TETRA Touch

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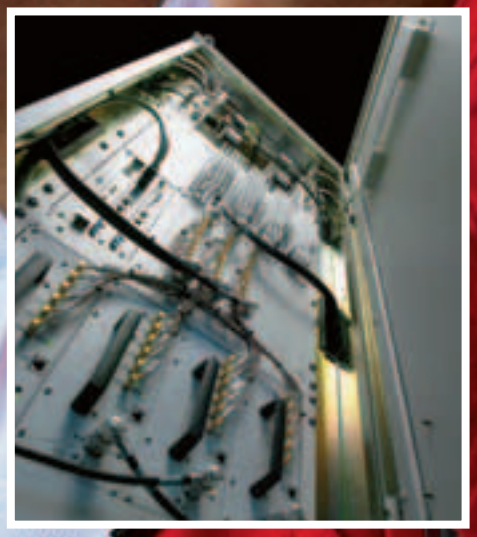
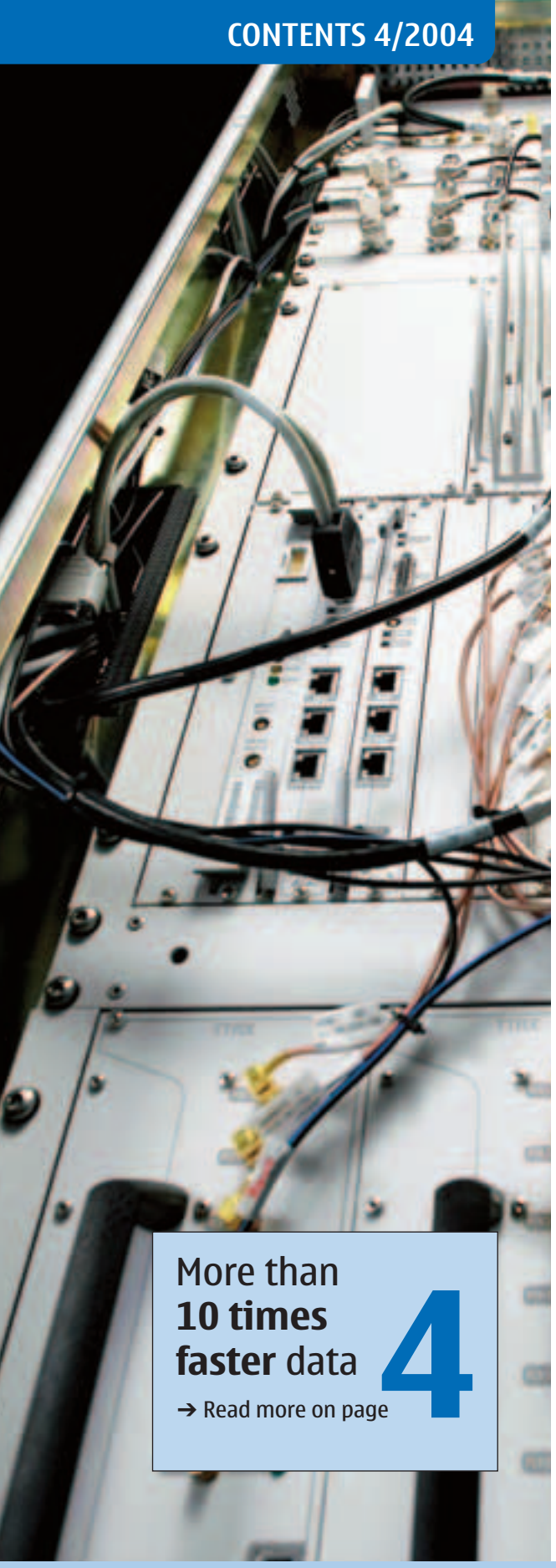
How to build and operate true shared networks

More than 10 times faster data without hardware upgrade





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Editor-in-Chief: Tiina Saaristo
tiina.saaristo@nokia.com
Sub-editor: Johanna Kolehmainen
Lay-out: Spokesman Oy
Printed by: Libris Oy

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The new sharing world

In the past, public service radio networks were built to serve only one organisation. This has severely restricted the ability of different organisations to communicate with each other during an incident. In today's world where emergencies are more likely to need the input of two or more forces, it is widely recognized that inter-agency communications restrictions are no longer acceptable.

The solution would seem to be one network shared by all public safety forces. But this presents a problem because organisations such as the police want the security and complete control that a dedicated network brings.

Virtual network – real capability...

Today's digital radio technology enables a physical network to be shared in complete security. Nokia TETRA's Virtual Private Network (VPN) system allows several organisations to share the network infrastructure and yet still feel they have their own independent, private network.

Sharing the network also brings real improvements in efficiency and allows new ways of organising the efforts of emergency personnel. Because Nokia TETRA allows public safety agencies to share the same physical network while maintaining the privacy and security of each organisation, different organisations can communicate seamlessly when necessary. And each organisation works independently unless common communication is specially set up.

...and it costs less

There are also big cost savings from sharing. Separate communication networks have involved separate planning and budgeting, separate services and separate resources. These networks may have seemed relatively cheap to plan, build and operate in their time, but this is certainly not the case today. In contrast, a shared TETRA network means that the investment and operating cost can be spread across several user organisations.

These operational and cost benefits have only become available and practical with the arrival of TETRA.

Indeed, is it any wonder that one of the global trends in public safety communications today is building shared TETRA networks, such as VIRVE, the countrywide public safety network in Finland; ASTRID, the countrywide public safety network in Belgium; or the Just Top network for the Beijing Government. Sharing is one of those things that brings benefits to all – it promotes cooperation, helps the exchange of information and expertise, and it can cut costs significantly.

In this issue of TETRA Touch we dig out the secrets of what it takes to make and operate a true multi-agency network. We also describe the numerous benefits that TETRA can offer, from seamless services to network coverage, and from security to location solutions.

Matti Peltola

Senior Vice President, Professional Mobile Radio

The fundamentals of

TETRA provides voice and data services efficiently because it has data capabilities integrated into its infrastructure and is supported by standard TETRA terminals. This is an economical alternative to providing dedicated radio resources for data. Flexible prioritising of voice and data services should always guarantee that mission-critical communications take priority.

TETRA Packet Data

TETRA provides IP packet data in a similar way to GPRS in GSM. Most transactional services work well using TETRA IP packet data with a one-slot gross bit rate of 7.2 kbit/s. This gives a net bit rate of 2.5–3.5 kbit/s for applications. That is sufficient for WAP and email, while images, fingerprints and slow-speed video can all be supported using compression. TETRA IP packet data is supported by the same capacity and coverage plan as a basic TETRA voice network because the TETRA standard makes the most of any available capacity. TETRA IP packet data is already available in TETRA networks and is a standard feature of many TETRA terminals and applications.

TETRA multi-slot packet data

TETRA multi-slot IP packet data provides up to 28.8 kbit/s gross bit rate, which yields a bit rate of around 9 kbit/s for applications. This can provide an enhanced service for images, mobile email and low-speed video, although it can't match the GPRS service in GSM networks. The capacity and coverage of a basic TETRA voice network can support TETRA multi-slot IP packet data, but there are practical drawbacks.

Prioritised voice traffic may disconnect or pause a data session, for instance, so only additional radio capacity can improve the resulting quality of service for multi-slot packet data. At least one radio transceiver should be reserved for the multi-slot packet data service in each cell. This pushes up the number of carriers, causing an increase of up to 30% in the cost of network implementation and operation.

Multi-slot packet data also increases terminal power consumption. The battery life of a handheld four-slot packet data terminal operation

More than 10 times faster data

"Nokia's choice is to integrate high-speed data capability seamlessly into the Nokia TETRA system," says Matti Peltola, Senior Vice President in Nokia Professional Mobile Radio. "In future, Nokia TETRA Systems will offer high-speed data services in addition to currently available TETRA services.

"We have selected an integrated approach. Bringing high-speed capability into an existing Nokia TETRA network would not require an overlay network or additional network elements. This will secure our customers' capital investments. In addition, because the integrated approach results in single user and service provisioning, billing and management for all TETRA services, including high-speed data, it will also optimise operational expenditure, which we know can form as much as 80% of the total cost of ownership of a TETRA network".

"What's more, our goal is to develop TETRA high-speed data as a software feature, upgradeable over a remote connection to the Nokia TB3 TETRA base station. This means that planning the TETRA network for a subsequent high-speed data upgrade today can achieve enormous savings later. Nokia has again applied its innovation and systems expertise to addressing the challenges in professional mobile radio".

High-speed data will be vital

"These strategic goals are an answer to future needs. We predict not only that high-speed data will bring more value to customers, but that high-speed data will in fact become essential."

It will take time to develop interoperable, TEDS-capable infrastructure and terminals, so an early decision on the way forward is essential to maintain the interoperability achieved in today's TETRA networks. Spectrum allocation and radio compatibility are other long-term issues that must be tackled early enough to enable seamless network upgrades.

Most importantly, key decisions must be taken now to enable today's TETRA networks to be planned with future TEDS upgrades in mind. Nokia can provide TEDS upgradability in the Nokia TETRA infrastructure solutions delivered today, providing a great opportunity for TETRA customers to minimise the cost of later upgrades.

Its high-speed data capability will ensure that TETRA remains viable – in fact, vital – in professional mobile radio communications for years to come. Taking advantage of developments in mobile data services will provide TETRA users with a growth path and leading-edge technical solutions. Nokia TETRA customers will be best positioned to fully exploit these developments.

The promise

TETRA 2 promises data services 10 times faster than today's single or multi-slot packet data. But the following criteria must be met in order for a solution to match that promise:

- integration of TETRA 2 high-speed capability should be seamless, without an overlay network
- it must exploit the efficiency of TEDS radio for adaptive high speed applications
- in addition to 25 kHz, also 50 kHz carriers must be available in the TETRA bands.

Most solutions will fall short of this ideal, but the Nokia TETRA system can provide a cost-effective upgrade path that will enable networks to realise the full potential of high-speed data in the future.

TETRA data

time is dramatically reduced. This may not be an issue for vehicle-mounted mobile terminals, but the extra investment required for a four-slot implementation could still outweigh any improvements in the data service.

What about using a commercial GPRS service?

The obvious alternative to TETRA high-speed data is to use the GPRS service from a GSM operator and GPRS-capable GSM terminals. However, the key issue is service availability.

Only a dedicated PMR data service can ensure the availability of critical data at all times. Commercial networks could be overloaded by the public or damaged in times of crisis, which is just when the safety services need all their resources.

TETRA 2 – TETRA Enhanced Data Service

ETSI is currently defining TETRA Enhanced Data Service (TEDS), a new air interface standard to increase TETRA data speeds up to 30–150kbit/s. TEDS will be more than 10 times faster than multi-slot packet data. TEDS will need significantly more radio spectrum and capacity than TETRA, so TEDS carriers will be dedicated to high-speed data and cannot be used simultaneously for voice. This will raise the cost of network upgrades in the same way as multi-slot packet data, although it will provide a significantly better service.

TEDS coverage at the highest speed will not be the same as TETRA coverage, so the highest-speed TEDS service will only be available over a limited range, although the service will be continuously available at a lower speed.

Enhanced data services need more radio spectrum and wider channels, so TEDS needs 50–150kHz compared to 25kHz for TETRA. In the public safety bands this spectrum is restricted, but 50kHz carriers are readily available. Such carriers could also be allocated in a frequency band other than that currently used by TETRA. Selecting a 50kHz band would make it possible to integrate TEDS into existing TETRA networks, so it is clearly the best choice.

Complete loca

Knowing the whereabouts of field officers can add significantly to the security and effectiveness of public safety operations. A number of solutions are already available for TETRA to take advantage of location information.

Nokia can provide all three types of location solution: location based on a separate Global Positioning System (GPS) device, location based on an integrated GPS, and network based location technology, the only choice when the use of GPS is impossible.

On the map

The most common application for GPS, either a separate device or integrated into the mobile, is Automatic Vehicle Location, AVL. This uses a GPS device connected to a mobile TETRA radio, either directly or via a mobile data terminal, and is designed for fixed installation in a land vehicle or sea vessel. The terminal sends its location data to the location information application using SDS messages, allowing the dispatcher to monitor the vehicle's location on a digital map.

The trend of integrating GPS into radio terminals will no doubt also boost the use of Automatic Person Location (APL) applications – using location information to put field personnel on the map.

The location of Nokia TMR880, THR880 and THR880i radios can also be determined without GPS information, letting the Nokia TETRA network provide the necessary data. This is the only choice when the use of GPS is impossible, such as within basements and tunnels. The accuracy of the calculated location can be very good, with smaller cells near the location providing greater accuracy.

A location server in the TETRA network infrastructure provides location data on registered TETRA radios within the network area: outdoors, indoors and even under ground. The location is calculated from radio signal measurements that the radio makes, which it sends to the network via SDS or status messages. The big advantage of the solution is that field personnel need only the Nokia TETRA radio, no extra devices are needed.

Complete Location

Nokia's Complete Location solution combines a field command system (including map applications), wireless browsing and a GPS receiver within a TETRA terminal. All the features are integrated to form an effective whole. The application enables dispatchers to follow units live on the map as field personnel move around.

The Missing Persons database is a perfect example of where these mobile browsing features might be useful. The user can view the images of missing persons in the database directly on the THR880i terminal. The images in the database may be canonic identification images used as standard by both Interpol and the FBI. This type of image is 240 pixels wide and 320 pixels high with the face always centred. Alternatively, the THR880i can retrieve detailed, true-colour images from the database for viewing with great clarity.

tion – a sense of place

This helps the dispatcher send the closest and most suitable units to deal with an incident.

In addition, field units can check the position of their closest colleagues with the help of Nokia's new THR880i hand portable TETRA radios. A field officer can send an inqury to an innovative Nokia TETRA partner application via WAP, which automatically sends location information to required units.

If these units are equipped with Nokia THR880i terminals, the application receives exact coordinates from the radio terminals. The application then creates a location map of the relevant units and sends it as a .jpg image to the originator.

This approach takes advantage of the following winning characteristics of the Nokia THR880i:

- The new display makes it possible to view a sharp and detailed map. The display shows not only bitmap images but also clear and detailed true-colour images, such as jpeg.
- The integrated GPS receiver enables the terminal to send its location to the application, wirelessly.
- Wireless browsing and the ability to view XHTML pages directly on the terminal display are also possible, thanks to the inclusion of a XHTML browser.
- The terminal can receive WAP data messages sent via TETRA SDS, such as Over the Air (OTA) Provisioning and OTA PUSH.

OTA Provisioning makes life easier

OTA Provisioning allows dispatchers to send WAP settings to the mobile terminal over the air. This makes it easy for the user to get the configuration of the terminal right. He only has to accept the configuration settings, which are then stored in the terminal memory ready for use.

OTA PUSH makes it possible to send links to the user's terminal. TETRA also allows links to be sent to a group. The user simply opens the link and the terminal opens the correct XHTML/WAP page for browsing. This eliminates intermediate actions, such as typing in the URL.

Nokia THR880i combines innovation with ease of use

Nokia's latest TETRA terminal, the THR880i hand-portable radio has started to ship from November 2004, following its official launch in September 2004. The Nokia THR880i is poised to improve communications in the most demanding situations, thanks to a careful analysis of the needs of users combined with state-of-the-art technology and handy innovations.

A built-in GPS receiver enables the Nokia THR880i to collect position information from GPS satellites. This allows authorised users such as command and control personnel to request the radio's location over the air. Sending the nearest available unit to the scene of an incident brings faster response times and a better service for citizens.

Know where everyone is

Dispatchers and team members can keep track of field personnel in the most critical situations. The THR880i can even show users' position on a digital map, delivered to the radio display over a WAP/IP packet data connection. Alternatively, personnel can use the radio's colour browser to view digital content from their organisation's database or from the web when such access is supported by the TETRA network infrastucture. Thanks to the new active colour display and convenient four-way navigation, browsing and capturing essential information is quick and reliable.

Clarity with colour

Receiving information in clear colour pictures or graphics leaves no room for misunderstandings that could hamper operations. The benefit of colours extends beyond viewing pictures and graphics however, to enrich all the information shown on the display. Users can even choose a preferred colour scheme. Handy short cuts with the four-way navigation keys make using the radio even quicker and easier.

For example, a single press of the arrow key accesses the list of group folders or the phone book, or enables users to enter the status list or open the text message editor.

The two-sided concept of the Nokia THR880i radio is also designed to boost efficiency. Using the simple controls on the radio side gives straightforward group communication when officers need to focus on the job, not on using the radio. Voice feedback will prompt and confirm operations while selecting a talk group or using the fast menu. The phone side features everything people need to make phone calls, send messages or personalise the radio.

The robust construction is designed to handle the toughest situations without compromising convenience. Whether it's exposed to water, dirt or repeatedly dropped, the Nokia THR880i radio remains fit for the task – providing clear communication in critical situations.

Complete security – a place of

Public safety users need secure communications in order to safeguard their personnel and the public they serve. TETRA Touch takes a look at Nokia's Complete Security – the world's most advanced security system for TETRA.

Getting started

When a dispatcher arrives at work, he registers on the system with his own workstation user ID and password, or even personal smart card key. Every workstation user has a defined set of rights depending on his duties. The dispatcher may need to create new users or new groups, add members or new workstations to the system and so on. Every time he performs one of these actions, the system checks he has the right to do so.

When a field officer turns on his radio terminal, it starts to negotiate with the network for access to the system and the user's right to access different groups and services. First it must authenticate, that is prove its identity to the network.

Next the terminal will negotiate the air-interface encryption (AIE) keys, so that AIE can be used whenever communication is initiated. Then the terminal tells the system which groups it wants to listen to. These include the user's chosen home group and all the groups he wishes to scan. The system checks that the user is a member of all the requested groups before granting access. This feature is unique to Nokia's TETRA solution.

Security through flexibility

A dispatcher handles different communication and management tasks throughout the day. He can even manage personnel from other organisations when necessary. For example, a police dispatcher may create combined groups made up of users from the fire department and the police. On the other hand, some organisations remain completely invisible, because they want privacy and there is no need for co-operation. For example, the secret police could use the same network as everyone else, but nothing about it would be visible in the system. Controlling the management functionality of the system

End-to-end encryption keeps everything under

Confidentiality is the key

Secure voice and data communication is critical for today's public safety organisations. Relying on analogue radio networks that are open to eavesdropping and outdated in both their functionality and technology is a major risk. Public authorities must ensure that their operations and the safety of their personnel are not compromised by insecure communications.

The Nokia TETRA System offers true security. Complete encryption solutions, including authentication, air-interface encryption and end-to-end encryption, fulfil even the most demanding confidentiality requirements. Authentication prevents unauthorised access to the network and paves the way for encryption functions to protect legitimate users.

High class air-interface encryption

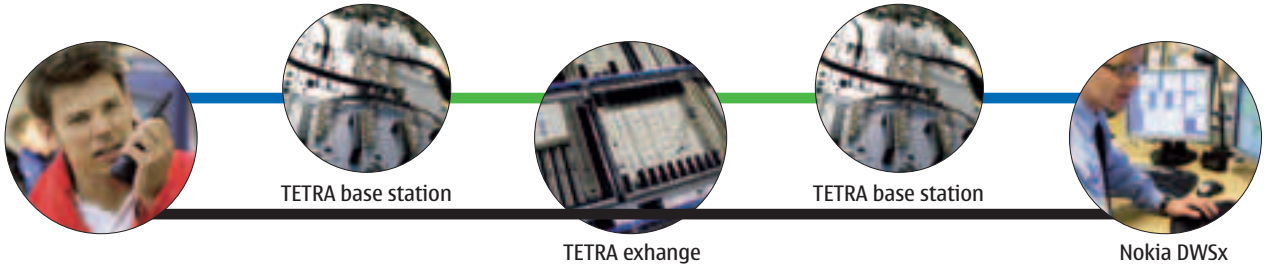
The Nokia TETRA System was the first to introduce the highest security class in the TETRA standard – Class 3 air-interface encryption. Not only are the speech and data encrypted, but the subscriber numbers and control information are too. It's not even possible to monitor who is calling whom and where the subscribers are. The encryption mechanism is available for both trunked and direct mode operation. Authentication is mandatory and the encryption relies on dynamic keys.

End-to-end encryption tops it all

In systems needing a very high level of security, additional measures are needed to protect information transmitted from one terminal to another, not only over the air interface but also within the network infrastructure. End-to-end encryption complements air-interface encryption and operates between terminals without any intervention by the infrastructure, except in its role as a bit carrier. The secrecy is fully under the control of the end users.

End-to-end voice encryption is a specialised service for use, for example, where national security may be an issue. The TETRA Mou Security and Fraud Prevention (SFPG) workgroup has specified a default

Different encryption schemes meet different encryption needs



AIR INTERFACE ENCRYPTION protects against interception, analysis, and misuse on the radio path.

LINE ENCRYPTION protects against interception, analysis, and misuse on lines and microwave radio links.

END-TO-END ENCRYPTION provides full protection against interception, but does not protect against analysis and misuse.

safety

plays a big part in security as a whole, since it decides who has rights to which parts of the system.

When a group call is initiated, it alerts all members of the group who have elected to listen to or scan the group. Communication between the base station and radio terminal is encrypted as standard so that the voice traffic is secure and the radio terminal ID and locations cannot be traced.

It is also possible to communicate via status and SDS messages and IP data, and the contents of these messages are also encrypted with air interface encryption.

Ultimate security

End-to-end encryption on top of air-interface encryption provides the pinnacle of communication security. Air-interface encryption always encrypts the radio terminal IDs and locations. In addition, end-to-end encryption scrambles the actual content (voice or data) throughout the network, all the way from one radio terminal to another. Nokia is the only TETRA supplier in the world to also offer end-to-end dispatcher capabilities, so that end-to-end encrypted voice or data can be delivered or received by a dispatcher.

The Nokia TETRA System even makes it possible to use different encryption algorithms, for example, to comply with national regulations.

wraps

end-to-end encryption framework, Recommendation 02 (end-to-end encryption). This document specifies all that is required for end-to-end encryption other than the algorithms. Nokia´s end-to-end encryption concept complies with Recommendation 02.

But end-to-end encryption alone is not enough to provide a high-security system. Simultaneous air-interface encryption is also needed. This is because the sensitive TETRA signalling elements in the air interface can be encrypted by air-interface encryption but not by end-to-end encryption.

End-to-end encryption includes dispatchers

Nokia's system never decrypts end-to-end encrypted communication in the network. The message is carried as encrypted TETRA coding throughout. This level of security also requires that fixed terminals such as dispatching stations must be able to encrypt/decrypt communication if they want to participate in end-to-end encrypted calls.

The Nokia DWSx Dispatcher Workstation is used for managing and dispatching field operations with end-to-end encryption. Nokia DWSx supports both end-to-end encrypted and clear mode voice communication. Nokia DWSx automatically switches into the right communication mode depending on the other parties in the call.

The end-to-end encryption capability of the Nokia DWSx offers even the most secretive operations and user groups the ability to use a dispatcher.

Key management is a key issue

TETRA security is based on regularly changed encryption keys rather than maintaining secret encryption algorithms, which tend to become more widely known as time wears on. Each end-user organisations' own security policy defines how often keys are changed.

Customised end-to-end encryption

The Nokia DWSx supports the IDEA algorithm in end-to-end encryption by default, but some users may want to specify their own algorithm. Nokia's end-to-end encryption concept includes flexible hardware and software interfaces to support this requirement.

Complete coverage
– unrivalled coverage with lower costs

For a TETRA network, excellent, reliable coverage is a necessity. Yet, building coverage is expensive, while most OPEX is racked up by base station sites and transmission costs. Nokia's solutions are geared to bring the best of all worlds.

Providing network coverage everywhere, at any time, for the small numbers of officers that are typically using a TETRA network is certainly a tall order. But this is just what Nokia's revolutionary TB3 TETRA base station was designed to achieve. With the improved uplink connection, an operator using the Nokia TB3 can improve his quality of service, provide more coverage, or achieve a combination of the two.

As well as coverage, Nokia TB3 also helps the TETRA operator deal with that other major headache – operating costs. In TETRA networks, base station site rentals and transmission costs can account for up to 80% of operating expenses (OPEX). Selecting the most cost-effective transmission options without compromising resilience is therefore a worthwhile consideration. And, because the transmission units are integrated into the base station, there is no additional cost for transmission equipment.

Roll-out of the network is also simplified, making it less costly as well as faster.

Site visits to maintain and upgrade base stations are a major and ongoing cost that operators face. Remote operation and maintenance greatly reduces these costs and is an important area pioneered by Nokia TETRA. Nokia TETRA base station software can be downloaded and configured remotely. And Nokia NetAct for TETRA brings further savings, allowing all elements of the TETRA network, including radio access, to be controlled from a central network management centre.

Resilience brings personal safety

Based on a modular design and built-in redundancy, Nokia TETRA base stations such as the TB3 can be used in a variety of network topologies, giving designers the freedom to choose the options with the best network availability and security. Using Nokia TETRA solutions results in tough, resilient networks.

With thousands of Nokia TETRA base stations in operation, statistics have shown that mean operating time between base station failure is in excess of 20 years. Also, should a base station fail, the ability to select a multidrop loop network means that the transmission system will automatically recover, keeping all call connections intact and ensuring the safety of users.

Resilience, redundancy and recovery are the watchwords on which Nokia TETRA is built, leading to the overall criterion that PMR users demand – reliable coverage.

Nokia TB3 TETRA base station –Data sheet

Frequency bands
- Tx: 380–390 MHz and Rx: 390–400 MHz

Max. TBS power at top of cabinet
- 25 W
- 40 W (with combiner by-pass configuration and duplexer)

Max power at TTRX output
- 65 W

Dynamic sensitivity at top of cabinet

-113 dBm (TCH 7.2, BER 4%, TU50) without diversity
< -112 dBm (according to EN 300 392-2) without diversity

Static sensitivity at top of cabinet

< -119 dBm (TCH 7.2, BER 4%) without diversity

Receiver class
- Class A and B EN 300 392-2

Diversity reception
- Maximum ratio combining (MRC) improving the uplink budget by 3...8dB compared to single receiver antenna solutions.

Number of receivers per radio
- 6 receivers with MRC for e.g. three-sector X-pol panel antennas

Sectorized reception
- Three sector topology improves receiver C/I by 5 dB compared to omnidirectional solution

Duplex spacing
- 10 MHz

Switching range

≤ 5 MHz

Carrier spacing
- 25 kHz

Combiner options
- Auto-tuned cavity. Manually tuned cavity. Wideband hybrid combiner with duplexers. Combiner by-pass with duplexer.

Supply voltage options
- 230 VAC (184 VAC...276 VAC)
- -48 VDC (-36 VDC...-60 VDC)
- -60 VDC (-44 VDC...-75 VDC)

Power consumption
- Nominal 0.5 kW with one TTRX at 65 W/100% duty cycle.
- Max. 1.4 kW with four TTRXs keyed
- Max. 2.5 kW with eight TTRXs keyed
- Power consumption varies according to the traffic volume.

Width x Height x Depth
- 60 x 162 x 48 cm, one cabinet

Weight (max.)
- 200 kg (1 cabinet) 380 kg (2 cabinets)

Operating ambient temperature
- -10°C ...+55°C

TBS transmit mode
- Downlink continuous (D-CT) (as specified in the TETRA standard). Only carriers that are needed to carry the traffic are keyed.

Transmission
- Three E1 interfaces with inbuilt multiplexer and loop protection capability with remote configuration.
- Support for satellite transmission.

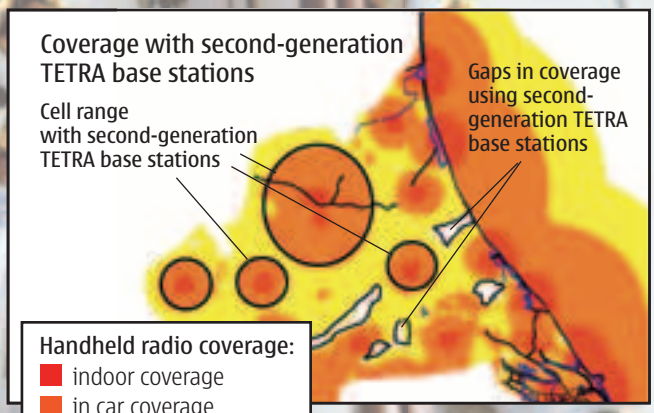
TBS management
- Integrated into the DXT exchange

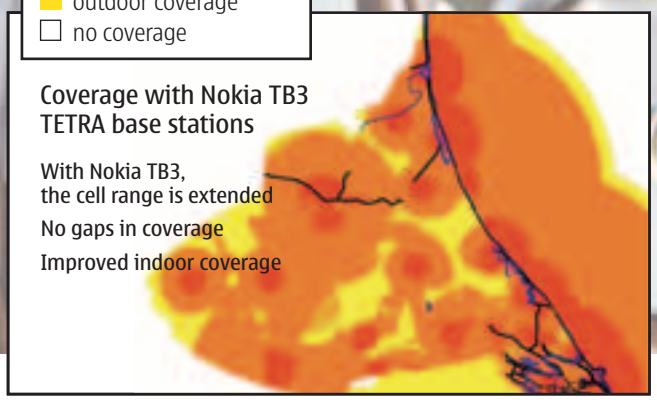
O&M functions
- Remote and local configuration. Remote and local alarm handling. Remote and local SW downloading. Remote and local test services. Eight remote outputs.

Additional base station features
- Superior and versatile coverage solutions
- Intelligent Radio Resource Management
- Fallback
- Automatic Main Control Channel change-over
- Standby TTRX for redundancy with optimised transmission
- Modular design for redundant base station main units
- Jamming detection
- Dynamic air encryption with two simultaneous encryption algorithms
- Adaptive random access window for congestion control
- Additional signaling channel for Automatic Vehicle Location use
- Load directed roaming
- Dynamic channel allocation between voice or packet data Optional Global Positioning System (GPS)

Values shown in the table are typical for network planning.

ACTUAL VALUES HAVE PROVEN TO EXCEED INITIAL DESIGN ESTIMATES





Complete services – the whole story

Just as every story has a beginning, middle and end, so does every TETRA project. Preparation and procurement is followed by implementation and planning, with operational use and maintenance completing the picture. Nokia's TETRA solutions and related services can support customers at every stage in a network's lifecycle.

Getting the right support is more important today than ever before, since the need to provide better, services more economically as quickly as possible presents authorities with new challenges when it comes to justifying investment in communications.

A case in point, Beijing Just Top network

The right support is the key to securing the right results. For example, Nokia recently rolled out a multi-agency TETRA network in under a year for Beijing Just Top Network Communications Company Limited. The network included close to hundred base stations, as well as dispatcher stations and the latest Nokia DXTip TETRA exchanges. The service package included implementation, commissioning, integration, project management, and staff training.

Special emphasis was put to the operational planning of the future users, the purpose of this work to secure their mission critical operations from day one. Currently the Just Top TETRA network is serving thousands of satisfied Beijing Government users, including police, city administration, the Water Conservancy Bureau, ambulance service, disease control, law enforcement and other authorities.

Project preparation and procurement

When choosing a new radio communication system, the purchaser must decide which technology best fits public safety mission-critical requirements in a cost-effective way.

Nokia can help purchasers plan services and model network economics to estimate the lifetime cost of ownership. These costs can be split into capital, implementation and operational expenditure. Nokia can use its modelling expertise to build several economic scenarios. The calculations combine proven Nokia models with actual data from the customer.

Knowing the lifetime costs is crucial when justifying investments, but cost is seldom the only consideration where public safety is concerned. Legislation, tactical and operational requirements are also important. Nokia Operative consultation constantly checks its solution against the actual tactical and operational requirements. But it's a two-way process, with feedback from users playing a major role.

Implementation and planning

Nokia project managers have a great track record of steering TETRA projects in the right direction, on time and on budget. Although the grade of TETRA services can be measured in several ways, the coverage and usable capacity tend to dominate. Nokia network planners can fulfil the target coverage and resource capacity settings while optimising the number of base stations. Nokia's planners also support transmission planning, IP network dimensioning and implementation.

Implementation includes network element rollout and operational rollout. Nokia can assume full responsibility for the rollout or can take a back seat, depending on customer requirements. Nokia can install the network elements, including commissioning each element and integrating them into a functioning system.

The usability and usefulness of services must also be carefully planned. Nokia has the experience to ensure that nothing is missed and that the most important features are decided early.

Radio users will need training that focuses on the differences between their old system and the TETRA solution. Nokia has had great success in previous projects, bringing users up to speed with the new technology.

Operation and maintenance

Organizations can make the most of their investment by fine tuning their TETRA network once it is up and running. This is possible with Nokia's comprehensive services that are driven by network availability, reliability and security requirements.

System availability is essential in public safety networks. The network operator must react quickly if a fault develops, but it's seldom economically feasible to have an extensive network of monitoring personnel on duty 24 hours a day. Nokia NetAct's automated systems allow either central or distributed network monitoring and management. With a centralized view to network performance, the users can have one point to contact when they are reporting potential network related anomalities.

And if something fails, Nokia expertise can swing into action to provide fast fault correction. Nokia's global logistics network provide rapid fixes for hardware faults, with several options available to keep the cost of spare parts under control.

> "Nokia's role in supporting us during the operational roll-out was essential. We steered the project and had the expertise of Nokia's consultants to call on when we needed support. With the help of Nokia, we were able to make the right decisions at the right time, and the operational and tactical planning was in control all the time".
>
> *– Mr Pan Feng, Deputy Director of Beijing Government Network Administration Center*

Nokia TETRA System achieves first ever certificate for Pre-emptive Priority Calls

The Nokia TETRA System has been awarded the first ever interoperability certificate for a pre-emptive priority call service

Awarded by the TETRA MoU Certification Body, ISCTI, this latest certificate proves Nokia's ability to deliver the best service on the market for TETRA users and operators. Tero Pesonen, responsible for TETRA interoperability at Nokia, says: "Nokia is committed to leading the way in TETRA development and to providing the best combination of services with the highest level of interoperability in the field."

The new approvals mean that the Nokia TETRA System now provides an unmatched guarantee of service levels in shared networks. A combination of priority group scanning, pre-emptive priority calls and other functions allow flexible control of organizations and subscribers.

Master class on TETRA IOP and operational planning

The TETRA MoU Technical Forum will provide a master class on "How to make IOP real in the field" at the TETRA World Congress in Vienna. The master class follows an imaginary case study from the tendering phase to network operation and maintenance, addressing all the practical issues along the way.

First TETRA conference in South Korea in September

The TETRA MoU hosted its first conference in South Korea on 22 September, with more than 300 delegates registering. A wide range of Korean organizations are showing interest in TETRA, including the military and public safety services, as well as the utilities sector. Jeppe Jepsen is one of two TETRA MoU vice chairmen and the moderator of the September meeting. He stressed that TETRA provides unbeatable technology for the PMR market, with its superior functions and interoperability proven by unrivalled evidence from the field.

PMR Expo 2004 in Leipzig, Germany

The annual PMR Expo took place in October in Leipzig, Germany. PMR Expo is the main national event for professional mobile radio users and gathers together TETRA and proprietary PMR technology providers to present the latest developments.

TETRA was showcased by 12 manufacturers and several application providers and integrators, clearly demonstrating the power of an open interoperable standard and competitive market.

31st Technical Forum meeting in Zaragoza, Spain

TETRA MoU Technical Forum (TF) representatives met in Zaragoza on 29–30 September. The main topics for discussion were the updated version of the TETRA Interoperability Certification (TIC) process description and the new, clearer design for the TETRA IOP Certificates. Both are expected to be taken into use early in 2005, despite several issues that remain to be resolved.

News from the IOP specification working groups on the Peripheral Equipment Interface (PEI) and ISI was especially welcome. The PEI group has been successfully established and aims to provide its first specifications to the TETRA MoU Members' Enquiry in the spring. The ISI working group is now establishing procedures for conducting ISI testing.

Small terminals get heard with Kathrein antenna

Advances in technology mean that TETRA radio terminals are getting smaller and their radio performance is improving. To make the most of their capabilities a first class quality of service to these ever smaller terminals is needed. Typically, the uplink – the radio link from the terminal to the base station – is the weakest link in the chain.

The uplink gain can be improved by fitting the base station with a Kathrein x-polarized antenna, which the new Nokia TB3 base station uses. X-polarized antennas provide high gain, yet before the advent of the Nokia TB3, TETRA base stations have been unable to use them in omni-directional sites with diversity. A high-gain virtual omni solution combines the benefits of omni-directional coverage with the benefits of diversity gain and the modern high-gain panel antennas.

Using x-polarized antennas to maximize coverage, together with the most effective base station and transmission solutions, cuts the number of base stations needed to achieve a given coverage, cutting costs while giving emergency crews the excellent service they need.

This is particularly important in TETRA networks which typically have relatively few users, making the cost of coverage per user substantial.

In addition, maintaining radio access can make up 70% of annual operating expenditure.

➔ www.kathrein.de

KATHREIN Antennen · Electronic

Seamless networks give customers what

Users want results. Most neither know nor care how their communications network operates. They simply want to run their operations without worrying about technical limitations. This is especially true when personnel need the right information to make snap decisions under pressure, which is often the case in public safety situations.

A Nokia TETRA network meets these needs because its technical structure is invisible to users, providing all the services needed seamlessly. Although the concept sounds simple, there are many criteria that a TETRA network must meet in order to be seamless.

Uniform network-wide TETRA services

Public safety operations can easily spill across local, regional or even international borders. Users need communication services that cross jurisdictional boundaries – they don't want to worry about how their position in the network may affect communication.

TETRA services must be available uniformly to all users throughout the network. It makes no difference whether a user is part of a national police force or a local fire-fighting service – everyone must have access to the same level of service.

No internal barriers

The seamless network-wide functionality of the network means that user organisations don't have to worry about internal network boundaries when planning their operations. They can organise network functions to meet their needs without having to trouble the network owner to rearrange the hardware.

Seamless data services

When data services in the TETRA network are seamless, even a national network can offer a single location where the open and standard interfaces and communication protocols are available for data or application servers. The network-wide nature of TETRA services frees the operator to choose the optimum location of data or application servers and the best access point to the TETRA network.

It should be possible to introduce new data services without changing the existing TETRA network infrastructure. Third-party applications can be developed without having to know anything about the physical network structure or the number of user organisations that will access the applications.

Free mobility

Radio users can move freely within the network without the worry that straying from their usual patch could affect communication. Cell reselection and handover features mean that users can cross between cells seamlessly in the middle of a call.

Any radio user can reach other group members or their dispatcher with a voice call or data message from anywhere in the network. This happens automatically, without the need for a manual location database or an operator to connect a call between separate parts of the network.

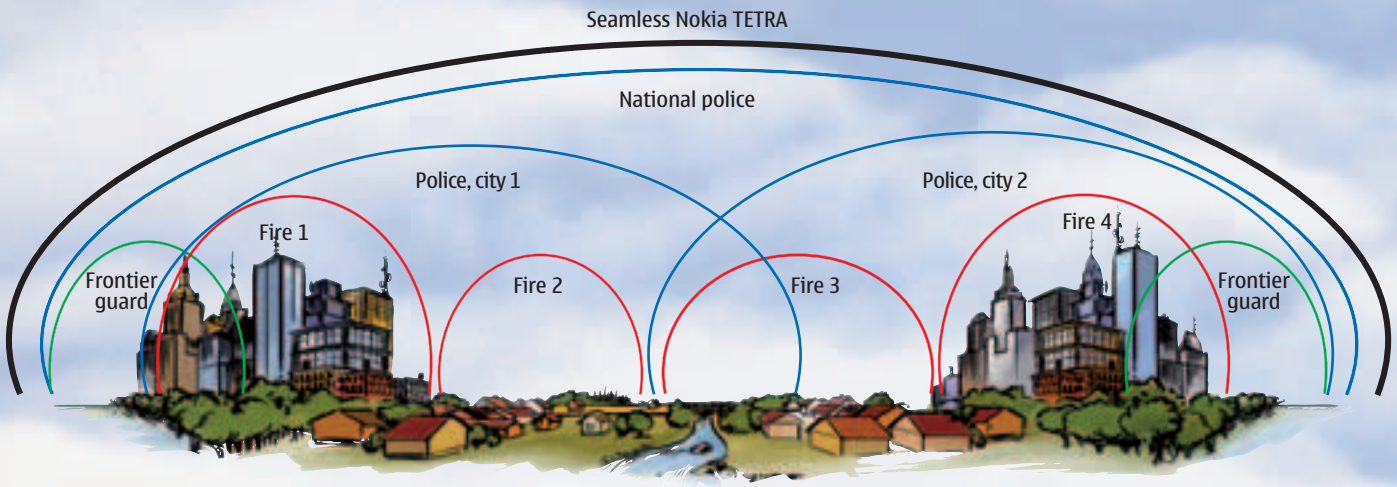
No area codes are needed for individual communication, even in the case of a multi-switch network. The numbering scheme can be chosen to guarantee fast connection times.

The ability to access national databases from anywhere in the network allows radio users to work at full capacity from any location.

Seamless personnel safety

Police and rescue personnel often encounter dangerous situations, so reliable emergency radio services are crucial.

Regardless of the location of the mobile radio within the network, an emergency call can be connected according to the user's predefined preference, either to the nearest operator or to the operator of the user's own organisation.



The operational areas of the organizations sharing a TETRA network may be very different. When services are truly seamless like in Nokia TETRA, each user organization can plan their operational areas in the way that best suits their purposes, for instance, according to city limits or areas of population and not according to the technical network structure.

they want

Advanced emergency call routing secures users' personal safety. Even if the normal phone settings are disrupted and the primary call target has been lost, an emergency call will always connect to somebody. A dynamically tailored priority system pushes an important call through from anywhere in the network, even in heavy traffic situations.

Eavesdroppers can't disrupt security, thanks to the availability of end-to-end encryption for protecting messages along their entire route.

Even if part of a seamless network is physically damaged by a disaster or by sabotage, alternate routing between network elements guarantees a safe connection.

Seamless dispatching

When dispatching is also seamless, authorised dispatchers can manage users and groups throughout the whole network without any geographical limitation. Seamless dispatching is independent of network architecture, so there are no limitations on the dispatchers' location, or the users or area they cover.

Seamless dispatching gives group members constant voice and data access to their group and to the dedicated dispatcher, regardless of their location.

No dedicated dispatcher terminal networks are needed.

Centralised network management

Centralised network management allows the entire TETRA network (its exchanges, base stations and dispatcher workstations) to be seen and managed from one location. This is only possible if the network management is independent of the network architecture.

It renders regional network management centres unnecessary, but it also makes it essential that the network can be maintained from the centre. It should even be possible to download software to remote locations from the network management centre.

A truly seamless TETRA network needs only one interconnection point to other networks. This gateway can be chosen as the optimum interconnection point through which to route calls between the TETRA network and other networks.

Delivering results

Above all, customers do not want broken promises. A TETRA network advertised as seamless must be truly seamless, like the Nokia TETRA System. Get it right and the rewards are impressive. For example, flexible co-operation means that radio users from different organisations can share talk groups and develop effective, co-operative working processes. Sharing information between agencies in real time saves precious moments and enables emergency responses to be properly co-ordinated.

By making it possible to mount a faster, more co-ordinated response to any incident, seamless public safety communication can help safeguard the personnel who all too often find themselves serving their communities under difficult and dangerous conditions. We owe them that.

Belgian TETRA

Since it was first proposed more than a decade ago, Belgian's nationwide shared public security network has attracted much interest. As it nears completion, the number of users is rising fast and TETRA is proving to be the right technology. TETRA Touch looks behind the scenes.

One of the biggest challenges that ASTRID faces has nothing to do with actually operating Belgium's advanced nationwide shared TETRA network. That part of the organisation's business is reliable and effective.

The challenge instead is getting users and potential users to understand the benefits that the TETRA network offers for their everyday work as public safety and security officers. Overcoming this hurdle was one reason that ASTRID held a users day in March 2004.

With more than 900 visitors from across Belgium, the ASTRID User Day proved a great success, says Mr Daniël Haché, ASTRID's Director of External Relations . "We were surprised by the large number of people interested in ASTRID, most were users eager to get their hands on TETRA terminals. Our goal was to give users more confidence in TETRA's capabilities. It worked because now we see a higher level of confidence from users who are asking very specific questions about using the network, rather than the more general queries before."

The User Day was just one communications measure that ASTRID has introduced since the beginning of the year when it decided it needed to shift from promoting the technology of TETRA, to explaining its advantages more clearly to users. "We need to say simply and plainly how users benefit," explains Haché. "Users want to know how they can communicate securely with others in the field, not how encryption works or other technical jargon."

Problems with permits

ASTRID has a big task on its hands to operate one of the world's first nationwide multi-agency TETRA networks. The network currently serves seven priority public safety services – national police, local police, local fire service, customs, state security, civil protection and ambulance services – connected with about 10,000 ASTRID radios. There is also increasing interest from commercial public safety organisations such as energy distributors and private ambulance and fire services.

The network features 11 dispatching centres and 436 base stations that will ultimately provide country-wide TETRA coverage for up to 40,000 users. A big obstacle to rolling out the network has been gaining local planning permission for erecting masts and antennas. With only 436 base stations to provide nationwide coverage in Belgium, this may seem surprising, but as Haché explains, the network's roll out coincided with heightened resistance from the public: "We came along with our few masts at the same time as the commercial GSM operators were requesting permits for thousands of sites.

"Solving the problem involved a lot of lobbying and discussion with politicians and local citizens. Ultimately they have to decide between enhancing their safety and security and the possible impact of the masts on the landscape."

The network now covers most of the country except in the south where about 30 base stations still need to be deployed.

users gain confidence

Despite this widespread coverage, ASTRID plans to roll out a further 100 base stations to improve coverage in the south and even to provide indoor coverage in other areas. "Even though users have better coverage than they ever had with their analogue systems, their expectations are rising because of their experience of GSM coverage," says Haché.

Simple to connect

ASTRID, which is owned by the federal government and local authorities, maintains and operates the network. Its prime tasks are to promote the network, to define the communication needs of user organisations, to help them to connect to the network and to provide support and training in using the services. As TETRA is an open standard, ASTRID users have a choice of different brands of TETRA terminals.. Each of these terminal types has first been validated and approved by ASTRID for connection to the network according to the quality and functionalities requested by users.

Fleetmapping for the network is decided by a users committee. New users simply tell ASTRID their terminal numbers, which are then connected according the existing fleetmapping plan.

The costs for users are simple, says Haché. "There is an annual subscription fee of about 268 Euros per radio, which is the total cost of the network divided by the number of potential users, with adjustments for factors such as depreciation and interest payments. Additional costs come from exceeding traffic limits and for calls to external GSM and PSTN networks."

TETRA the right choice

TETRA was definitely the right technology for ASTRID, says Haché. "We made an excellent choice, not only with TETRA, but especially with the Nokia network. Nokia has a very good product. It works well and is established for the security services. We have lots of discussions with Nokia to improve the network still further and we are pleased with the service they give."

Haché insists on the importance of user friendly TETRA terminals developed for the specific needs of emergency professionals: "A fireman at work wears thick gloves, heavy clothing, a helmet and a mask. In the extreme conditions of fire and water, he will not be able to use small buttons on a radio's display. This shows that public safety TETRA users have different needs to ordinary citizens using a mobile telephone."

Daniël Haché, Director of External Relations, ASTRID

ASTRID recently implemented the Nokia NetAct network management system and is hopeful that this will give a much better picture of traffic patterns and network usage. "NetAct will tell us exactly where and how much capacity is being used and help us to provide an even better service for users," comments Haché.

Looking at a data future

Looking ahead, Haché is anticipating TETRA 2 with its high speed packet data capability and urges the industry to implement it quickly. "TETRA 2 is very important for datacomms and would bring extra value to users," he says.

"We are only just starting with data in its operational phases. The challenge now is to change the culture of users, but it takes time before they see the extra value of data. They have to change their way of thinking. Maybe next year we will have success with the police forces, but smaller services will be harder to convince."

Has the network yet been proven in action with any big incidents? Haché answers: "Fortunately, we have had no major emergencies in areas where the network is operational. But the network has worked well at major events such as the Belgium Formula One Grand Prix and the Tour de France this year."

So the network is proven in action and the Belgian public can feel confident that ASTRID is prepared, should the worst happen.

Fryslân fire brigade in the Netherlands welcomes Nokia terminals

Nokia distributor KPN has won a contract to supply a Dutch fire brigade with Nokia THR880 TETRA terminals.

The contract, awarded by fire brigade Fryslân, which operates in the northern part of the Netherlands, will help the organisation deal with incidents across its operational area, covering 31 cities and villages with a total population of 650,000.

With 61 fire stations manned by more than 1,000 workers, including many volunteer firefighters, it was important for the fire brigade to choose terminals that are easy to use. Theun Frankema, project manager for fire brigade Fryslân described the Nokia THR880 as "good looking and easy to operate".

KPN operates as an authorised distributor of Nokia TETRA terminals in the Netherlands. A growing number of user organisations in Public Safety have chosen the reliable, professional service of KPN, which incorporates a single point of contact with use of a dedicated Carry In and Roll Out Center, a dedicated organization of KPN for preparing and execution of deliveries to end user organizations.

Johan Koopmans and Theun Frankema, Fryslân fire brigade.

Beijing TETRA Network limbers up

As the capital of the People's Republic of China, Beijing is the centre of the nation's political power, as well as being a focus for China's cultural and international exchanges and a modern metropolis full of vitality.

In 2001, this historic city won the bid to host the 2008 Olympic Games. Now gearing up for this major event, the city's preparations include setting up a new digital PMR network.

Biggest TETRA network in Asia

In 2008, Beijing will host the world's biggest sporting event – the Olympic Games. In preparation, Beijing TETRA network's operator, Beijing Just Top Netcom, which is owned by Beijing Olympic Partner China NetCom, is gearing up for Phase II of its ambitious TETRA network project, which is the largest of its kind in Asia.

Phase I of the Beijing Government Shared TETRA Network, completed at the end of 2003, saw the city set up an initial network to serve up to 50,000 subscribers, covering the urban area, all the county central area and the highways in Beijing.

Phase II will start in 2005, with the network expanding to a capacity of up to 200,000 subscribers, and covering almost all the area of Beijing Municipality, as well as other Olympic cities.

The combined efforts of the operator, the supplier and the government have made this the fastest PMR project roll out on the Chinese mainland – even the devastating impact of the SARS epidemic in 2003 did not slow its progress.

Brought into use on a trial basis in March, 2004, the network was serving over 5,000 subscribers by the end of September, including police, city administration, Water Conservancy, fire, Ambulance service, Disease Control, Law Enforcement and other authorities.

By the end of 2005, there will be more than 30,000 subscribers in the network. As well as the obvious operational benefits and the overall network economy, it will provide a sound basis for Digital Olympics.

Sharing the network

The city's communications were facing a crisis in the 1990s. Different government departments each used their own outmoded analogue trunking networks. Isolated and incompatible, these made it difficult for different government agencies to communicate with each other during major events or incidents. A shared network was vital to get these agencies operating effectively. Combined with the Beijing government's promise to set up an up-to-date PMR system for the Olympics and the planned return of 800MHz analogue frequencies to the Ministry of Information Industry, a new shared digital PMR network was a must.

During the planning stage, the Beijing Government had a clear idea of what it wanted:

- To provide an efficient and comprehensive shared radio network for the government agencies, including Police, Fire, Ambulance, City Administration and so on.
- To meet the present and future needs of dispatching services, particularly Digital Olympics 2008
- To achieve a significant improvement in readiness for emergencies and disasters

Police join Beijing's shared TETRA network

The Beijing Public Security Bureau is to join the Beijing Government shared TETRA network following a successful trial. During the trial, the Xuanwu sub-bureau used around 700 Nokia THR880 terminals to show that the TETRA network provided the right coverage, complete with all the necessary functions.The decision also follows the successful use of the TETRA network by the DongCheng sub-bureau on 1 October, during celebrations to mark the 55th anniversary of the foundation of the People's Republic of China.

The landmark announcement signals the switch of the Beijing police radio system to digital. Police forces from the other sub-bureaux will each join the Beijing TETRA system in turn, enabling the current 800MHz analogue system to be closed in October 2005.

Mr. Liu Shaowu, deputy chief of the Beijing Public Security Bureau, announced the changeover at a Mobilisation Conference in September. Ms. Zou Tong, deputy director of the Beijing Municipal Office of Information and Mr. Liu Ying, director of the Telecommunication & Information Department of the Beijing Public Security Bureau, also gave speeches.

The coverage and services provided by the Beijing network were outlined by Mr. Ding Rui, vice president of Beijing JustTop Network Communications Co. Ltd. The chief and director of the Telecommunication & Information department of each sub-bureau also took part.

➔ For more information about the Beijing Government Shared Digital Trunking Network, visit the official website: www.bjnac.gov.cn

for 2008 Olympics

Operating the network

The Beijing Government has no expertise or interest in operating a communications network, and so a dedicated company, Beijing Just Top Netcom, was formed as the owner and operator, with the Beijing Government purchasing services from it.

The Beijing TETRA Network has a very clear structure, with an Infrastructure Level, a Dispatching Network level and an End user level.

The Infrastructure Level of the network, which includes the TETRA Base Stations and Switch System, is managed and maintained by Just Top Netcom, with the Beijing Government managing the Dispatching Network Level and the End-user Level.

Government end users operate in different Virtual Private Networks, controlled by the user organizations through VPN workstations. Just Top has no access to these virtual private networks and cannot listen to communication in the network. This allows users to communicate with each other seamlessly during incidents, yet maintains 100% privacy in normal daily communication.

The TETRA network is also becoming the wireless platform for the Emergency Response Systems of the Government, through a seamless integration with the emergency centres in Beijing. TETRA's unique features meet the needs of demanding emergency communications and will greatly increase the speed and efficiency of emergency response in the city.

With the fastest PMR roll out in China and the biggest TETRA network in Asia, the Beijing Government Shared TETRA Network is surely set to make more records as it gets into its stride for Digital Olympics 2008.

Mr Pan Feng, Deputy Director of Beijing Government Network Administration Center

Guangzhou Metro chooses Nokia for TETRA roll-out

Nokia has been selected as sole supplier of a digital TETRA professional mobile radio system for Guangzhou Metro Line 4 in Guangdong province, China. The Nokia system will provide TETRA voice and data service. Guangzhou Metro's urban rail system Line 1 and Line 2 have served Guangzhou's 400 million passengers for 5 years. With the launch of Line 4, Guangzhou Metro will provide better services to millions of Guangzhou citizens.

Under the agreement, Nokia will provide DXTip switching equipment, TETRA base stations, a Nokia dispatcher workstation and a large number of new TETRA terminals. Nokia will also provide implementation and training services. The equipment will be delivered since the end of the year and the system launch will be kicked off starting from next year.

Implementation is being carried out in cooperation with the system integrator Shanghai Railway Communication Equipment Factory, which will also provide data applications based on the Nokia DXTip switching platform.

"We are convinced that Nokia's TETRA system will satisfy Guangzhou Metro's demanding requirements for good voice service and rich data applications," says says Mr. Miu Weizhong, Head of Shanghai Railway Communication Equipment Factory.

"We are pleased to working with Shanghai Railway Communication Equipment Factory again to provide our state-of-the-art system to Guangzhou," says Topi Kinnunen, Director of Professional Mobile Radio Asia Pacific and Greater China, Nokia. "This implementation highlights once again how ideally suited the Nokia TETRA solution is for large-scale public transport organizations."

Think big
– creating successful TETRA networks

A country looking to upgrade its public safety radio communications today will probably be confronted by hundreds of existing communication systems within the safety and security sector. This set-up makes it difficult to establish effective co-operation between rescue organisations in an emergency and may even affect day-to-day work.

A shared radio communications system for the whole country's public safety organisations is the obvious answer. Such a system can help the authorities protect their communities and will be more economical too.

Bringing such an ambitious project to fruition can be daunting, but national networks based on TETRA are already proving their success around the world.

What is a big network?

A big TETRA network typically has 100,000 users or more and covers an extensive area, such as an entire country several hundreds of thousands of kilometres square. Such a network might have between 2,000 and 3,000 base stations and 20 or 30 exchanges. For example, VIRVE, the nationwide public safety network in Finland, supplied by Nokia, covers 350,000 km^2.

Experience counts

Having implemented several nation-wide networks and helped get them operational, Nokia is uniquely placed to understand the challenges involved in a big TETRA network. There are four key factors for success:

- A seamless, transparent network
- Radio access solutions to build extensive coverage
- Easy physical roll-out
- Support for operational roll-out.

Seamless TETRA networks

It is essential that a big network is seamless, offering uniform services to users whatever their location. With uniform services, an organisation with a nation-wide operating area can access the same services as a local agency. For example, a group call must reach every member of a group, no matter where they are.

Providing coverage

TETRA network coverage must be extensive. Since base stations provide the coverage and their site rentals and transmission costs make up around 70% of annual operating expenditure, selecting the most economic base station solution is critical for a big network. Using Nokia TB3 TETRA base station can mean fewer sites and dramatic savings over the lifetime of the network. Nokia base stations can also provide a stronger signal, leading to better indoor coverage and more satisfied TETRA users.

Physical roll-out

Rolling out a big TETRA network is simpler if the network elements have been designed with the practicalities of roll-out in mind. For example, if the network elements resemble those from mainstream phone networks such as GSM, it's much easier to find personnel who will be competent to implement the roll-out with minimal training. In principle it should be easy to find such people because GSM networks are so widespread.

Operational roll-out

Operational roll-out prepares the network for use. It is more demanding than the technical roll-out and holds the key to the successful introduction of TETRA services.

Operational roll-out is a complex business, especially in a big network. But getting it right helps achieve the fastest possible migration from existing systems with the least resistance from users. Nokia's consultancy services are there to help customers get the best from their TETRA investments.

Professional help

When faced with a mammoth task, it's best to bring in the experts. No one is better placed to deliver professional communications on a big scale than Nokia, with tens of operational TETRA networks in close to 30 countries.

The top 20 rules of shared TETRA networks

Sharing a TETRA network between different agencies provides great benefits and is increasingly common. But what is really needed for multi-agency networks to succeed? We look at the 20 golden rules of successful network sharing.

A shared system provides a common, TETRA based infrastructure for several organisations. Individual organisations communicate via their own talk groups within their Virtual Private Networks, while dispatchers and the organisation's admininstrative staff can manage the subscribers Virtual Private Network. The organisations can also easily communicate with each other when they need to.

Setting up multi-agency radio communication networks for authorities is a major trend in public safety. A single, large-scale infrastructure, shared by several agencies, can bring major benefits in economy and security, as well as making it easier for the agencies to communicate and co-operate with each other.

The ideal is for one professional operator to manage the infrastructure for all user organisations, each of which has its own Virtual Private Network (VPN) with private communication and the capability to manage its own users. Yet, different organisations can communicate with each other easily when needed.

Five rules for privacy

For uncompromised privacy, it must be possible to manage the Virtual Private Network easily and logically. The first five golden rules are a must for privacy:

Organisation hierarchy. The communication system must allow secure, hierarchical management of user organisations and their services.

Virtual Private Networks. Privacy must apply for data, security and applications, as well as voice.

VPN numbering. Virtual Private Networks must give maximum flexibility in numbering.

Statistics. Solid statistics must be available on the performance and capacity of the network, as well as on each organisation.

Classification of users. It must be possible to categorise users to control how they use the network.

Five rules for security

The golden rules for ensuring first class security are:

Multiple encryption algorithms. A physical network shared by public safety and other organisations must support multiple encryption algorithms (TEA1 and TEA2).

Encryption for dispatchers. For completely secret VPNs, dispatchers need end-to-end encryption as well as end-to-end encrypted radios.

Authentication of radio terminals is a must.

Air interface encryption ensures that communication from each radio is encrypted differently.

Technical network management separated from user management. The technical operator should not be able to access information related to users, organisations, or talk groups. For operational management, administrators should be allowed to manage users and organisations only if they are specifically authorised to do so.

Nine rules for flexibility

The ideal shared network is flexible, allowing organisations to plan their operational procedures without worrying about the network infrastructure.

Co-operation groups. It must be possible to create temporary inter-agency talk groups without jeopardising privacy.

Priorities during exceptional situations. For example, making an emergency priority background group call to all organisations within a certain geographical area.

Prioritising organisations. It must be possible to give some organisations a higher priority than others, so that during an incident, a public safety organisation has a higher priority than, say, a taxi company.

Access to talk groups. The system monitors and controls access to talk groups, preventing unauthorised participation within and over organisations.

Access to messaging. Only authorised users can send or receive SDS messages.

Access to one-to-one calls. Only authorised users can make or receive one-to-one calls.

Access to other systems. Each organisation can define which users can access which external systems, such as PSTN or PABX numbers.

Intelligent group call coverage brings flexibility to defining group areas.

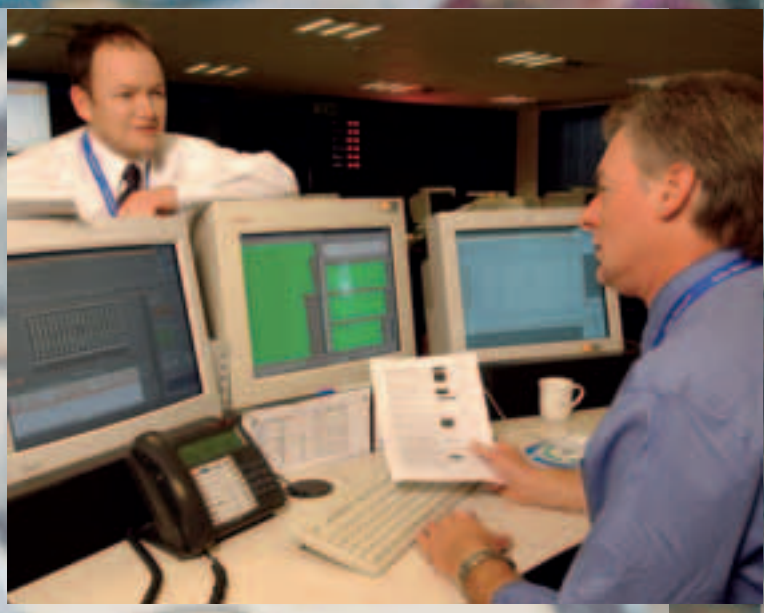
Base station fallback. A flexible network allows each organisation to define which talk group the users will use if their base station goes into fallback mode.

Follow these 19 rules when planning a multi-agency network and you can be confident of getting it right.

Oh and the 20th golden rule? Choose TETRA from a vendor that is able, today, to provide a system that follows the other 19 rules!

Automated subscriber management comes to TETRA

PMR networks are technically very similar to any commercial wireless network operation. Subscriber management is also moving closer to commercial practice, with customers taking on more of these tasks themselves.



Automated Subscriber Management (ASM), where public safety organisations manage their own subscribers, terminals and privileges, has many benefits, allowing them to retain control over their privacy and anonymity and keep sensitive information secret. But operators need to be assured that the system they choose guarantees absolute data privacy.

This was the major reason for States Security Networks of Finland choosing the Comptel ASM system, which provides authentication, authorisation and accounting mechanisms to meet the highest security and data privacy requirements of PMR.

The benefits of distributed maintenance

The network operator naturally concentrates first on running the network and providing reliable services. Sharing maintenance tasks with user organisations makes sense because it cuts operational expenditure and can be achieved with a single ASM system providing both centralised control and distributed maintenance.

Distributed maintenance also allows user organisations to create and maintain their hierarchies, as well as data on radio subscribers and subscriptions. The Comptel ASM system, with its easy-to-use GUI, hides the complexity of technical tasks.

The solution also allows the terminals and support systems to be provisioned as batch tasks, enabling changes in network services for one or more organisations to be done as a single action. This also works in situations where a whole organisation has to be provisioned into a number of support systems. The work needed to deploy new services and users is reduced significantly.

Taking full advantage of the information available

TETRA is by nature all about group communication, its users being an individual organisation or cross-organisational incident groups. With a user management system, the operator is always aware of which person and which terminal belongs to which organisation. Network resource inventory is also a prerequisite for mass provisioning, which naturally requires exact information on the resources available.

The ability to relate usage data to each organization, user and terminal, is essential for accurate usage monitoring, guaranteeing the quality of service for the user organisations. Billing aside, this ability also allows the network operator to track service usage, according to, for example, location or control area.

Exact and reliable information on the system modifications is yet another essential feature. For instance, when delegating tasks to the user organisations, the operator must have a full audit trail of the changes applied, stamped with the dates, the details of the modification and a digital signature of the modifier. This allows even the strictest non-repudiation requirements to be met.

Comptel – paving the way for confidence

Reliable and flexible services, reasonable service costs, and accurate information about service usage, are all supplied by Comptel's ASM solution.

Organisations need to understand how their users are making calls or sending messages from the PMR network to public mobile or fixed line networks. They also want to know whether restrictions should be applied to certain terminals at certain times. This information allows network operators to charge user organisations, and gives user organisations a detailed understanding of their service usage. It also helps user organisations, especially authorities, in both budgeting and finance control.

Comptel ASM, which also provides effective authentication, authorisation and accounting, is paving the way for confidence for both PMR operators and their users.

→ www.comptel.com

COMPTEL
INTELLIGENT LINK

Photo: Erja Lempinen

TETRA users get the message

Nokia is now offering storage and forwarding capabilities for TETRA SDS with the introduction of the Tecnomen SDS Centre.

SDS, or short data service, is the text messaging standard for TETRA networks. Similar to SMS on GSM networks, SDS lets TETRA terminal users send text messages to other users when they're connected to the network.

With the Tecnomen SDS Centre, TETRA terminal users can now send text messages even when the recipient's terminal is not immediately available to receive the message. The system stores the message, forwarding it when the recipient's terminal becomes available. With the Tecnomen SDS Centre on the network, users can always be sure that their messages will get through.

Crossing networks

In addition to this store and forward functionality, the Tecnomen SDS Centre also serves as a gateway, allowing TETRA network users to send SDS messages to a variety of different terminal types across different networks. It converts messages between SDS and SMS formats, so that TETRA terminals and GSM handsets can send text messages to each other.

Operators who send bulk announcements to groups of users can rest assured that everyone will get the message. For example, an alarm message can be sent both to the TETRA terminals of the regular fire brigade and the GSM terminals of the volunteer fire fighters. SDS messages can also be sent to pagers.

The Tecnomen PMR Messaging concept also provides other mobile messaging services for TETRA networks, such as voice mail and wireless email. A web-based composer allows users to send messages via the web. TETRA networks that offer Tecnomen voice mail services to their users can also provide SDS notifications of voice messages.

TETRA network users benefit in many ways from the Tecnomen SDS Centre. They get access to mobile messaging services similar to those that have proven to be vital to the success of GSM networks. They get seamless messaging access to other types of network and the Centre's store and forward functionality ensures that TETRA users remain available at any time, no matter where they are.

Enhanced functions

Nokia TETRA enables a safe, shared network, in which the operator can serve all its existing and new customers with centralised added-value services such as SDS Centre, including those customers who require modern GSM type mobile telecom services.

As the number and variety of users on TETRA networks grows, enhanced functionality will become more and more important. Different user groups will undoubtedly have different communication needs and patterns. Tecnomen's suite of PMR Messaging solutions extends the value of Nokia TETRA networks, providing the flexibility and utility that operators will need to serve the growing, changing needs of their users.

Nokia and Tecnomen have been in partnership for several years, providing a wide range of value-added services for TETRA networks. The Tecnomen SDS Centre is the latest example of this partnership providing clear benefits to TETRA network users.

➔ www.tecnomen.com

TECNOMEN

Metro Bilbao expands Nokia TETRA network

Metro Bilbao in Spain is extending its Nokia TETRA network, adding 17 new base stations as well as additional services such as data. The TETRA network expansion will be fully operational by the end of September 2004 and includes portable Nokia THR850 and mobile TMR420 terminals to be installed on board trains.

The expansion comes on the back of Metro Bilbao's successful first two years of the TETRA project, the first stage of which comprised the installation of one control centre (DXT) and nine base stations. In that time, it has fulfilled the demanding communication requirements of a mass public transport system serving more than 70 million passengers per year.

The Nokia TETRA network has also demonstrated its speed and accuracy, with immediate call set up and no failures at all. It has brought a substantial improvement over the analog system previously used, providing better speech quality as well as improved reliability and ease of use. Coverage was also increased, going beyond the track itself and reaching halls, corridors, equipment rooms and even outdoors, thanks to two sites installed on neighboring mountains that allow communication with maintenance vehicles.

As with the first stage, Nokia's value added reseller OMNILOGIC Telecomunicaciones was awarded the contract for the expansion. It supplied the complete TETRA network and provided the necessary customer services to ensure the right network performance: engineering, integration and commissioning of the TETRA system, including control centre, base stations, and dispatchers as well as portable and mobile terminals for locomotives.

Photo: Aitor Ortiz

Zenitel Netherlands becomes distributor for Nokia

In September 2004, Nokia and Zenitel Wireless Solutions signed a contract for the Distribution of Nokia TETRA terminals in The Netherlands and in the Netherlands Antilles and Aruba.

Zenitel Netherlands provides the Public Safety and Security forces (e.g. Police Fire brigade, Ambulance Services and Defence) with TETRA terminals as one of the three selected suppliers of the C2000 users. In the Netherlands Antilles, Zenitel operates as a TETRA-network service provider and offers its customers the Nokia TETRA terminals. The Tetra network is now rolled out in Curacao and St Martin.

Zenitel Wireless Solutions provides wireless voice and data solutions for professional customers demanding fast, reliable and secure communications. Applying our systems integrator knowledge, we base our portfolio on well-recognised and approved building blocks, achieving reliable, first-class, and cost-effective solutions.

The markets that Zenitel operates in, include Public Safety and security, Public Transport (e.g. Metro, Railway), Private Transport (e.g. Taxi, Courier services), TELCO Operators, Authorities (e.g. Airport-, Port-, Road & Tunnel authorities), and Business Industry (e.g. Oil & Gas, Utilities). Our core competence is to provide our customers with a full suite of solutions and services for integrated wireless communication systems and networks, in areas with specialised and/or mission critical communications.

First Nokia 300 MHz pilot in Moscow

The first pilot TETRA system using Nokia's new 300 MHz TETRA base station is now being installed in Moscow by trunking operator ZAO AMT.

Launched at the 2nd Russian TETRA Congress in Moscow in October 2003, Nokia's TBS300 was scheduled to be available in the second half of 2004.

The 300 MHz band is widely used in Russian radio networks, by utilities such as oil and gas companies as well as commercial trunking operators. The band is specific to Russia, since in most other countries, the frequency is used by military organizations and is not available for public use.

ETSI has approved this frequency band and the specific channel spacing used in Russia as part of the TETRA standard. The pilot system is also being used to certify the TBS300 for the Russian Ministry of Communications.

Third Russian TETRA Congress

The Russian TETRA Forum held its 3rd Russian TETRA Congress on 4–6 October. The three-day event attracted close to 400 users and industry representatives, who all wanted to share experiences and information on the latest developments.

The number of TETRA contracts is increasing rapidly in Russia, but a common concern expressed by the closing panel was the difficulty of obtaining spectrum licences during the ongoing reorganisation of the telecomms administration. The Russian TETRA Forum agreed to put extra effort into resolving licencing issues in order to help users to take full advantage of TETRA technology

New field command system cuts response time for Helsinki Rescue Services

A new field command system being tested for Helsinki Rescue Services promises to speed up response times and bring more accurate and timely information to commanders in the field.

Developed over two years in association with WM-data Novo, the system is based on Merlot Mobile, an application that runs on emergency vehicle computers. The location solution is being tested in Helsinki and will be finalized in 2005 or 2006.

Its main purpose is to receive alarms and guide teams in the field to the site of the emergency. Once there, Merlot Mobile acts as the field commander's primary point of access to information, as well as a reporting tool. Merlot Mobile allows first-line responders in the field to access information more quickly and therefore make better decisions.

The application receives its information through the Finnish authority network VIRVE, and displays the location of the target, as well as the position of all vehicles in the response group.

Speeding up response

When the Helsinki Rescue Services gets an alarm via VIRVE, or a traffic accident is reported, it is vital that the responsible units find the site of the incident as fast as possible. Although the Rescue personnel know Helsinki well, it is impossible to know every address in the city. Also, the quickest route to a destination is not always obvious.

The field command system at the Helsinki Rescue Services helps response units locate the destination and also helps them reach it as quickly as possible by indicating the quickest route on a map. In addition to the exact destination, the display shows the task, any additional information, and in the event of fire, where the water hydrants are.

The field command system not only helps the personnel reach their destination quickly, it also helps commanding officers estimate how many personnel are required at the incident.

In addition, rescue plans and procedures can be entered into the system so that in the event of an accident in the Helsinki metro, for example, the map will show the planned locations and tasks of the rescue units.

Not just technology

When WM-data Novo started to develop the new system, it involved Helsinki Rescue Services from the start of the project. Carried out phase by phase, the customer piloted new features as soon as they were developed. The system and its component parts have been piloted at fire stations, with users' comments taken into consideration during the development work.

The success of the project so far has been a testament to the co-operation between the TETRA network, the commanding application and users. Yet, its ultimate success will be determined not solely by the technical implementation or by the reliability of the operation of the application – how users adopt the field commanding system is at least as important.

"With the help of the new system, rescue efforts can be started quickly, and everyone will be on the map at once," says Fire Chief Yrjö Niiranen, Helsinki Rescue Services, who represented the organisation during the development of the new system.

"With a fast response, we can often reduce the need for hospital days that the accident victims will require, so minimising the response time is of primary importance for us," he adds.

According to Niiranen, it is also important that all personnel participating in the rescue get the same information at the same time. The new system enables this by reducing the chain of command.

With this new command system, VIRVE and Nokia TETRA have again shown that, in concert with advanced applications, they can bring great improvements to the work of emergency services.

→ www.wmdata.fi

Enhancing your TETRA

On this spread TETRA Touch presents a range of accessories and applications provided by specialist companies for Nokia TETRA Terminals. Catch a glimpse of headsets, chargers, carriage solutions and more, and find out new possibilities for enhancing your TETRA radio.

Avertes Tetrabook

With Avertes' cost-efficient and intuitive software, Nokia TETRA terminals' phone books are easily maintained and backed up. The application allows for effortless data duplication from terminals and other sources such as MS Excel. Phone books can thus be rapidly synchronized with verified REF and ITSI codes. The tool also provides optional one-key status sending feature.
➔ www.avertes.fi and jami.rantanen@telering.fi

Highpull

Highpull produces a 6-slot multi-charger for the BLN-4 battery of Nokia THR850 and THR880 / THR880i terminals. Customers in large volumes both in Europe and the Middle East are using the small, light- weight chargers of Highpull.
➔ housman@highpull.com.tw

Highpull Technology Co., Ltd.

CeoTronics

CeoTronics is specialised in communication headsets, speaker systems and radio accessories for professional use in demanding environmental working conditions.
➔ www.ceotronics.com

CeoTronics
Audio · Video · Data Communication

INVISIO

INVISIO™ – a bone mic headset for Special Units within Law Enforcement, Defense, Intelligence and Fire and Rescue. Placed in the ear, the INVISIO™ headset enables precise and clear communication. Nextlink.to A/S in Denmark supplies the INVISIO™ with a range of PTT switches, compatible with Nokia THR880 and THR880i radio terminals.
➔ www.nextlink.to

NEXT LINK TO

Fanttiset

A range of clothing attachments and carriage solutions for the Nokia THR880 / THR880i radio are available by company Fanttiset. Fanttiset's attachments enable the radio be fixed to different types of uniforms and in different positions. The attachments can be made in the same material as the uniform.
➔ www.fanttiset.com

Phonak

Phonak Communication Systems concentrates on developing, manufacturing and marketing ultra miniaturized wireless communication devices. phonito in-ear inductive receivers combined with a covert kit, provides audio receive and transmit capability for covert use.
➔ www.phonak.com

PHONAK
communication systems

radio

Peltor

Peltor manufactures a complete product line of hearing protection and communication products for noisy environments. For connecting headsets to the NOKIA TETRA Terminals there are two new models of Peltor adapters. The adapter FL5042 is used for cable connection, while the adapter FL6042 has a wireless Bluetooth link to Peltor headset.

➔ www.peltor.com

Stop Noise

Stop Noise Light headset is specially designed for noisy conditions, to allow convenient two-way communication with Nokia TETRA handportable radios.

➔ www.stopnoise.com

Savox Communications Ltd.

Savox Communications Ltd. produce high-quality headsets for Nokia THR880 / THR880i users. A full range of audio accessories includes police-type light-weight earpieces and robust bone-conductive helmet headsets for firefighters, as well as PTT models from finger PTTs to glove-operated models. A remote speaker-microphone / PTT for Nokia THR880i model is also available.

➔ www.savox.com

Zenitel ZMT5000

Zenitel ZMT5000 is a programmable Status and Messaging terminal with touch screen. Connecting to the PEI interface of the radio terminal, the ZMT5000 is compatible with the Nokia TMR880 mobile radio.

➔ berry.klaver@zenitel.biz, Zenitel Netherlands

Sonic Communications (Int) Ltd

Sonic Communications (Int) Ltd offer a full range of audio accessories for use with the Nokia THR880 / THR880i terminal, to suit all aspects of Law Enforcement use. Such accessories include earpieces and lightweight headsets for Public Order, Firearms or Uniformed Officer duties, in addition to covert and discrete solutions for Officers operating in plain clothes.

Sonic also provide accessories to use along with the Nokia TMR880 mobile radio, to complete the installation kit for overt and covert motorcycle use, as well as installation service if required.

➔ www.sonic-comms.com

Accessories and applications help you get the most out of your Nokia TETRA radio.

Shared networks around the world

Sharing a radio network by various user groups is probably the best way to achieve the essential need for effective communications between different agencies. This is true even among public authorities who traditionally have preferred their own exclusive networks.

From Belgium...

A network that has realised these advantages is ASTRID, in Belgium. The TETRA based network has solved the problems caused by obsolete analogue radio equipment that dogged the Belgian emergency and security services throughout the 1980s. During major incidents, each participating service would communicate using different frequencies, making any kind of co-ordination impossible. Officers were reduced to using megaphones to communicate or to have several radios for each frequency. Clearly, the situation was unacceptable.

...to Finland...

Finland's authorities were also facing a serious communications problem in the 1980s. Because each organisation had its own, separate radio communication system, they could not talk to each other, making joint operations almost impossible.

...to Bahrain...

On the Arabian peninsular, Bahrain was facing problems of relying on a conventional VHF system, which was not only costly to maintain, but could not be made secure.

...to China...

Gearing up for the 2008 major sports event, Beijing was also keen to update its authority communications.

...the answer is TETRA

The solution in all these cases was the Nokia TETRA system, whose flexibility allowed the development of a communications network to suit each situation, ranging from a citywide network to full nationwide coverage. With the Nokia TETRA network's full VPN capability, each member of the network is able to share the same physical network while maintaining the privacy and security of each organisation. This means that different organisations can communicate seamlessly when necessary, promoting co-operation, helping the exchange of information and expertise, and offering the potential to cut costs significantly.

Operational Nokia TETRA networks in more than 26 countries

- Barrick Gold Corporation, Argentina
- Well.COM, TETRA service in Burgenland, Austria
- ASTRID, countrywide public safety network in Belgium
- Telcom Telecomunicações do Brasil
- Ministry of Defence, Brunei
- Bulgarian National Service Border Police
- Beijing Government, Just Top Network
- China Light and Power, Hong Kong
- Hong Kong Fire Services Department
- Hong Kong Police
- Nanjing Metro Corporation, China
- Ningqi Railway Co., Ltd., China
- Shenzhen Metro Co., Ltd., China
- Guangzhou Metro, China
- Tianjin Public Security, China
- Tianjin Water Conservancy Bureau, China
- The Coast Guard Administration of Taiwan
- Civil Aviation Administration in Finland
- Falck Security, Finland
- Finnish Customs
- Finnish Defence Forces
- Finnish Defence Forces, international crisis management system
- Finnish Maritime Administration
- Finnish Road Administration
- Finnish Coast Guards
- Helsinki Energy, Finland
- Rescue Services in Finland
- Social and Health Services in Finland
- The Finnish Police
- The Frontier Guard in Finland
- VIRVE, countrywide public safety network in Finland
- Aéroports de Paris
- Bordeaux Metropolitan Area Authority
- RATP public transport, Paris, France
- SAPRR motorways, France
- Berliner Verkehrsbetriebe
- European Central Bank, Frankfurt, Germany
- Kölner Verkehrs-Betriebe
- Greece OSDTR public safety
- OTE commercial TETRA system, Greece
- TETRA Iceland
- An Garda Síochána - Ireland's National Police Service
- National Security Communications, Bahrain
- Ministry of Interior, countrywide public safety network, State of Kuwait
- Moratel, TETRA service in Morocco
- Fire brigade Fryslân, The Netherlands
- Kennemerland Police, The Netherlands
- Midden Ambulance Services, The Netherlands
- TeleDenmark Internordia, Norway
- TETRA pilot project in Trondheim, Norway
- Police Academy, Szczytno, Poland
- Radiotel trial – TETRARUS
- Tomskneft oil company, Russia
- Telecom Slovenije, Slovenia
- Metro Bilbao, Spain
- Regional Government of Canary Islands, Spain
- Regional Government of Murcia, Spain
- Agora, TETRA service in Catalonia, Spain
- RAKEL, countrywide public safety network in Sweden
- Swedish Armed Forces
- L'Office National de la Telediffusion, TETRA Service in Tunis
- Cheshire Police, UK
- Sussex Police, UK
- Warwickshire Police, UK
- Dubai Government, United Arab Emirates
- Dubai Electricity & Water Authority
- Dubai Municipality
- Dubai Police General H.Q.
- Dubai Tourism
- EMAAR Properties PJSC, Dubai
- Emirates Airline (DNATA – Airport Operation), Dubai
- Government of Dubai – Department of Civil Aviation
- Venezuelan state of Monagas