

TELECOMMUNICATIONS SYSTEMS

- "Online" monitoring of all the train signals.
- Saved log downloading
- Automatic sending of critical alarms from train to land.



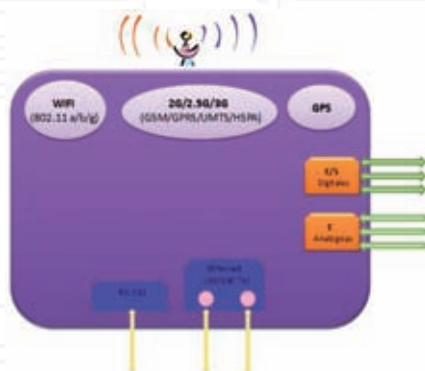
DESCRIPTION

The Communications system provides the onboard **Ethernet** network with **wireless interfaces** providing remote access to the various items connected to said network. This equipment consists of various modules, with are scalable and highly available.

In view of the travelling character of the train and of the requirement of **remote connection** with the same when it is in motion, an onboard remote wireless communication system must be fitted.

This 3G communications system covers **train-land connectivity**, independently of the technology to be used, including technologies such as GSM, GPRS, UMTS, HDSA, Wifi, etc. with **scalability** to greater capacity **future technologies**.

Therefore, in addition to the advantages of a wireless connection (speed and ease of installation, freedom of movements and maintenance cost reduction), there is the added advantage of the use of one technology or another according to the signal at each point of the unit's route (**roaming & handover** between technologies transparently).



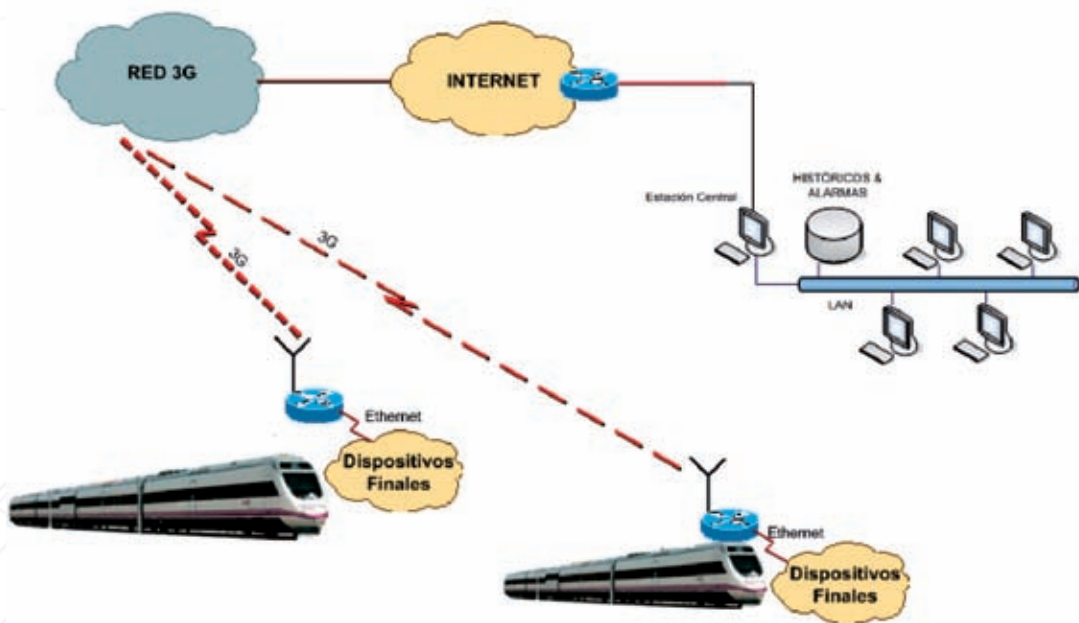
FUNCTIONALITY

This equipment controls communications to and from the train, providing the possibility of executing remote diagnosis. It performs the following main functions:

- **Remote diagnosis:** Transmission of log to a base station, with information regarding any equipment connected to the TCN network.
- **Real time display** of a set of **variables** chosen by the user for monitoring correct system operation. This data transmission can be automatic (interrupted data transmission) or at request, either from the train itself or from land.
- **Autonomous transmission** of the **alarms**, using state of the art communication technologies: GSM, GPRS, UMTS, HSDPA, Wifi, etc.

Also, the communication systems envisaged by Traintic, together with the analysis-diagnosis tools can provide variables analysis or predictive maintenance which facilitate train maintenance tasks. Integration between different Traintic products and services, which make the most of train maintenance and control.

** See the "Custom-Made Solutions" sheet*



ETHERNET NETWORK

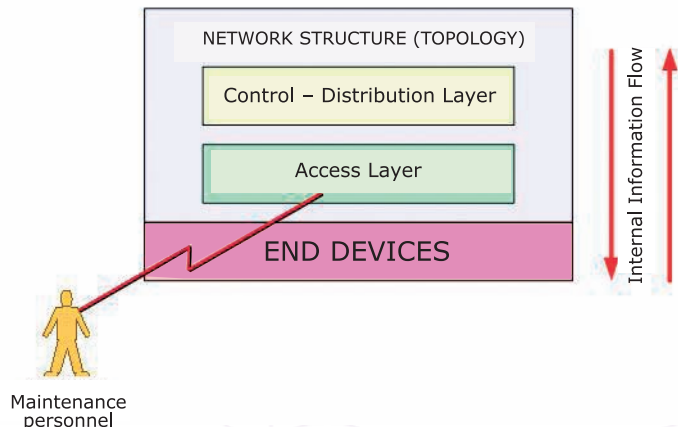
The use of new technologies requires the train **communications** to become **faster** and **more effective**, which requires a high degree of **innovation** in the use of new communications technologies.

As a base for all the equipment with this **high traffic volume** demand type with high transmission speed, Traintic opts to implement an standard data transmission **Ethernet** network (IEEE 802.3 [3]).

The onboard Ethernet network is proposed as a general purpose bus, with a high bandwidth, which is standardised and the technology is common and has been amply tested. It is also considered as a network which presents numerous added value services such as:

- The provision of **communications** to other systems, e.g. passenger information, Video-surveillance and entertainment.
- It facilitates local or remote **maintenance**.
- **Redundancy** of other communications buses (RS-485, MVB, WTB,...) on the train.
- It facilitates the **monitoring** of the network itself and of the end devices connected to the same.

The general description of the system is shown in the following block diagram:



The end devices: All the equipment intended to communicate via the onboard Ethernet network, which must therefore be physically connected to the same.

The network structure shall be formed by those structure devices (interconnected to each other) which are capable of providing the end devices access to the red (Access Layer), and by those devices which control and distribute the traffic in said network (providing QoS, access control, filtering,...).

In general, the onboard Ethernet network must be capable of:

- Permitting communication between the devices connected to the network, in accordance with the safety policy. It must also cut the communications that are not admitted by the safety policy.
- Permitting communication between the devices connected to the network and devices of external networks, in accordance with the safety policy. It must also cut the communications that are not admitted by the safety policy.
- Permitting free-flowing communication, preventing, wherever possible, bottle necks and infinite loops, prioritizing traffic based on a specific policy (QoS) and appropriately sizing the connections. In this way the basic services are guaranteed.
- Providing a redundant medium for the data passing through the MVB bus.
- Implementing redundancy mechanisms to convert it into a fault tolerant system, the same as the diagnosis and monitoring mechanisms.
- Permitting connection of other Ethernet networks, maintaining functionality and executing the necessary reinaugurations, in a transparent manner for the end devices which are connected to the onboard Ethernet network.

