly open for a group to communicate. Anybody in the group can push a button to talk and all other users will hear the voice. This provides an immediate call capability between a user in the field and a dispatcher, or between a group of users.

This is very important in critical situations in which there is no time to establish a call and the instructions of a command chief or a dispatcher must be heard immediately by a group of users. Keeping a telephony call open constantly for a number of users con-

sumes a lot of radio resources and is therefore expensive.

Circuit-based group communications features have been implemented over GSM (GSM Pro or GSM-R) but because of the circuit reservation for the whole duration of the session and because of the lack of multicasting, the group service model in GSM is very inefficient and costly for group communications and has not been implemented in any operational GSM networks. This means that circuit-based GSM is not feasible for public safety communications.

GPRS provides a virtual "always on" packet connection through the GPRS

network. GPRS, however, does not support voice services over the packet data channel. A streaming type of service is coming in future releases of GPRS, but the delay for voice is significant and the reliability of data transport over GPRS access is not high enough for critical public safety communication. GPRS does not support multicasting over the air, making group communications inefficient. Hence GPRS does not support efficient communications and gets congested around a communication hot spot, which is typical in an emergency.

INFO

Where consumer technology falls down

To summarise, the following key public safety requirements are not met in GSM, GSM-R or GPRS networks:

1. GSM and GPRS are public services and do not prioritise users. GPRS is designed to provide a public data service, rather than a high-availability mission-critical public safety service for emergency situations. Obviously the set-up times currently achievable by GSM-R systems would not be acceptable in the event of an emergency.
2. Neither GSM nor GPRS provide any group communications features and all group functionality needs to be built outside the GPRS network. Since there is no multicasting support in either GSM or GPRS, GPRS's capacity to support emergencies or hot spots is very limited and it cannot prioritise public safety users over the big public GPRS users.
3. GSM does not offer the shared radio channels and multicasting

needed to support a high number of users at an emergency hot spot.
4. Dispatching is not available in GSM networks.
5. GSM, GSM-R and GPRS do not provide any DMO (Direct Mode) operation.
6. GSM security is implemented with standard GSM security measures. These are inadequate for the needs of public safety user organisations.
7. Even though GSM has many manufacturers supporting it, the same cannot be said of GSM-R. Because the market size is limited, most GSM manufacturers have elected not to support GSM-R. TETRA has far wider support among manufacturers of both infrastructure and terminals. This will lead to greater competition for infrastructure provision and greater choice of terminals to match user needs.
8. In addition, it must be noted that although GSM-R evolved from GSM, both systems cannot di-

rectly interoperate, because the operating frequency allocated to GSM-R radio and its additional features are not supported in the GSM infrastructure. GSM-R radios cannot roam into GSM networks and vice versa.
9. Future VoIP solutions in mobile packet networks such as GPRS would use SIP for signaling (selected in 3GPP as the signaling standard). SIP is built for cellular and multimedia call control. It does not provide the push-to-talk facility, which requires a response time of less than a second to reserve the speech item session. GPRS provides packet data features without Quality of Service in the first releases. Streaming support will emerge in later GPRS releases, but there is currently no real VoIP support in GPRS. All-IP over UMTS, integrating both voice and data in IP, is a target in 3G future releases, but current standardisation plans do not include group communications or shared channels.

Continued from page 7

In other words, GPRS does not support the basic requirements of public safety communications.

Public safety traffic should always take priority. Current GSM/GPRS networks are not designed to support the needs of priority user groups.

Security authorities need their own network

GSM infrastructure and terminals are already widespread and tough competition between GSM operators and GSM terminal manufacturers could make the service attractive to public safety users and provide low cost terminals. GSM's strong evolution to future services and 3G could also provide mass use and mass service benefits to public safety users.

In spite of these benefits, security authorities cannot afford to compromise and need a service that is as robust as possible in critical situations. They need their own network, now and in the future.

The European TETRA standard is a good choice for these authorities. It is

Compare and contrast – TETRA vs

The uninitiated may think that TETRA and Tetrapol are competing technologies on a par, each with its own set of pros and cons. But a comparison drawn recently by the TETRA MoU explains why there really is no contest.

TETRA is the only standard developed by the European Telecommunications Standards Institute (ETSI) for trunked digital PMR/PAMR wireless communications. Tetrapol, on the other hand, was originally developed under a French Government contract for the MoI in France by Matra Communications (now EADS). It is not recognised in France (ART), by ETSI, by the ITU or anywhere else in the world as an open standard. In fact, Tetrapol tried and failed to get ETSI standard recognition using the Publicly Available Specification (PAS) procedure in 1998.

This difference has enormous implications for the future of the two technologies. The TETRA market is already served by eight independent infrastructure manufacturers and six independent terminal manufacturers. The main supplier of Tetrapol equipment is EADS, with secondary support from a small number of other suppliers.

Since the first operational deployments of TETRA in 1997, the market for TETRA has grown to represent over 100 contracts or commitments. The major market uptake of TETRA is by the public safety sector in Western Europe, although there are significant deployments in the Far East, Middle East, Africa and South America. TETRA networks are being used by all traditional PMR organisations, as well as by public operators to provide outsourced PAMR services. It is also being used by the military for non-tactical communications, a market not previously envisaged by TETRA.

The number of deployments with Tetrapol is less clear because quite often the contracts are not public. The information that is available shows that usually there is only one Tetrapol bid for a contract compared with multiple bids from TETRA manufacturers.

This indicates that there are not many manufacturers that can provide a total Tetrapol communication solution.

Spectrum efficiency

A major difference between TETRA and Tetrapol lies in their approach to making the best use of the spectrum. Tetrapol uses Frequency Division Multiple Access (FDMA) technology to provide one communication channel in an RF channel of 10 or 12.5 kHz. TETRA uses Time Division Multiple Access (TDMA) technology to provide four independent communication channels in a 25 kHz RF channel. TETRA therefore makes far better use of the frequency spectrum.

Its use of TDMA technology translates into several advantages for TETRA. For example, it is more economical for medium and high-capacity urban coverage. TETRA is also more spectrum efficient for medium and high capacity networks, whether they operate across single or multiple sites.

Services such as full duplex wireless telephony and concurrent voice plus data are also simplified thanks to TETRA's use of TDMA. Even though full

designed for public safety use and already used by a number of advanced police, fire and emergency forces.

Furthermore, even though the GSM-R standard was specified to meet the requirements of the railway industry, TETRA may prove to be a better standard for railway operators too. Among the factors that support this view are: better spectrum efficiency, better coverage, lower cost, public safety and mission-critical features, more manufacturer support, clear future plans and evolution of the TETRA standard.

There are good system suppliers for TETRA networks and new model terminals with modern technology and advanced voice and data functions are launched constantly. TETRA network functionality is increasing and installed networks can be upgraded to offer enhanced services. There is a strong TETRA community, keeping the system and terminals interoperable and producing future features and services specifically for the needs of public safety users.

Tetrapol

duplex voice is possible with FDMA technology, it requires duplexers and RF screening within terminals, resulting in more costly and bulkier radios than TETRA.

TETRA data throughput is more efficient, in part, because of its full duplex capability. This makes Automatic Repeat Requests (ARQs) easier to deploy when data messages are corrupted as a result of RF fading. With terminals operating in full duplex mode, ARQs can be sent efficiently after each time slot transmission if required. FDMA terminals operate in semi-duplex (either transmit or receive), so any ARQs must interrupt the transmission in order to be received.

TETRA also improves the throughput of data by supporting bandwidth-on-demand, in which 2, 3 or 4 timeslots can be combined to provide a greater data throughput. This multi-slot allocation can provide a maximum net data capacity of 28.8kbps, 19.6kbps or 9.6kbps throughput, depending on the protected mode selected. FDMA technologies in contrast only describe a single protected circuit mode data channel with a throughput of around 8kbps.

The combination of TETRA's multi-slot data capability and the support for a time efficient ARQ mechanism makes TETRA more efficient overall at passing data.

TDMA technology also gives TETRA an advantage when it comes to Direct Mode operation (DMO). The DMO range performance is superior when providing high-capacity localised area communications that require many RF channels to be used. Operational trials by public safety organisations have proved that TETRA meets the RF coverage and performance requirements for typical DMO applications. However, in high capacity, multiple channel, localised DMO scenarios, such as a major incident, the range performance of TETRA exceeds that of FDMA-based technology because TETRA produces less localised transmitter Intermodulation Interference (IM), which becomes the limiting factor for range performance.

A secure solution
TETRA scores highly in terms of security, which is incredibly important in public safety and security applications. TETRA already provides over the air encryption, which will meet the needs of the majority of security services. However, TETRA also provides scope for encryption modules within terminals to accommodate various encryption standards as dictated by national security organisations. Several national public safety contracts already let to TETRA suppliers will require end-to-end encryption for specialist security forces. This demonstrates that TETRA manufacturers are already contractually committed to provide end-to-end encryption solutions.

Because of needing to mainly address the security requirements of the French MoI:
• Tetrapol provides "end to end" encryption

Only special Police units would be expected to use end-to-end encryption. Also, over the air encryption is more economic than an end to end solution, which requires relatively expensive encryption modules to be incorporated in terminal devices. Also end-to-end encryption needs a more complex key management system, which is often not so user friendly.

Nokia wins praise in Palermo

Nokia won the personal thanks of the Italian Prime Minister, Silvio Berlusconi, for providing a communication solution covering the recent 'e-Government for Development' conference in Palermo *(see www.palermoconference2002.org).*

The conference was a joint initiative between the United Nations and the Italian Ministry of Technology and Innovation and brought together over 500 high-level delegates from 91 countries.

Nokia Italy won a prestigious role as a technology partner in the event and took just two weeks to plan and install a four-site live TETRA network covering most of the Palermo area. The company supplied about 120 terminals for use by the police, UN officials, security services and conference organisers. All the feedback from the users was extremely positive.

The conference gave Nokia representatives an opportunity to spread the TETRA message to some largely untapped potential markets, by meeting high-level contacts from many African and Asian countries.

Nokia's vice-president, Hans Holmberg, gave a presentation focusing on the role that TETRA can play in protecting citizens' safety. The message was particularly relevant in Italy, following the tragic accident this year in which an aircraft crashed into the Pirelli skyscraper in Milan. The local GSM network was overwhelmed following the crash, making it harder for emergency personnel to co-ordinate their efforts. This led to calls for a separate communication solution for the emergency services.

Holmberg explained how TETRA can improve the efficiency of e-Government by adding a mobile dimension to the work of an administration without compromising security.

Photo by ANSA

Italian Prime Minister Silvio Berlusconi (left) meets Nokia Director Massimo Gotti at the recent 'e-Government for Development' conference in Palermo

Nokia TETRA System wins Brazilian approval

Nokia has obtained type approval for its 800MHz TETRA equipment from the Brazilian National Telecommunications Agency (ANATEL). Approvals cover Nokia TETRA Base Stations and Nokia TETRA Terminals.

The approval is an important milestone in helping the Brazilian Public Safety forces achieve their desire of adopting TETRA for their communications needs. In Brazil, public bids are ruled by complex legislation and the approval will help ensure the Nokia TETRA System is competitive.

Nokia selected OCP-TELI, one of eight ANATEL-nominated institutions that are legally constituted to certify the products as complying with the regulations. Nokia chose OCP-TELI because of its reputation as a hard working, results-driv-

en and price competitive company.

The operational reliability of the Nokia TETRA System, integrated to a Call & Dispatch System, has already been demonstrated to the Brazilian Military Police, Civil Police, Fire Brigades and other forces at different fairs and demonstra-

tions held during the last year. Many in Brazil are now hoping for Brazilian decision-makers to set a high priority for the radio communications needs of the public safety organisations.

ISCTI wins TETRA IOP testing contract

Testing and certification for TETRA Interoperability is to be carried out by the technical body of the Italian Ministry of Communications, the Instituto Superiore delle Comunicazioni e tecnologie dell'Informazione (ISCTI).

The five-year contract, awarded by the TETRA MoU, covers the entire scope of IOP testing and certification. In addition, ISCTI will help write TETRA Interoperability Profile (TIP) specifications, as well as create TIP test cases. ISCTI will also take an important role in the TETRA MoU Technical Forum, which aids co-operation between the TETRA industry and TETRA operators and users.

Following a thorough review of possible candidates, ISCTI was selected because it could provide the best techno-commercial service for the TETRA community. Ray Ginman, Chair of the TETRA MoU Association, says: "As part of the MoU's 'added-value' services for its members and for the TETRA community, we have devoted a lot of time and effort to ensure we found the best solution for the IOP testing and certification process. We have succeeded, and I am delighted to establish this relationship with ISCTI."

ISCTI engineers are currently going

Ray Ginman of the TETRA MoU and Ing Carmelo Basso of ISCTI shake hands on the signing of a contract covering the testing and certification for TETRA Interoperability

through a comprehensive TETRA training programme, which began with a week's training at Nokia. Similar sessions will be provided by other TETRA vendors focusing on various parts of the standard and TETRA Interoperability Profile specifications, as well as practical training on TETRA products and testing procedures.

As well as the main contract with the TETRA MoU Association, ISCTI has signed individual contracts with Marconi, Motorola and Nokia to test their equipment. Other equipment vendors are currently in the process of signing individual contracts.

It is expected that the major part of the tasks and responsibilities will be handed over to ISCTI during May and June, enabling the new Certification Body to be fully operational for the entire second half of 2002.

Nokia terminals poised for operation in Aachen

The German authorities have ordered Nokia TETRA radio terminals and will soon begin operating them in the TETRA pilot scheme in Aachen. The Aachen project is the official TETRA pilot project of the German public safety authorities.

The supply of the terminals is an important step. One of the main goals of the Aachen pilot is to prove interoperability and to demonstrate the related multi-vendor market in TETRA. This is a major requirement from the German authorities.

Nokia and Motorola demonstrated mutual Direct Mode Operation (DMO) TIP compatibility between their terminals in April, prior to the order being placed. The terminals passed all the related tests. Nokia already has DMO TIP certification with Simoco, Cleartone
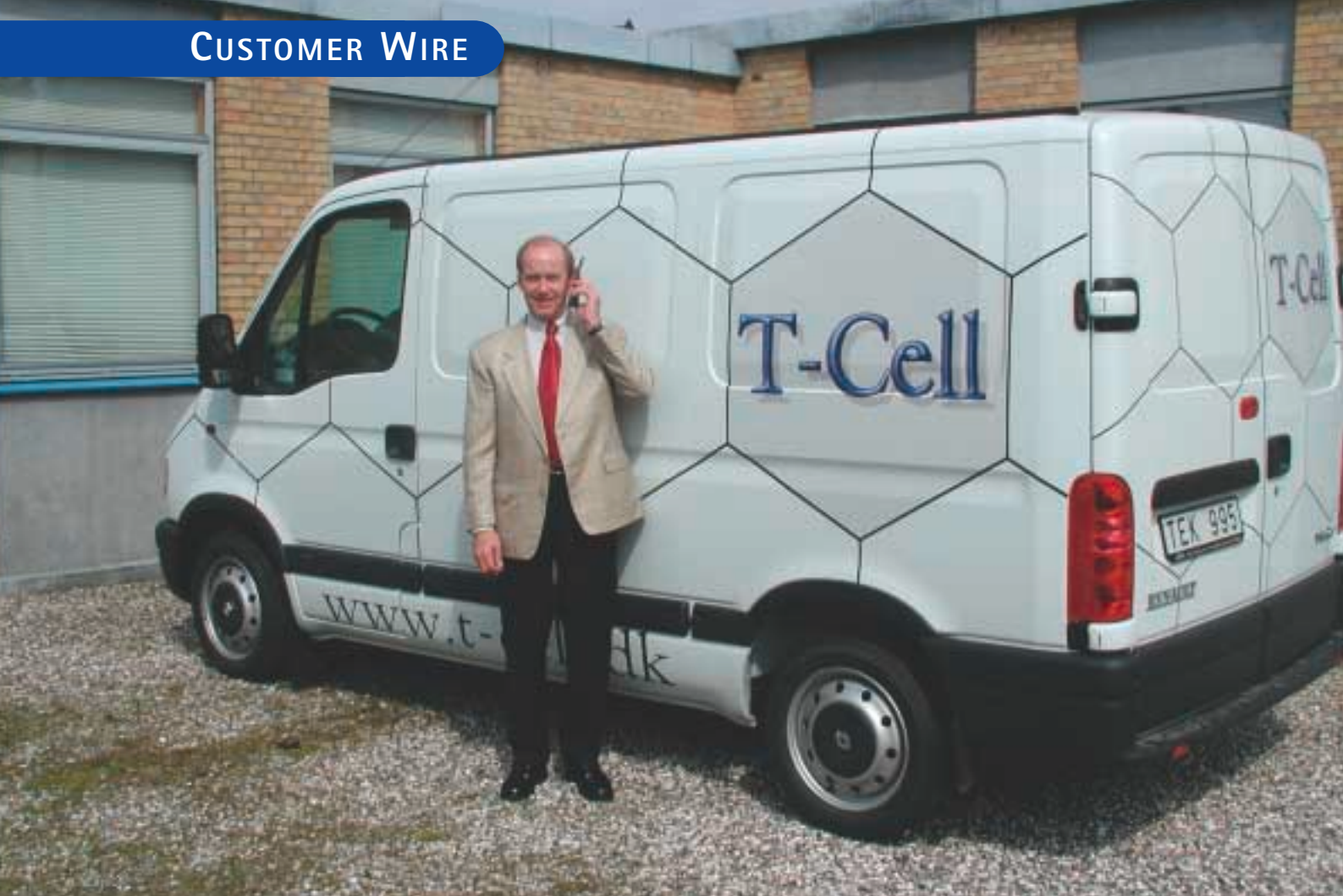
and Marconi and is looking forward to an official test session to expand the existing certificate to cover Motorola.

Managing Director Bjørn Steenberg shows off T-Cell's new display van that will be used to give live demonstrations of the T-Cell TETRA-network

First Danish TETRA network goes live

The first TETRA network in Denmark has become operational with Danish operator T-Cell.

T-Cell has worked with Nokia since the company was granted its TETRA civil band licence in October last year. Bjørn Steenberg, Managing Director of T-Cell, says: "We are working with Nokia because it is the only company that has supplied a nationwide TETRA network.

"Nokia also provides great product performance, and excellent service and support for the system, all things that will be valuable in our TETRA network. Moreover, Nokia supports the TIP (TETRA Interoperability) and ISI (Inter Systems Interface), which are very important elements for the daily- and future operation of the TETRA network. "

T-Cell's coverage vision

T-Cell is targeting professional users across the private and public sectors, including public safety users. Covering Greater Copenhagen during the initial phase, T-Cell has plans to extend the network over the whole country. "Given the competitive situation on the Danish market, T-Cell considers it to be very important to establish wide coverage throughout Denmark, in order to deliver optimal coverage at a reasonable price and furthermore, to be able to respond quickly to particular customer demands, in order to build up credibility for T-Cell and its services," says Steenberg.

"The primary goal is to be the pre-eminent provider of civil communication services to the professional market in Denmark", he adds.

The complete Nokia TETRA System for T-Cell includes switches (DXT), Base Stations, Network and Dispatcher Management Systems, under a frame contract valued at approximately 100 Million Danish Kroner for the first phase. T-Cell has already established the technical support organisation for the daily running of the system, including Network and Dispatcher Management.

The sales and marketing organisation has also been established and T-Cell is currently working with a number of partners on applications in sectors such as boroughs and city councils, transport, construction and logistics, as well as emergency and civil defence services.

"Our output will come through close co-operation with partners from different fields of manufacturing, system-integration and distribution", say Steenberg. "Through such co-operation, T-Cell also will be able to offer integration with GSM and other mobile services."

Distributing key information, quickly and securely with Nokia NetAct™ for TETRA

In the world of TETRA networks, it is essential that the correct network performance information goes to the correct person. Performance management involves the monitoring of the network performance (usage, capacity, load and traffic). From performance reports, operators can follow-up the transfer of traffic data and fault statistics throughout the entire TETRA network.

For example, if a large accident occurs, by looking at the network performance information supplied by NetAct™ for TETRA, the operator can predict whether or not there is enough

porter. With Reporter you can, for example, create reports about the network performance and via your LAN or WAN networks, share these reports throughout the organisation. The re-

ports are visualised in graphical format quickly and easily.

There are two different kinds of reports: ready-made reports and user-defined reports. Ready-made reports ensure that the newest data is always available, and are very quick to make. User-defined reports can be made via Nokia Report Builder. This is an easy-to-use, web-based tool for creating reports.

The distribution of reports from NetAct™ Reporter ensures that the right reports reach the right person, thus avoiding information overload. This is achieved through the creation of User rights, so that specific groups or individuals have rights to view only specified reports.
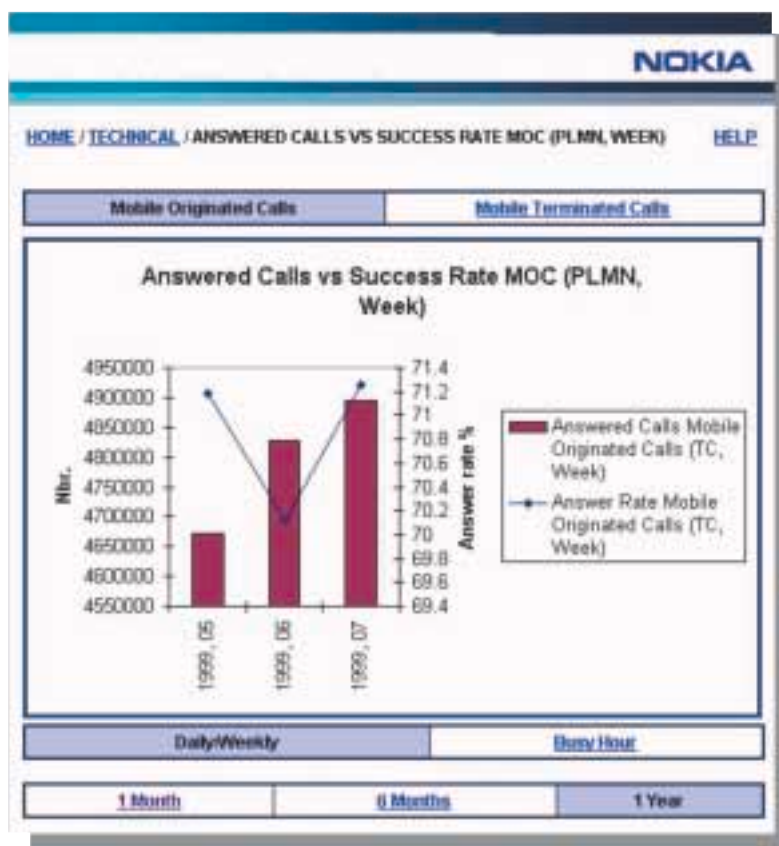
capacity for all the important calls. Based on that information, corrective action can be taken before there is any disruption to the calls.

Performance information is also vital when planning the network investments. By following the capacity trends highlighted in performance data reports, you can ensure that network investments are timed correctly.

Performance Management & NetAct™ for TETRA

In NetAct™ for TETRA, the application that deals with performance management is Nokia NetAct™ Re-
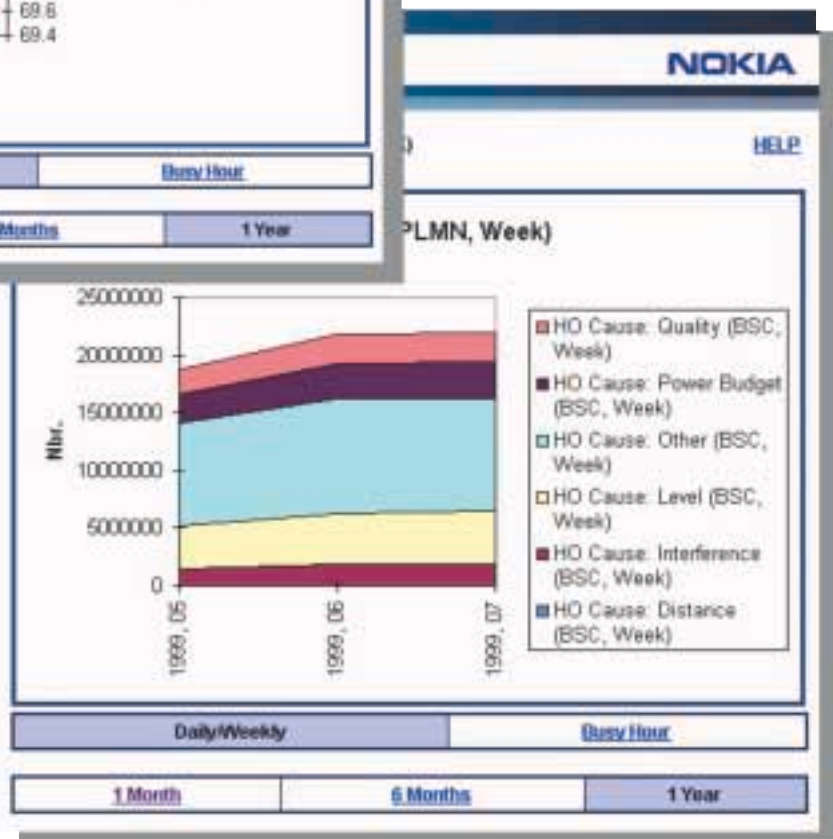
First CAD centre opens for ASTRID network

Belgium's first Computer Aided Dispatching centre for the ASTRID TETRA network has been opened in the city of Ghent by the Minister of the Interior.

Staffed by a team of five call-takers and one co-ordinator-supervisor in the first stage, the centre serves the province of East Flanders, and is the first of the 11 provincial dispatching centres to come on line.

The centre answers police calls from the entire province and distributes information to 35 computers, known as CAD-Viewers, installed in the provinces' police stations. With the CADViewer, individual forces in the province can consult the information and the incident management of the dispatching centre remotely.

ASTRID brings a whole new level of efficiency and capability to PSS communications. When an emergency call for help comes in, the control room operator's screen shows the address and map details, as well as the locations of the nearest available units even before the call is answered.

After deciding on the help needed, the dispatching officer assigns the task to a unit by clicking a few buttons on the screen, automatically sending the address, task description and other critical details to the unit's mobile terminal. The result is a faster response and more efficient use of resources. During its first month of operations, the dispatching centre received no fewer than 19,000 calls, for which 14,000 incidents were entered into the system and redirected to the police zones.

Proven in practice

In East Flanders, a number of police services and one fire brigade are already using the ASTRID radio equipment and network, which recently passed its first test when it played a major role in the "The Tour of Flanders" cycle race. Despite the very hilly landscape of the area, ASTRID maintained perfect communication.

The chief of police in Oudenaarde says: "My people were amazed by the excellent transmitting and receiving quality of the spoken messages. Unlike in the past, it made no difference where our teams were located.

"Our previous (analogue) equipment was obsolete, and that led to misunderstandings, confusion and wasted time - we already had serious communication

problems during large-scale police operations." In contrast, he praised the accessibility of the new TETRA system: "We are in constant contact with our crews, even in places - tunnels, in buildings with thick walls - where no communication was possible before."

Oudenaarde police also hope that group calls will improve co-operation with other police forces, civil defence, fire brigades and medical services.

A developing network

By the end of 2003, the remaining Belgian provinces will all be connected to ASTRID. The complete system will have more than 450 base stations, with a dispatching centre in the capital of each of the 11 provinces. As well as police forces, other safety and security organisations can become part of the network by paying an annual fee of €250 per user.

The official opening of the first CAD centre has aligned all major safety officials behind the project. This has helped guarantee ASTRID's continued public support, particularly important as Nokia has now been awarded Block 2 of the contract. Some delays are being experienced, however, mainly due to the time needed to obtain building permits from town and country planning authorities.

Part of Nokia's contract involves the supply of 1000 Nokia TETRA Terminals including THR850 and THR420 hand-portables and TMR400 mobile radios.

ASTRID recently published a comic-style booklet to promote TETRA services to all its users

The Finnish authorities are already operating their VIRVE network using a number of indoor repeaters.

Meeting the challenge of indoor coverage

Indoor repeaters are a recent addition to the TETRA armoury available from Nokia. They ensure that mobile communication remains reliable in situations such as tunnels or large office buildings, which may be difficult to cover using TETRA base stations (TBSs) alone.

Many obstacles can cause fading and attenuation of TETRA signals, making it tricky to reach places such as Metro-, road-, railway- and mining tunnels, large office buildings, factories and underground locations. Nokia indoor repeaters offer a proven reliable solution.

Installed together with a directional antenna and leaky cable, and indoor creates an easy-to-install and reliable solution. The coverage of repeater installations is not affected by changes in the network, making the system very flexible and easy to use. The repeater provides a remotely controlled, transparent connection to the TBSs.

Indoor coverage solutions are typically combined with radio propagation-, site survey- and commissioning services. The package is normally provided by teams specialising in indoor coverage.

A TETRA repeater ensures good voice quality for underground alarm centres
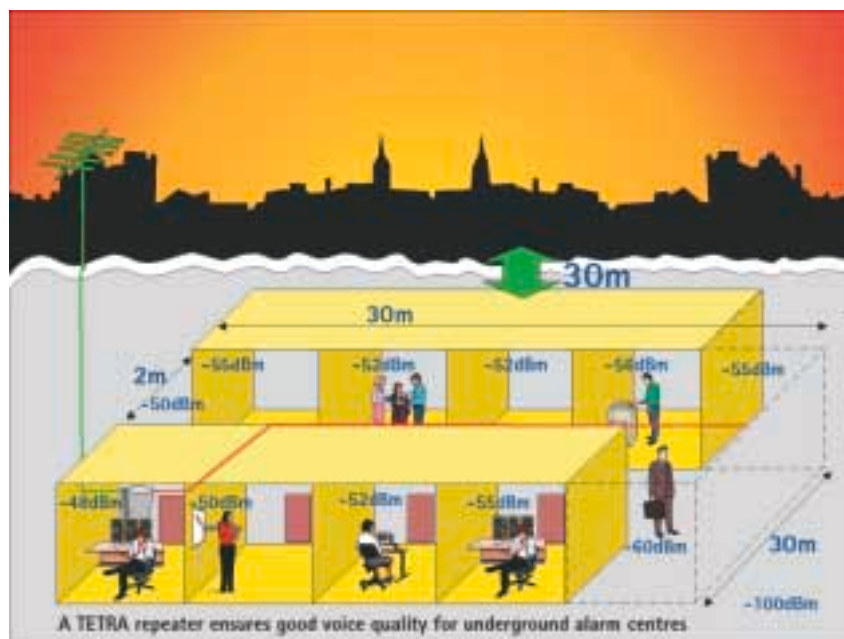
Top, from left to right : Mourad Sallem, ONT ; Riadh Frikha, Nokia ; Makram Azouz, ONT ; Driss Ben Said, ONT ; Ben Ammar, ONT ; Robert Freval, Nokia ; Raoudha Zarrouki, ONT ; Olivier Pierret, Nokia. Below, from left to right: Salwa Moualhi, ONT ; Hajer Ben Sassi, ONT ; Noureddine Laghmardi, ONT ; Ramzi Touati, ONT.

Advanced Nokia TETRA system for Tunisia

North West Africa's first Nokia TETRA network was agreed in 2001 with the signing of a contract between Nokia and Office National de la Telediffusion (ONT) of Tunisia.

The agreement involved Nokia supplying equipment to build a secure, TETRA-based digital communications network for professional mobile radio users in the capital Tunis. The contract covered a complete range of Nokia TETRA infrastructure, as well as a host of services, including technical support, training and project management for roll-out.

Robert Fréval, Nokia TETRA Project Manager, says: "Our biggest challenge has been to manage the project remotely from France, as we had no local Nokia premises established in Tunisia. During the roll-out, we faced a number of other challenges, such as transmission synchronisation. Thanks to excellent co-operation with ONT's teams, we were able to complete a successful implementation within three months."

In time for the games

In September 2001, the TETRA network was used successfully to support the organisation of the "Mediterranean Games at Tunis", a major sports event attended by 70,000 people. Among the 600 users connected to the network were staff from the Tunisian authorities, who expressed their clear satisfaction with the TETRA system.

The expansion of the ONT TETRA network in Tunisia was agreed in March 2002, adding more coverage to the main Tunisian cities of Tunis-Hammamet, Sfax, and Sousse.

April this year saw the first data IP call made on the network, using the latest Nokia TETRA handset, the THR850. This opens the way to many WAP based applications such as bar code readers, Automatic Vehicle Location, instantaneous access to databases, such as ID check and vehicle check, and telemetry applications.

These advanced TETRA services should enable ONT to meet the needs of its customers and reach professional users such as utilities, transportation companies and public organisations.

Bringing TETRA networks to life

To help orchestrate a smooth migration to digital technology for public safety trunking systems, Nokia offers a complete range of services for planning and deploying networks and keeping them operating at peak performance.

Nokia's network planning services enable features such as optimal fleet mapping, network reliability, and maximised organisational and individual safety and security. Project management is the key to efficient, on-time rollout. Our strengths in this area come from experience. We have a proven record of delivering more than 100 GSM networks, over 150 analog professional mobile radio networks and 30 TETRA networks worldwide. This success is also reflected in our ability to integrate new technologies into existing networks. Nokia has 59 public GPRS core network references, including 33 commercially launched networks.

Once the network is up and running, Nokia Care Services provide crucial network operations support with special emphasis on functionality and security. These services, together with TETRA-specific training solutions, help ensure successful network operations right from the start.

Nokia THR850 enters UK TETRA terminal market

Nokia is entering the UK TETRA terminal market serving users of the country's Airwave public safety network. The Nokia THR850 leads the way, with shipments expected to begin before the end of the year. Nokia TETRA terminals will be available through recognised service providers in the UK.

The announcement came at the recent BAPCO (British Association of Public-Safety Communications Officers) exhibition in London. Visitors were invited to try the THR850 and were particularly pleased with how small, light weight and easy to use the terminals are.

"I was delighted to hear that Nokia are to offer their TETRA handportable terminal to UK public safety users," says Phil Kidner, President of BAPCO. "Nokia is a large international company in the mobile communications world and its participation in the UK TETRA market can only be of benefit to us all."

Nokia already supplies most major TETRA Public Safety networks around the world with TETRA terminals, including Belgium, Finland, Hong Kong, Ireland, Italy, Norway, Spain and the United Arab Emirates.

"The UK market is an important market for Nokia TETRA products, and we are committed to continue developing our product offering for the TETRA community. Users of TETRA terminals need easy access to services that are crucial in their daily work. In our phones, this means easy-to-follow, logical menu structures and fit-in-the-hand design. We recognise the value of ease of use, and believe that with the Nokia THR850, the professional user market will enter a new era," says Kenneth Björklund, Director, TETRA Business Line, Nokia Mobile Phones.

Endowed with classic Nokia form factors, the Nokia THR850 meets an array of communication needs. The Nokia THR850 is ideal for organisations with large mobile forces in the field. It offers fast, dynamic and efficient communication, with strong emphasis on immediate call set-up and an extensive range of group features. In addition, it supports status and short data messaging, WAP and IP Packet Data, giving public safety personnel and other professional users the ability to access information through their TETRA phone quickly and easily.

The Nokia THR850 won second prize at the TETRA World Congress 2001 in the category of 'Best TETRA Product of the Year'.

Nokia TETRA System success for public safety organisations in Tianjin

Chinese delegates have seen some of the latest developments in Nokia TETRA systems at a digital trunking seminar hosted by the Tianjin Security authority and Nokia.

Participants attended from organisations such as National Security, Public Police, Fire, 110 Emergency Response Centre, Traffic Control Centre, Anti-aircraft Office, Information Office and Armed Police and saw Nokia TETRA solutions for the Chinese market. They saw TETRA IP and WAP, Professional Portal and public safety applications in a demonstration that included a digital TETRA switch DXT, TETRA base station, a Chinese Dispatcher WorkStation and a WAP server.

Also on show was the Nokia THR850, the first TETRA terminal with Chinese functionalities. Participants were particularly impressed with the terminal's advanced features and its Chinese User Interface, Chinese input and Chinese texting.

The seminar allowed other public safety organisations in Tianjin to review TETRA's advanced technology, as well as providing Tianjin Security with possible partners for sharing a future TETRA network.

Nokia base stations
– more options, more benefits

Greater reliability, lower operating costs and the ability to meet the needs of specialised applications. These are some of the many benefits of Nokia's latest improvements to its range of Nokia TETRA base stations (TBS).

One innovation is a new set of versatile, integrated plug-in units that can be used to build different configurations for different needs. For example, the autotuning combiner (ATC) and wideband combiner (WBC, often called hybrid combiner) allow the operator to set frequencies remotely, without the need for a site visit. This cuts operating costs.

Antenna and feeder costs are also cut by an integrated duplexer unit, which combines both transmit and receive frequencies in one antenna. Other cost saving innovations include the combination of two duplexers into one plug-in unit, while a bias-T/TX monitoring unit can now monitor the transmitter antenna line.

As well as the basic functions, the new hardware allows some rather specialised solutions to be implemented. For example, road coverage can be achieved without additional power splitting units by using the wideband combiner and dual duplexer. X-polarised panel antennas with built-in diversity gain can be installed back-to-back on the antenna mast to maximise coverage along the road.

A similar solution can also be adopted to improve reliability. In this case, two omnidirectional transmit antennas provide redundancy if one antenna or antenna line is violated.

Another possible solution is a combiner-by-pass for maximum output power. This option will appeal to many operators. A wideband combiner can be installed to function only as an isolator, while the actual signal combining is by-passed. The main drawback with this combiner-by-pass solution is that each transmitter requires its own antenna.

Compact switch range launched

Nokia has launched a scalable switching family based on the well-proven Nokia DX200 platform. The Nokia DXTip family delivers the same functionality, high capacity and performance in the TETRA core network as before, but is more compact and easier to install and maintain.

The new DXTip family comes in three versions for the access level and one for the transit level.

The basic single cabinet DXTip product is an entry-level switch for start-up installations. It targets public safety trials and pilot studies and applications in small utilities, transport, light rail and so on.

The medium-sized 2-cabinet DXTip switch targets applications where the basic DXTip product is not enough and networks need to optimise the overall configuration.

The high-capacity 3-cabinet DXTip product targets large public safety applications that typically require nation wide coverage and services. It also provides an expansion path for the single cabinet and 2-cabinet DXTip products.

The high-capacity transit level DXTip product supports a hierarchical network topology when the fully-meshed topology between access level DXTip switches is no longer viable in terms of CAPEX and OPEX. The product supports all the same connectivity as the access level DXTip switches, except for direct connections to base stations.

The switching system hardware is scalable by adding extension cabinets. Scalability in the software can be achieved by increasing the size of the Home Location Register (HLR), which governs the maximum number of subscribers in the system.

A network in three layers
The Nokia TETRA System consists of three layers - the TETRA radio network, the IP Backbone network and the IP Packet Data network.

The core of the Nokia TETRA System is a traditional radio network, consisting of DXTip switches, radio base stations and several interfaces with services such as dispatching and public/private telephone networks. The system supports both flat and hierarchical network topologies, depending on the operator's requirements to achieve the best balance between cost and redundancy. In the Nokia TETRA System, the DXTip is the centre of communications, supporting fast call set-up and high traffic throughput.

The TETRA IP Backbone is a reliable, scalable and secure IP network that provides IP connectivity to various TETRA network elements and applications, such as the TETRA Connectivity Server

PDAs
– powerful new tools for field personnel

It's afternoon in the city centre. Police officer Hans Lundgren stops a car whose driver has been speeding. Lundgren carries a Personal Data Assistant, or PDA – entering the vehicle licence number, he receives the message that the car is not stolen. However, when he scans the barcode on the driver's licence, a crime database reports that the driver has a criminal record for drug offences. Lundgren asks the driver to accompany him to be tested for illegal drugs.

The above is an example of how a new solution - using PDAs with digital TETRA radio communication – can help officers in the field work more efficiently. Police and rescue workers can use the solution to get the information they need to handle an emergency and also to send information back to a central office.

Several PDAs are suitable for police use and can be connected to a TETRA THR850 terminal with a serial cable, using a Web Browser or a PDA version of a WAP browser a user interface.

Using PDA devices with a Nokia THR850 allows the connection of barcode readers, cameras or GPS devices to the PDA, bringing new applications to TETRA. If large amounts of data need to be transmitted, such as large maps, WLAN cards such as the Nokia C110 or D211 could be used in the PDA's PCMCIA slot.

As well as being easy to use, the application has other benefits - all software and platforms, such as Nokia Professional Portal, is located at the infrastructure side in a command & control room, which keeps maintenance costs very low. PDAs also have no need for application updates.

Nokia TETRA and Nokia TETRA partners (TWISP) provide efficient solutions, allowing police forces to make good use of PDA based applications.

(TCS), Configuration and Data Distribution Server (CDD), Gateway GPRS Support Node (GGSN) and Wireless Application Protocol (WAP) servers. In addition, the TETRA IP Backbone provides an IP connection between the DXTip switching sites of the TETRA network.

The IP Packet Data network provides the same function between TETRA radio users and internal and/or external IP networks and services. The Nokia TETRA System IP Packet Data Service supports point-to-point IP data communication between one MS host and another, or between an MS host and an external host.

All these layers are connected through the transmission network and operated and maintained via the Nokia Network Management System, Nokia NetAct.

Telemedicine over TETRA brin

Modern technology really can help save lives and protect property. The high capacity data transfer of GSM/ GPRS and extremely fast data transmission set up of TETRA IP promises to change the way public safety personnel work in the field. For the first time, telemedicine applications can be made available to rescue groups in the field. Data communication gives field personnel access to information that the dispatcher would otherwise have to pass on verbally, such as details of buildings, dangerous goods or injured patients.

Another example of new mobile technology delivering new types of services is the home care concept. Mobile telehealth treatment and health care services can be provided away from hospital premises, typically at home. The patient, or a visiting home care nurse, regularly measures pulse rate and blood pressure, as well as recording ECG (electrocardiogram) and sends the results to healthcare professionals at the hospital for immediate instructions.

Using TETRA, telemedicine has an important role in improving the chances of patient survival and enabling carers to provide more effective services in the field. In essence, such technology makes a higher level of expertise available to field personnel – the sharp end of medical care. The benefits of better on-the-spot monitoring of patients in the field are many, from better on-the-spot diag-

nosis, which enables faster and more accurate treatment, to providing recorded information that can be used for training purposes. Added to which there are significant economic benefits by reducing the amount of expensive hospital care required and generally making healthcare much more cost-effective.

WAP goes medical

WAP comes into its own in the hands of professionals, who can use an efficient wireless IP bearer, such as GPRS or TETRA, for WAP-based applications. A familiar browser-type user interface brings vi-

tal information directly to the handset or mobile computer display in seconds. Information about a patient's medical records can also be processed in seconds and sent directly to the mobile unit's display. Additionally, pictures can be sent back from the scene to keep command and control centre personnel informed.

Emergency service personnel routinely use mobile communications to share information between units, make phone calls and request information. As well as conventional person-to-person calls to any phone number, digital radio communication systems offer a host of added

Ergo – a cloak that protects and monitors

The Ergo project is developing a weather–proof protective covering for accident patients that will also monitor the patient's vital signs.

Consisting of a thermal insulating cover, Ergo will incorporate monitoring probes and cables to enable emergency medical crews to collect data on vital body functions such as circulation, respiration and consciousness.

Ergo meets two vital needs that are often missing in the very early stages of patient rescue and treatment – protection against hypothermia and pa-

tient monitoring. Accident victims often suffer hypothermia, a decrease in the core body temperature, even in temperate climates. This frequently goes unnoticed at the scene of the accident and, once the core temperature falls, it is very difficult to restore, even in a hospital.

Early monitoring is vital

Monitoring of vital signs is also critical in the early stages, as vital functions often deteriorate in trauma patients. Yet, monitoring at this stage is very rare, even though patients' vital functions can be

in as much danger in the rescue phase as during anaesthesia and trauma surgery in hospital, when monitoring is used routinely.

Transmitting the data from the Ergo monitors over a wireless system such as TETRA, which is already used by many authorities, will allow medical experts based at a hospital or other emergency centre to assess the patients and prioritise them for treatment.

TETRA is ideal for this application, because of the fast access it offers to data services. Either short data or TETRA IP packet data can be used and mon-

gs patient benefits

features such as versatile group communication. Thanks to the TETRA direct mode feature, groups can even communicate in locations such as basements and tunnels where there is no network coverage. Pre-defined status messages, such as 'on the way' or 'in position', enable field units to be tracked quickly and accurately.

One of the most challenging roles in medicine is controlling the action as a medical member of the command centre. Every accident is unique and requires special decisions, but the actions that need to be taken are based on the same principles. The most important is the prioritisation of casualties into categories so they can receive first aid, emergency care, transportation or treatment in hospital. These difficult prioritising decisions require exact information on casualties, their traumas and physical condition. Accurate information is one cornerstone for efficient co-operation between organisations, and without it, team leaders will encounter insurmountable difficulties. Modern telemedicine applications offer new solutions to the problems of co-ordination.

All eyes on the patient

The work of the management group is based on voice, images and videos transmitted from the scene and from hospitals. The images include overall views and detailed pictures of each casualty and his traumas, the same view as the rescue group leader or medical rescue leader sees with his own eyes at the scene of the incident.

Based on these views from the scene, the experts of the management group can make best use of resources and give general or detailed advice and instructions to the field personnel, transportation groups and hospitals. The aim is to master the situation and prioritise casualties and tasks. Telemedicine can also be applied in single patient emergency care, but in these cases the information is more concerned with the patient's history, physical state, measurements and monitored parameters.

The Nokia TETRA System meets the challenge of communicating in emergency situations that demand more speed, resources and security than normal. Versatile priority functions ensure that emergency calls will always get through, pre-empting low priority traffic where necessary. Members of the press and other potential eavesdroppers cannot eavesdrop on the digital TETRA signal when, for example, paramedics request confidential patient information over the air.

itoring devices can be connected to the TETRA radio via the TETRA PEI interface.

Using TETRA technology, Ergo will bring great benefits to both patients and medical staff – because more expertise is brought to the field, the patient gets the correct diagnosis, and faster and more appropriate treatment. The application will also increase efficiency and cut costs for the organisation, as well as allowing the recording of information for training purposes.

Above all, by improving trauma diagnostics and monitoring of vital parameters, as well as maintaining patients' normal core temperature, Ergo could substantially reduce the number of avoidable deaths.

TELEMEDICINE IN ACTION

Radio Data Dispatcher brings wireless dispatching

With the launch of the Nokia wireless dispatcher concept (DWSr), versatile dispatching functions have become available in the field. Until now, dispatcher systems have been tied to fixed locations, such as centralised command and control rooms. But the new Nokia DWSr Radio Data Dispatcher equips command vehicles or modules with powerful dispatching facilities that enable field officers to manage incidents and resources on the road.

In many countries, the police and other public services are under pressure to cut costs. This is driving a trend towards having fewer personnel in offices and more out in the field doing practical work. Centralising the command and control operations into fewer larger units moves them further away from the scene of ongoing incidents, which may require more responsibility to be given to the field officers.

A real need in the field

A police officer may need to be able to allocate a suitable free unit to an incident while he is on the road. A fire officer on the scene of an escalating situation may need to be able to bring newly arrived reinforcements into existing talk groups. The need to respond to incidents by dispatching free units or to manage field operations does not disappear as working models develop. Changes in the working environment do place new demands on communication systems and dispatching solutions. Nokia DWSr is a new solution from Nokia that is designed to better support existing or new, more efficient working models.

Nokia DWSr is dispatcher application software that is installed, for example, on a robust laptop computer in a vehicle. Wireless access to the TETRA network is provided either by a TETRA radio terminal using TETRA IP Packet Data or by a GSM/GPRS phone and the data services of the public cellular operator. The power of Nokia DWSr is that it brings subscriber, group and group membership management facilities to the field. Nokia DWSr also provides short data and

status messaging services via a proper keyboard and large screen, which make these features easier to use. TETRA voice communication is achieved using a normal TETRA radio terminal.

Nokia DWSr brings dispatching to the scene of an incident. The field of-

ficers can see for themselves what is happening and can react instantly. They can decide on actions based on their own observations, communicating with other people and additional information provided on screen by Nokia DWSr.

A superb short term solution

Nokia DWSr is ideal for short-term or temporary dispatching needs. A Nokia DWSr dispatcher station can be set up in the time it takes to set up a TETRA call. Typical incidents in which Nokia DWSr may be used can take place over anything from a few minutes to several days. For larger incidents, Nokia provides more powerful dispatcher products such as DWSi, which is based on a dial-up

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DATA

Nokia DWSr provides many wireless management features to the field officer:

- group membership management: new members can be brought into ongoing talk groups and released units can be removed
- group management: new talk groups can be initiated according to changes at the scene and, once the task is completed, temporary groups can be removed
- dynamic re-grouping feature for handling dedicated incidents
- changing a group area to be either smaller or larger, depending on the size of the incident
- real time status monitoring of individual subscribers helps the field officer to allocate available resources for new tasks and to monitor the progress of tasks already allocated
- location monitoring of individuals by showing the current site information
- handling callback requests
- event monitoring of the group speech items keeps the field officer informed about which group is communicating and who is talking
- monitoring of the group selections made by the individual radio subscribers helps the field officer to sort out potential communication gaps
- adding or reducing call access rights to/from a radio subscriber depending on the task an individual has been given
- a pre-emptive facility can given to a subscriber by a field officer, eliminating the need to queue for speech items
- changing the queuing priority for a radio subscriber or a group depending on the allocated task
- the ability to trace the history of speech items in each of the talk groups
- status and short data messages (SDS) are easier to use, thanks to a large keyboard and wider screen in the laptop computer

on the move

ISDN connection, or DWSe1, which is based on an E1 fixed connection.

Nokia DWSr is cost-effective. The use of the TETRA IP Packet Data service means that the dispatcher connection can be kept virtually open (packet data context), but a traffic channel or other system resources are occupied only when data is transferred. For the rest of the time neither radio channels nor system resources are allocated.

Nokia DWSr provides dispatching services to the field officer through the same easy-to-use Microsoft" Windows' based user Interface as all other Nokia dispatcher workstations. The user will therefore feel comfortable using the DWSr immediately and no additional training is needed.

Nokia DWSr uses Nokia's dispatcher application software as a default. However, customised Radio Data Dispatcher applications are also supported. Customised wireless applications will use the same bearers as Nokia DWSr. The interface to the TETRA network is the same harmonised Nokia TETRA Connectivity Server (TCS) Application Programming Interface (API) as for the line connected customised dispatcher applications. This optimises wireless dispatcher solutions for the specific needs of each organisation.

Nokia DWSr Radio Data Dispatcher Workstation
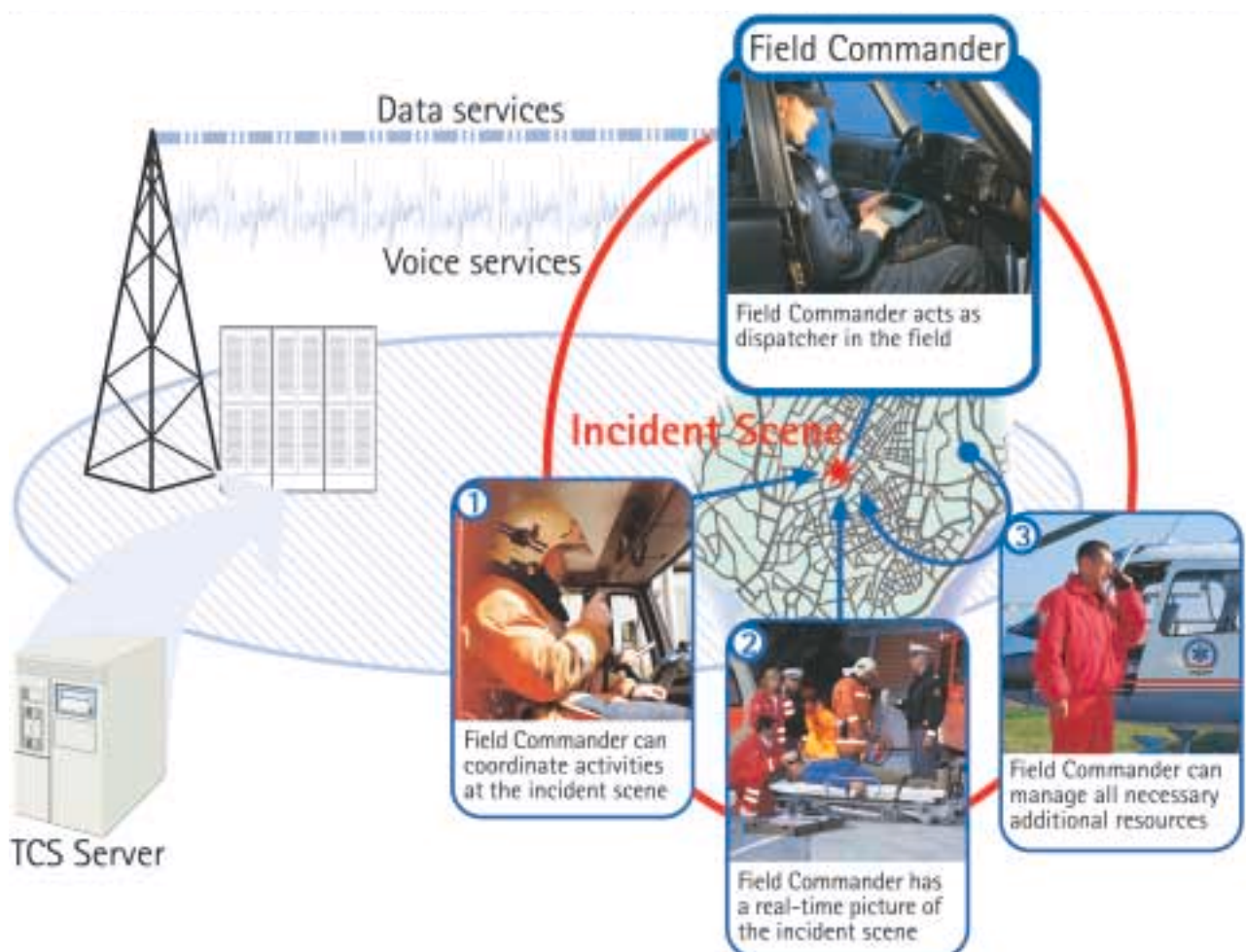
Nokia DWSr brings the power of dispatching to the field. A commander in the field is able to manage incidents and resources while "on the road"

Italy's first aid brigade

About once a week, Stefano Fietta staffs one of Milan's approximately 50 ambulances, driving around the city from one emergency call to another.

In Ciampino, Luana Giuliani spends her free time in an ambulance, too. So does Antonella Cesario, in her home town. The same goes for Ettore Circo, Emanuela Nava, Giancarlo Figini, and many, many more people all over Italy. But they are not doctors or nurses. They are Nokia employees who moonlight as emergency workers.

There are at least a dozen Nokia employees in Italy who volunteer in emergency services in addition to working full-time. Surprising? In Italy, this is not so unusual.

Emergency and first-aid services are not run by the government, instead, ambulances are staffed with dedicated volunteers who come to the task from a variety of non-governmental organizations. There are two kinds of ambulances: those staffed by trained volunteers, and those that include doctors as well. The organizations work together, and the government adds its contribution by coordinating the various activities and by providing some funding.

Some of Nokia's ambulance volunteers: Ettor Circo, Antonella Cesario, Dino Barbieri, Stefano Fietta, Giancarlo Finigi, Emanuela Nava.

Nokia office like anyone else.

"We usually work nights and weekends because it is the only time we have free," offers Antonella. "And we want to use our time to do some good."

Most of the volunteers came to this for the same reasons, although Emanuela, a 12-year veteran, jokes that an additional motive for her was to overcome a phobia. "I used to faint at

"If you don't believe in the good of helping people, you can't do it."

The first step

"I had a mind to use my free time in some way to do some good. Then I met someone who was volunteering in this way, and he told me all about the organization," says Stefano, who has been volunteering in an ambulance for seven years. "I felt so lucky to have good health, I thought, why don't I do something to help others?"

His friend convinced him to attend the training and to sign up with one of the emergency service organizations. Now, he drives an ambulance around Milan during night shifts, "always trying to find the fastest way," he says. His shifts typically end around 6 am. Occasionally, after a weeknight's shift, he dusts himself off and goes into the

the sight of blood," she laughs. "But I went through the training and got over my fear. That's how I started."

Emanuela, like everyone else, had to get used to the grim details and risks of the job. There are concerns about blood contamination, for example, though they use special protection. "But the objective is to help people, so you don't let things like blood get in the way," says Ettore.

Preparing for the worst

In addition to yearly refresher courses, all volunteers participate in simulations of major crises like collapsing buildings, earthquakes, and crashes. These are massive exercises which practice the coordination of the emergency service volunteers, police, firemen, and other

support and rescue services.

None of the Nokia volunteers have experiences anything on that scale. A typical night shift includes mainly rushing to the aid of the elderly, and assisting at car accidents.

"But anything can happen," adds Antonella. She once had to massage the heart of a patient in the ambulance. And almost all of them have had to deal with losing an occasional patient. "You don't think about it at the moment. You just try to work and do your best. Later, though, you do think about the people."

Hoping for the best

Despite the stress, none of them are inclined to quit anytime soon. "Sometimes I think I'd like to stop because I'm just very tired. But when I return to my shift, I always change my mind," says Emanuela.

The reason is because the positive side is also so overwhelming. They've all given comfort and saved lives, and in once case a colleague even helped a woman give birth in the back of the ambulance. Though it happened a few years ago, he still talks about it as if it were yesterday.

"It's true that those who volunteer in this way make some sacrifices, because you could use the time for yourself," says Luana. "If you don't believe in the good of helping people, you can't do it."

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