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UMTS rapid response real-time seismic networks: implementation and strategies at INGV

Aladino Govoni, Lucia Margheriti, Milena Moretti, Valentino Lauciani, Gianpaolo Sensale, Augusto Bucci, and Fabio Criscuoli

Istituto Nazionale di Geofisica e Vulcanologia, Centro Nazionale Terremoti, ROMA, Italy (aladino.govoni@ingv.it)

The benefits of portable real-time seismic networks are several and well known. During the management of a temporary experiment from the real-time data it is possible to detect and fix rapidly problems with power supply, time synchronization, disk failures and, most important, seismic signal quality degradation due to unexpected noise
sources or sensor alignment/tampering. This usually minimizes field maintenance trips and maximizes both the quantity and the quality of the acquired data. When the area of the temporary experiment is not well monitored by the local permanent network, the real-time data from the temporary experiment can be fed to the permanent network
monitoring system improving greatly both the real-time hypocentral locations and the final revised bulletin.
All these benefits apply also in case of seismic crises when rapid deployment stations can significantly contribute to the aftershock analysis.
Nowadays data transmission using meshed radio networks or satellite systems is not a big technological problem for a permanent seismic network where each site is optimized for the device power consumption and is usually installed by properly specialized technicians that can configure transmission devices and align antennas. This is not usually practical for temporary networks and especially for rapid response networks where the installation time
is the main concern.
These difficulties are substantially lowered using the now widespread UMTS technology for data transmission. A small (but sometimes power hungry) properly configured device with an omnidirectional antenna must be added to
the station assembly. All setups are usually configured before deployment and this allows for an easy installation also by untrained personnel.
We describe here the implementation of a UMTS based portable seismic network for both temporary experiments and rapid response applications developed at INGV.
The first field experimentation of this approach dates back to the 2009 L'Aquila aftershock sequence and since then it has been customized and refined to overcome most reliability and security issues using an industry standard VPN architecture that allows to avoid UMTS provider firewall problems and does not expose to the Internet the usually weak and attack prone data acquisition ports. With this approach all the devices are protected inside a local network and the only exposed port is the VPN server one. This solution improves both the security and the bandwidth available to data transmission.
While most of the experimentation has been carried out using the RefTek units of the INGV Mobile Network this solution applies equally well to most seismic data loggers available on the market.
Overall the UMTS data transmission has been used in most temporary seismic experiments and in all seismic emergencies happened in Italy since 2010 and has proved to be a very cost effective approach with real-time data acquisition rates usually greater than 97% and all the benefits that result from the fast integration of the temporary data in the National Network monitoring system and in the EIDA data bank.