The ESA SISNET Project: Real-Time EGNOS Services via the Internet

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Résumé

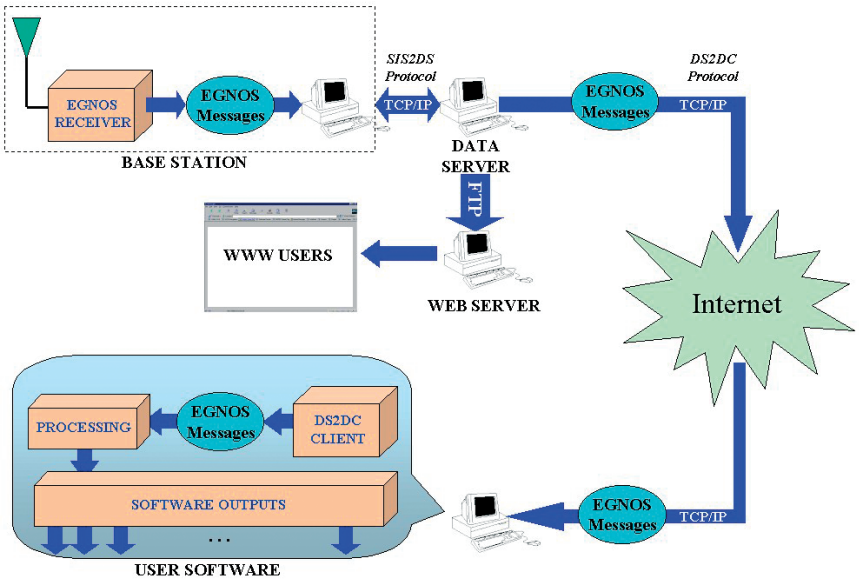
SISNET (Signal-In-Space through the Internet) est le résultat d'une initiative de l'ESA à travers laquelle, un nombre illimité de personnes disposant d'une connexion Internet, peuvent avoir accès au signal EGNOS. Le projet inclut non seulement un accès en temps réel aux messages diffusés par les satellites Géostationnaires, mais il offrira aussi la possibilité de tester les performances du système ainsi que d' améliorer les prestations des applications multi-modales.

Introduction

EGNOS, the European Geostationary Navigation Overlay Service, is the first step in the European contribution to the Global Navigation Satellite System, and a fundamental stepping-stone towards Galileo, Europe's own Global Navigation Satellite System (Ref. 1). EGNOS is an augmentation system to the GPS and GLONASS satellite navigation systems, which provides and guarantees navigation signals for aeronautical, maritime and land mobile trans-European network applications. Since January 2000, a pre-operational signal from EGNOS has been available through the so-called 'EGNOS System Test Bed' (ESTB, Ref. 2).

EGNOS will broadcast wide-area/integrity messages through geostationary satellites. The ESTB is already broadcasting the EGNOS message through the Inmarsat III AOR-E satellite (broadcast through the Inmarsat III IOR satellite is also planned in 2002. Broadcasting of EGNOS messages through GEOs is a very efficient strategy for many users (e.g. avionic applications). However, some users may also require transmission by other means to avoid potential GEO blocking (e.g. due to buildings and other obstacles in cities), or may simply be interested in EGNOS real-time information for scientific/technical purposes, without wishing to invest in a receiver (e.g. IONO maps of Europe, EGNOS performance monitoring, etc.). For this reason, ESA has recently launched specific contract activities, through its Advanced System Telecommunication Equipment (ASTE) Programme, to assess and demonstrate architectures where the ESTB signal is also broadcast by non-GEO means (e.g. FM or GSM broadcasting). In this context, ESA has also launched an internal project called SISNET - Signal In Space through the Internet - to provide access to the EGNOS test-bed messages via the Internet. References 3 and 4 provide more detailed information.

Figure 1. Architecture of the SISNET platform



SISNET platform architecture

Figure 1 shows the architecture of the SISNET platform. The four main components of the system (depicted as computers) are the Base Station (BS), the Data Server (DS), the User Application Software (UAS), and the Web Server.

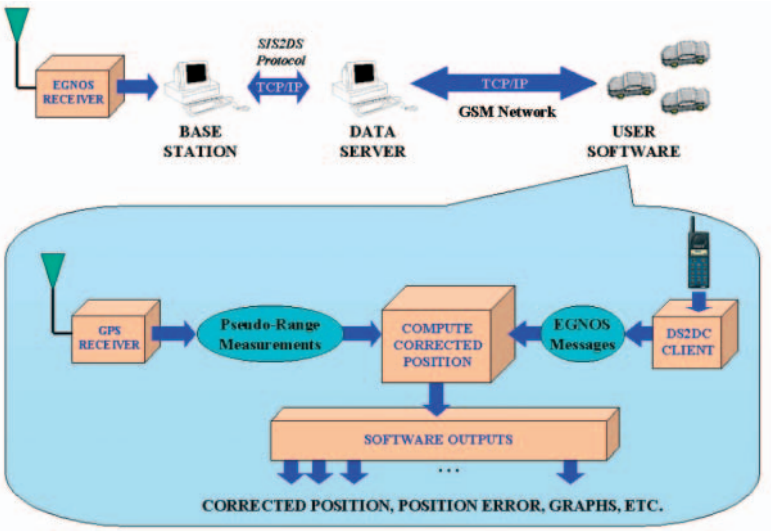
The BS consists of a PC, equipped with an EGNOS receiver. A set of software components allows the EGNOS message to be acquired and sent to a remote computer (the DS) in real-time (1 message per second, i.e. 250 bit/s). Supervision of the receiver is defined through an interpreted scripting language, allowing total control of the process. A considerable number of receivers is supported, with all components integrated into a software application called the Base Station Application. This software monitors the EGNOS messages obtained from the receiver and the status of communications with the DS, using a Graphical User Interface (GUI).

The DS consists of a high-performance computer, optimised for running server software with a large number of connected users (Fig. 2). The DS software receives the EGNOS messages from the BS and transfers them to the remote users in real time, using a special protocol based on TCP/IP. Specific data-compression techniques are used, in order to achieve high communications efficiency. In addition, the DS implements other extra services provided by SISNET (e.g. broadcasting of text messages to users). The DS periodically sends the most recent EGNOS messages to a remote Web server, enabling the development of Web/WAP applications.

The UAS is a software application that accomplishes the SISNET interface control specifications, by being able to obtain the EGNOS messages in real time (1 message/s or 250 bit/s) from the DS. It can also access the additional services offered by SISNET. The UAS is actually the most flexible component of SISNET. Each developer can build their own implementation of the UAS, defining the desired characteristics and purposes. The only restriction is that the requirements stated in the SISNET interface control document (available on request) must be respected. The UAS can be embedded in different kinds of computers and electronic devices (e.g. Personal Data Assistants). This portability enables the development of SISNET-based applications for land mobile users.

Figure 2. SISNET Data Server

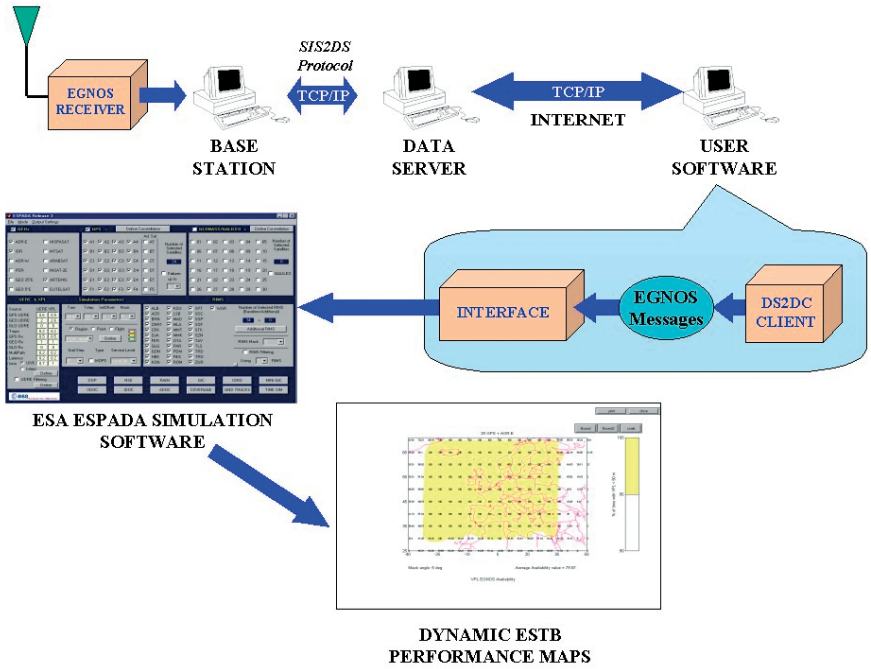
Figure 3. Application of the SISNET technology: positioning through the Internet



EGNOS-augmented positioning through the Internet

The SISNET project can provide noteworthy advantages to the GPS land-user community. In fact, ESA is currently working on providing the EGNOS services to land users through the Internet, by combining the SISNET, GPS and GSM technologies. Figure 3 shows the architecture of a SISNET-based system responding to that objective. In this kind of application, the UAS is 'embedded' in a vehicle, and the access to the Internet (and hence to SISNET) is established via the GSM wireless network. The processing stage of the UAS is in contact with a GPS receiver and with the EGNOS corrections injected through SISNET. Therefore, the position can be corrected whilst avoiding GEO blocking problems, substantially improving the accuracy of the GPS receiver.

Figure 4. Application of the SISNET technology: EGNOS performance monitoring



EGNOS performance monitoring the Internet

ESA has recently developed another application of SISNET, by replacing the UAS processing stage with two new components:

- the ESPADA software (the Agency's EGNOS simulation tool; see Ref. 5)
- an interface block able to adapt the data produced by SISNET to the format used by ESPADA.

Figure 4 shows the resulting system architecture. Needing only a connection to the Internet, SISNET provides a real-time virtual receiver, so that ESPADA is able to obtain the real data broadcast by the ESTB. As a result, the software produces performance availability maps in real time, which are available via the Internet *(www.esa.int/navigation/estb)*.

References

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