

TETRA Solution Overview

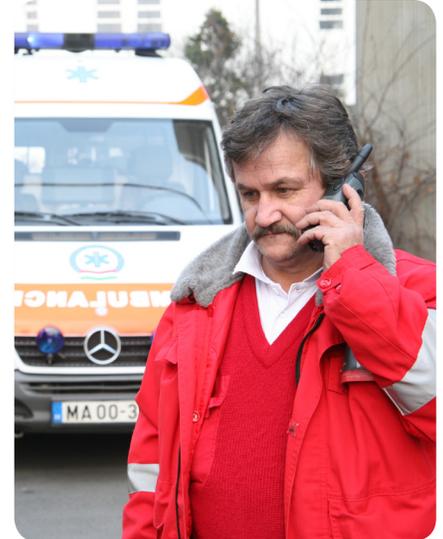
Satellite Connectivity for TETRA Deployments: Extending Coverage and Increasing Availability

TETRA two-way radio systems are used worldwide by government agencies, emergency responders and security forces, as well as by commercial operations as a way to maintain critical mobile voice and data communications. The goal is to deliver high availability and broad ubiquitous coverage, while facilitating fast call set up, group calling and dispatcher operations. Using satellite solutions to extend the coverage of TETRA networks ensures that the benefits of TETRA network coverage are available to emergency and security services over the widest possible areas, and in times of special circumstances when extra coverage is required.

Providing Cost-Effective Ubiquitous Coverage

As TETRA networks are built out across rural areas, end users must confront unique issues of cost, management and reliability. Specifically, they need to find a cost-effective way to connect TETRA Base Stations (the radio transceiver that provides coverage in an area) to the Switching Control Node (the telecoms switch that connects users with each other, the dispatcher and the public phone network). This can be accomplished through leased lines, microwave radio links or satellite connectivity. However, while leased line and microwave links often drive up deployment and management costs, satellite connectivity can be the most affordable solution.

- **Leased lines** are typically priced according to distance and can be expensive for rural access. They often have extremely long lead times for remote locations or may not be available at all at some sites.
- **Microwave links** can also be expensive to deploy over great distances. Each microwave hop can go no farther than the visible horizon, typically a maximum of about 40 km or less. After this distance a repeater station is required to relay the signal for another hop. When several relays are placed in series they become expensive, power can be a problem at intermediate hill-top locations, and the



The VSAT Advantage

- ◆ Establishing permanent links to remote base stations where traditional links can't reach
- ◆ Enabling rapid network build-out with links that can be up in days instead of months
- ◆ Connecting mobile base stations for rapid communications access during emergencies or special events
- ◆ Providing alternate routes for sites of strategic importance
- ◆ Delivering high-quality voice and broadband data access with guaranteed service levels

Satellite communications can overcome distance, terrain and cost challenges to ensure TETRA services can reach any location

availability falls unless the network is built-out in a ring topology, thus doubling the cost.

- **Satellite links** have several unique characteristics that make them ideal for TETRA deployments: the cost of a satellite link is independent of the distance to be spanned, availability is practically ubiquitous and reliability is excellent and in the control of the network designer as opposed to a telecommunication company. The economics of connecting remote or rural Base Stations via satellite is proven in the public cellular network domain and is finding a place in the networks of TETRA operators.

iDirect Satellite Connectivity – Built for TETRA Standards

Today, network operators can leverage iDirect's satellite IP platform to fill two major gaps in planning and deploying a TETRA network. It can provide coverage in remote and rural locations where leased lines are either prohibitively

expensive, on very long lead times or simply unavailable. And it can provide mobile cells with connectivity that can be on the air in minutes after arriving at the scene of a disaster or other unexpected event.

Efficient Bandwidth Allocation

iDirect's unique IP-based TDMA (Time Division Multiple Access) solution enables operators to share network capacity across multiple locations, allocating bandwidth in real time and on demand to increase efficiency. Very small sites of less than one Erlang of voice traffic of traffic all the way up to large scale networks can be economically serviced over such a dynamic capacity allocation. The result is significant bandwidth savings compared with alternative leased lines or microwave links to remote and rural locations.

Advanced QoS Management Enables Higher Reliability

When coupled with iDirect's advanced Quality of Service (QoS) feature, called Group QoS, operators can also segregate bandwidth by application so that TETRA Base Stations

can be assured of bandwidth management and traffic prioritization to avoid congestion and service degradation in a network shared with other types of IP traffic.

Group QoS can prioritize bandwidth allocation according to each Base Stations' dynamic requirements of various applications, and protect minimum CIR and QoS settings for high priority traffic during busy hours. Network operators can develop flexible service packages with accurate SLAs more economically, without compromising guaranteed quality and reliability.

Terrestrial-Grade Link Quality

iDirect's solution is suited for real-time applications through its advanced feature set, including UDP header compression, time-slot feathering and free-slot allocation, making the iDirect system less prone to jitter and more responsive to bandwidth requests. iDirect's time-slot feathering reduces jitter between voice packets by evenly spacing timeslots across a TDMA frame. iDirect's SAR feature, a QoS based

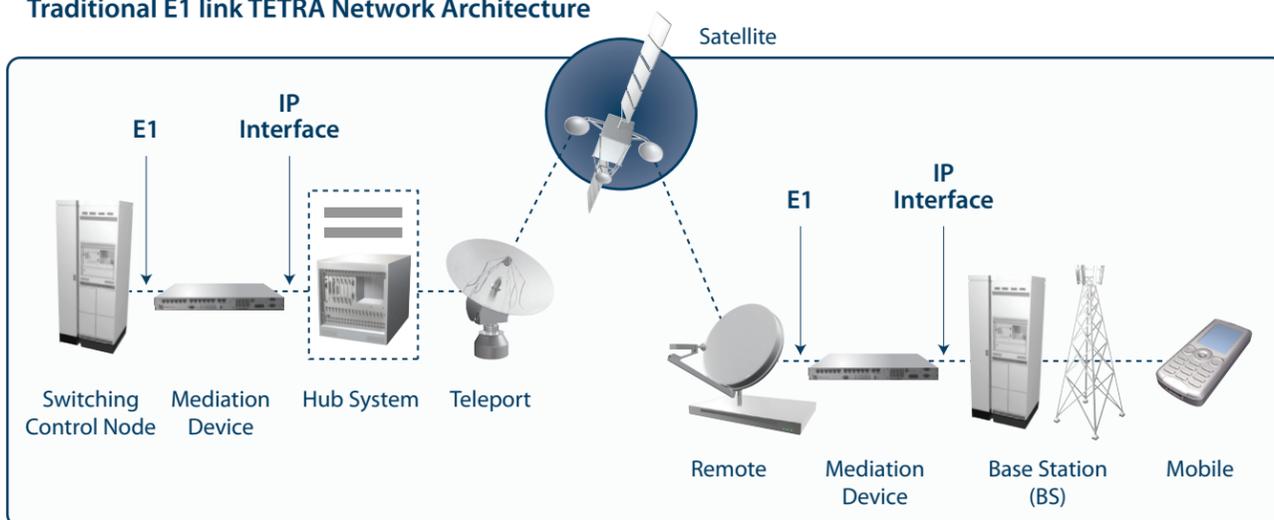
segmentation and reassembly algorithm, enables the system to interrupt large data frames to prioritize voice traffic. This eliminates unused time slots and enables more efficient multiplexing of channels.

Interoperability with All Systems

TETRA networks come in two types. Some are built around an IP core using soft-switch technology. Others use more traditional architecture of dedicated TDM E1 links to connect from the Base Stations (BS) to the Switching Control Nodes (SCN).

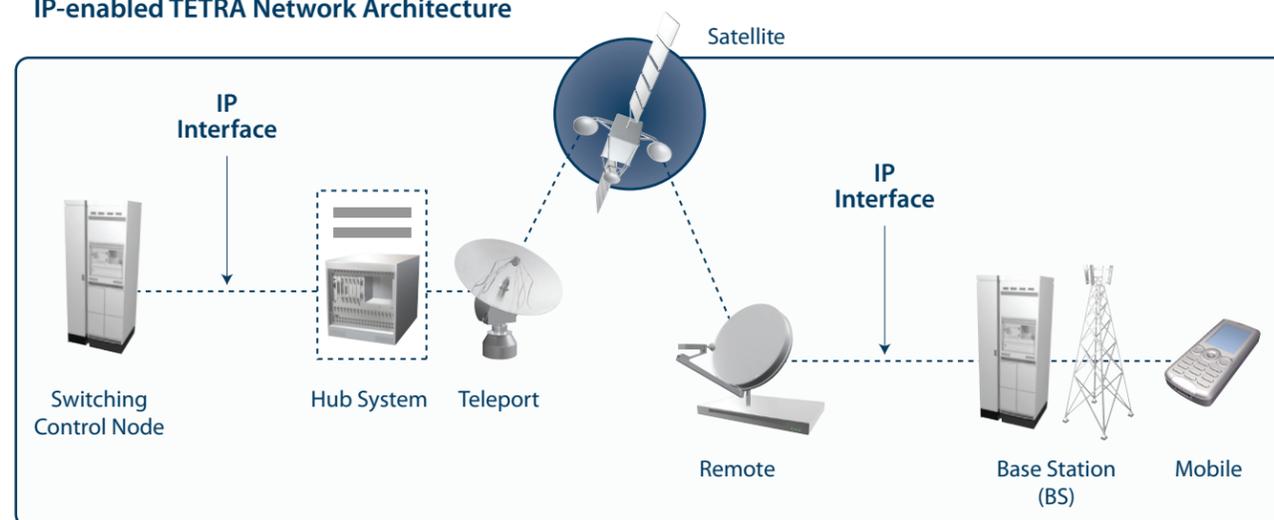
iDirect supports direct connection to IP-enabled infrastructure, straight from the BS or SCN to the iDirect remote router or the hub. iDirect can also support networks using traditional E1 links. In this case a mediation device is used to convert and optimize the data stream carried on the E1 link at the BS into IP packets that are carried to the hub where similar equipment is used to re-assemble the packets to form an E1 link once more to connect to the SCN.

Traditional E1 link TETRA Network Architecture



A TETRA network using E1 links connects via mediation devices at the hub and remote locations to an iDirect satellite network IP link.

IP-enabled TETRA Network Architecture



A TETRA Base Station at a remote site connects via an iDirect remote satellite router to an iDirect hub that is co-located with a TETRA Switching Control Node.

Taking TETRA Further

Today, many operators are taking advantage of satellite communications to ensure their TETRA networks can provide immediate, always available access to commercial organizations, government agencies and first responders.

With the iDirect platform, TETRA operators gain an efficient and reliable satellite solution for providing 100% geographical coverage that matches the quality of a terrestrial link. Operators count on iDirect to provide reliable high-speed broadband communications to their customers – whether they're in the heart of a major city or in a rural village.



Going Mobile with TETRA

A common setup is to use a fold-away self-pointing satellite antenna combined with a truck or trailer mounted Base Station. This offers almost instant satellite access with extra capacity at the touch of a button. There are no constraints on location, such as to be within line of sight of an existing microwave relay tower.

iDirect's IP-based satellite platform delivers maximum efficiency, reliability and flexibility so TETRA operators can meet even the most demanding end-user requirements

iDirect

13865 Sunrise Valley Drive
Herndon, VA 20171
+1 703.648.8000
+1 866.345.0983
www.idirect.net

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