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Finland's 5 Steps to

Photos courtesy Maria Kuula, State Security Networks

Critical Broadband

VIRVE, the Finnish TETRA operator, is looking to the future by implementing a hybrid network approach to LTE services.

By Jarmo Vinkvist, Tero Pesonen and Matti Peltola

The Finnish TETRA operator, VIRVE, has identified steps to eventually offer critical voice and broadband data that will be delivered by a government-controlled hybrid of dedicated and commercial Long Term Evolution (LTE) networks by 2030.

The country has identified three trends that are driving the need to re-engineer how public-safety communications is managed. Changes in the communications culture have been enormous in recent years, because of the impact of the Internet and advances in mobile communications. The natural ways of communicating are more versatile than ever before. This offers public safety great

The VIRVE network is based on TETRA technology and is used by emergency responders.

opportunity to develop new field operational ways of working, but at the same time, it is a significant challenge to meet the expectations of the next-generation employees and society.

The second major trend is the depopulation of rural areas — 80 percent of Finland's entire population inhabits only 20 percent of the area. This causes great pressure to public-safety service in both rural regions because of the cost and in urban areas due to the high capacity demand. The working methods from the past are no longer affordable, and greater efficiency is a must.

The third trend is increased vulnerability because of the unprecedented dependence on information networks, power supply and global events. Human errors and cyber attacks can push a society from balance. Thus securing only the communications aspects of public safety is not enough — many operatives in the field of critical infrastructure need to be included. No one can manage alone anymore or without always-available data applications.

VIRVE

In the late 1980s, Finland began a process to drive the efficiency and the service level of public-safety communications. By the millennium all agencies ranging from social services to defense forces shared the same national authority TETRA network — VIRVE — that provides critical voice and messaging services. Soon after, the hundreds of local and agency-specific emergency response centers were reduced first to 15 and then to six centers that now share units for the entire country.

The VIRVE network operator belongs to the fully government-owned State Security Networks Group that has the task of securing the critical leadership of the Finnish society and the information society services in all conditions. Alongside group and individual critical voice communications, alarming, positioning and further data services run on the network using the narrowband TETRA data capabilities. One network for all and one device for critical voice and data has set a highly effective standard. The railway sector is now considering moving from its dedicated GSM-R voice network to use the joint VIRVE network.

The VIRVE network works well and the user satisfaction is high, but the future is not staying still. Despite the great advances, more needs to be achieved. A number of European countries face the same situation. Nationwide digital narrowband authority networks live up to their promise and many times more, yet they have limitations. Demand for high-speed broadband data services is evident.

"Shared critical communication structure with other governmental agencies is not only very economical, but also excellent for cooperation," says General Ilkka Korkiamäki, chief information officer (CIO) of the Finnish Defense Forces and a State Security Networks board member.

VIRVE

Network Technology: TETRA
Base Stations: 1,350+
Users: 70,000+
Main User Groups: Fire and rescue, police, ambulance services, social services, military, border guard, custom and emergency response centers

The 5 Steps to LTE

The goal — to be able to conduct critical voice and data communications using broadband technology — is clear. A reasonable time window for the transition from TETRA to broadband begins with the availability of critical voice services over Long Term Evolution (LTE) early next decade and ends when the current TETRA network reaches its end of life — somewhere in the first half of the 2030s. Building out the nationwide TETRA coverage took several years, and it was even longer until all the separate analog systems were shut down. Thus, a long period of parallel networks with narrowband TETRA services and LTE broadband must be turned into an asset instead of a burden. Using the best of both technologies in five evolutionary steps can do this.

Step one is to set up a data mobile virtual network operator (MVNO) to address the increased everyday data requirements. This will be accomplished by extending the subscriber and services provisioning system to support provisioning users on a broadband network. At first an official can use externally purchased

Finland's Timeline for Broadband Rollout

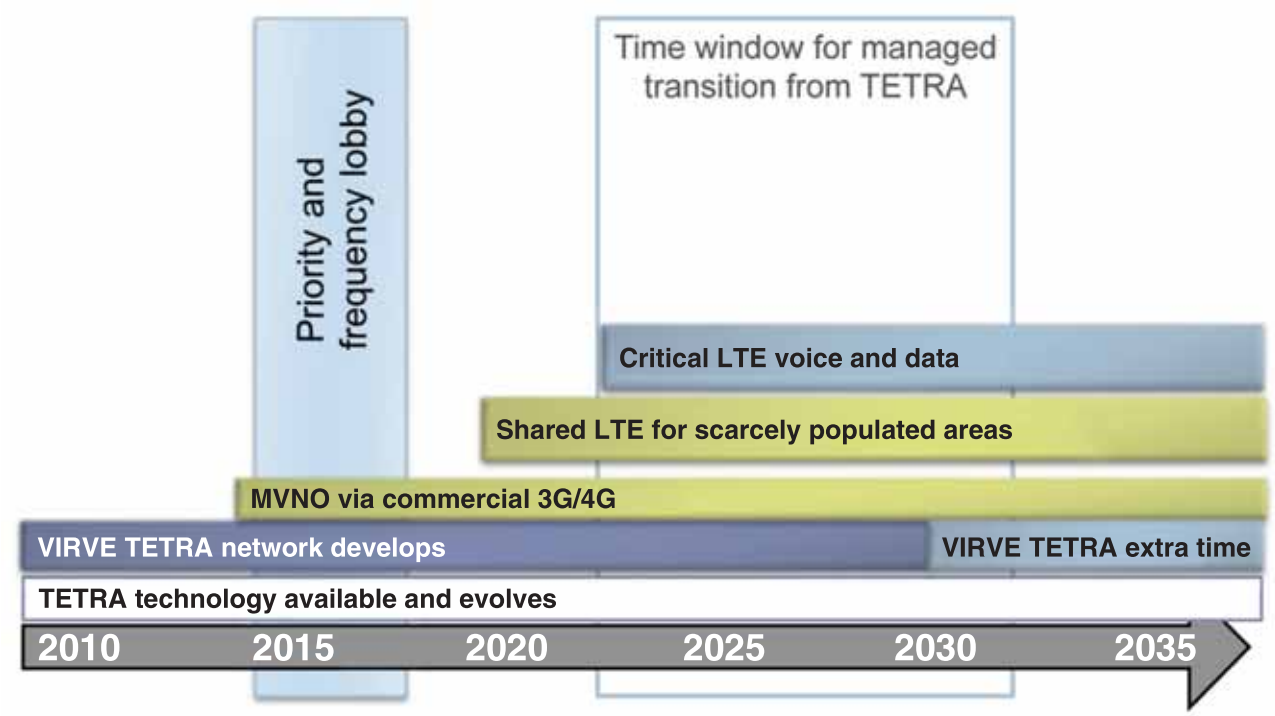

Image courtesy Tero Pesonen and State Security Networks

subscriber identity module (SIM) cards, but eventually the second step will be to own and control subscribers in the LTE core.

In this second step, the critical voice and messages will run in the narrowband network, and high-speed non-critical (but secure) data will run in the commercial broadband network. The natural follow-up — step three — is to expand the owned LTE core to an owned dedicated broadband radio access in chosen locations, providing critical-grade data services.

Once the critical voice over LTE standardization is ready and the TETRA supplier supports group call over LTE functionality in the TETRA side, then the two networks can be connected, which will be the fourth step. This way the large development investments in TETRA group communications functionalities, such as prioritization, could be used. Then the same voice services are available both in narrowband and broadband — in the dedicated networks on critical service levels and in the commercial operators' networks up to the levels they can provide.

The final fifth step is dismantling the TETRA radio access once broadband service availability and reliability meets public safety's requirements. In some — most of all rural — areas, this might take place first when the narrowband network spare parts stock runs out.

Nationwide digital narrowband authority networks live up to their promise and many times more, yet they have their limitations. Demand for high-speed broadband data services is evident.

During these five steps, the narrowband TETRA network will transform to a TETRA critical voice service server, the operator will gain knowledge and understanding about how to operate a broadband network, and users will have access to high-speed data service that enables them to benefit from data applications and to develop information-centric ways of working.

"Without VIRVE we would not have been able to get where we are now — the flexible path to critical broadband enables us to get where we want to go," says Janne Koivukoski, deputy director general for rescue services Finnish Ministry of the Interior (MoI) and the chairman of the VIRVE steering committee.

Hybrid Network

The most economical solution to establish a communications network for critical users is based on a hybrid of dedicated network(s) in incident-rich areas where the population is located and to rely on commercial

The goal is to conduct critical voice and data communications using broadband technology.

networks in the scarcely populated areas, provided that there is coverage available. Here the economic value is determined by the number of additional saved lives because of a dedicated authority network. The impact to the increased national security of dedicated broadband networks in the rural border areas, for instance, is not considered. In praxis this suggests to build dedicated broadband networks in urban areas as well as alongside the main highways. In the areas where coverage is still needed, but it is not economical for any single network operator to commercially build it, it makes sense to build the coverage using shared broadband base stations.

The substantial benefit in this solution is the in-built flexibility in terms of scope and funding. The greater the available funding or need for dedicated security, the more quickly the dedicated network can be built. On the other hand, during years of tight budgets, extension of a dedicated authority broadband network can be slowed, and commercial networks can be used more instead.

Prerequisites

There are prerequisites for moving forward to a critical broadband era, including technology, frequency spectrum and increased network availability and reliability within the used commercial networks.

Before the transition from the current narrowband network, a technology that corresponds to the higher requirements needs to be available. LTE standardization gives high hopes for this, but critical public-safety-grade voice services will not be available in a multivendor fashion until the next decade.

A long period of parallel networks with narrowband TETRA services and LTE broadband needs to be turned into an asset instead of a burden.

To deploy a radio technology, the frequency spectrum must be made available. There is always a shortage of spectrum, thus it is a highly valuable asset. The United States and South Korea already selected the 700 MHz band for public-safety data. In Europe there is an opportunity in the similar band because of the digital dividend. One can expect that the newly available spectrum will be allocated to the telecommunications use, but the struggle to dedicate some of it for public-safety needs is yet to be won. It must be harmonized with the other European Union countries so the market size is big enough to improve the economics for public safety.

A hybrid solution aims to benefit from the commercial broadband networks. However, to be able to use them at all, the networks must meet fundamental authority requirements such as capability to guarantee authorities' priority access at all times in addition to the increased network availability and reliability. They also need to support and enable the standardized critical communications features. Because there is evidence that providing services to the demanding public-safety customers is not lucrative to commercial operators, the easiest and probably the most effective way is to include these authority requirements into a spectrum license.

Once that decision is made and sufficient frequencies are allocated, Finland has the flexibility to evolve from TETRA to critical broadband on its own chosen schedule during the next decade, advancing the scope according to the funds made available.

Immediate Actions

The primary national action is to ensure the availability of the dedicated radio frequencies on the harmonized frequency band. Alongside this, the authority requirements need to be included in commercial fre-

Finland

Area: 338,000 square kilometers
Population: 5.5 million
EU Member State
EU Schengen-land border: 1,340 kilometers

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quency licensing terms before submission. Every effort needs to be taken to support the international public-safety community in the critical LTE standardization and market building to ensure the future technology availability.

The noncritical broadband data service needs to be offered via a data MVNO to the user community to boost development and to start gaining experience with the operator. And the VIRVE TETRA network needs to be well maintained with additional services, capabilities and users groups. ■

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