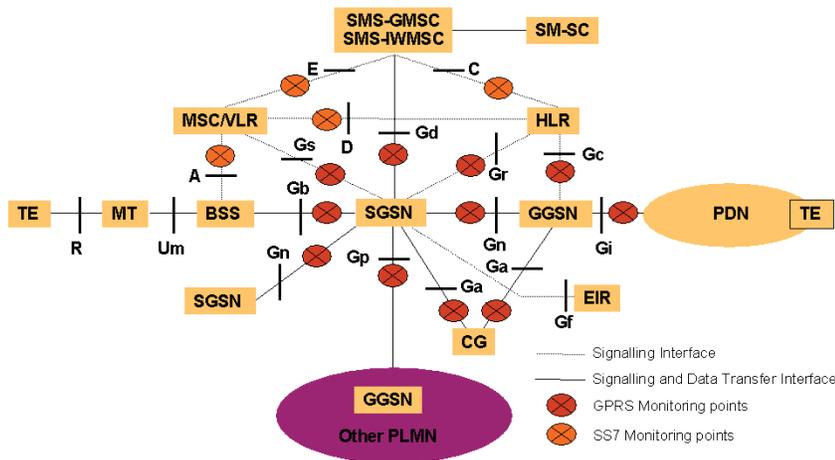


# Monitoring System

## ► NET-7™ System



## SS7/GSM/GPRS Monitoring and Analysis

Designed by Tektronix to meet the most demanding requirements of fixed and mobile operators, the NET-7 system is a robust SS7/GSM/GPRS non-intrusive network monitoring system that tracks all the activities related to the messages exchanged by different network nodes. The NET-7 protocol library includes more than 150 protocols and protocol variants for both fixed and mobile 2G, 2.5G and 3G networks. The flexible design of the NET-7 system meets requirements of high modularity and scalability. At the monitoring site, the NET-7 system is structured using monitoring probes connected to the SS7 network to monitor and a central unit that collects and analyzes data from the monitoring probes. The central unit displays network information to one or more users, who can be located at different user sites. The system architecture can range from a small, single-site system (a few links) to a fully distributed, multi-site system (thousands of links). The thin user interface ensures easy usability and integrated environment with MS Office applications and any other terminal standard.

### NET-7 System Capabilities

- Real-time Status Monitoring
- Traffic Monitoring and Signaling Measurements
- BSSAP, MAP, Q.752, TTS and Gb KPIs
- Signaling Accounting
- CDR (Call Data Record) and TDR (Transaction Data Record) Generation
- Traffic Analysis and Profiling
- Quality of Service Reports According to E.422 Recommendations
- Billing Verification
- Protocol Analysis
- Multi-protocol, Network-wide Procedure Trace
- Fraud Detection (e.g., Excessive Amount and/or Duration of Calls, User or Destination Black Listing, etc.)
- Carrier/Destination Traffic Monitoring and Analysis (QUATTRO Application)
- “Welcome” and Personalized Information Message Generation for Roamers (SMS Ciao System)
- Performance Analysis of Intelligent Networks Services
- Roaming Supervision at Interconnection Links (IRMA Application)

### ► Features & Benefits

#### Maximize Revenues and Improve Operational Efficiency

Prevent Revenue Losses Due to Fraud with Proactive Detection Capabilities

Minimize Losses Due to Billing Errors with Accurate Generation of Customer Call Detail Records for Every Call and Call Attempt

Locate and Bill for Previously Unbilled Services

Increase Customer Satisfaction and Reduce Churn by Delivering a Better QoS

Track QoS Delivered to Mobile Visitors at Any Single Cells to Capture and Retain Traffic Generated by Temporary In-Roamers

Build and Strengthen Your Network’s Reputation for Quality and Enjoy Smoother Relations with Regulators, Other Operators and Carriers

Provide a Comprehensive Quality of Service (QoS) Solution to your Operations and Maintenance, Planning and Engineering Quality, Marketing, Security and Billing Departments

Increase Maintenance Efficiency by Centralizing Operations and Enabling Fast, Accurate Troubleshooting and Planning

Increase Revenue-per-Customer by Increasing Network Uptime

Minimize Investments in Drive Tests by Using Real-time Cell Hand-over Monitoring

### ► Applications

Complete Monitoring System Management and Real-time Network Supervision

Billing Verification

Signaling Protocol Test and Traffic Accounting

Call Trace

Q.752 Real-time Measurements

CDR Generation and Reporting

Fraud Detection and Management Applications

Best Carrier Selection

Mobile Data Service KPIs

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- ▶ Cell Level In-Roamers Supervision (RST Application)
- ▶ SIM Cloning Detection
- ▶ Signaling and Traffic Routing Verification (Planet Application)
- ▶ Protocol Analysis
- ▶ GPRS Procedure Trace
- ▶ Gb Real-time Deciphering
- ▶ Gb KPIs for Control Plane and User Plane Cell Level Analysis (GbSTS Application)

### System Architecture

The NET-7 system architecture includes remote monitoring probes connected via a communications network (a WAN with TCP/IP) to a central unit. To meet a wide range of potential system applications, a large number of user sites can be supported from a single central unit.

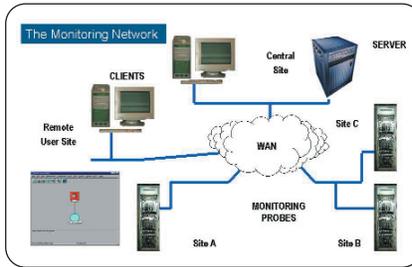
The NET-7 system physically links to the network at the monitoring site interface, located in a network node (e.g., local exchange, transit exchange, STP or MSC link or databases such as SCP and HLR, SGSN, and GGSN).

Monitoring sites – which can be distributed anywhere in the network – contain one or more racks equipped with:

- ▶ Monitoring probes having different interface boards to access SS7, GSM, GPRS network links
- ▶ Protected Mass storage of signaling raw data
- ▶ WAN connectivity hardware (e.g., hub and routers)
- ▶ GPS antenna

The monitoring probes provide the following functions:

- ▶ Nonintrusive interface to the E1/T1 (framed, Frame Relay, ATM) and 10/100 Mb/s Ethernet links
- ▶ Analysis of different SS7/GSM/GPRS/IN signaling protocols and protocol variants
- ▶ Decoding and storage of signaling data on a local hard disk
- ▶ Evaluation and storage of near real-time statistics and counters

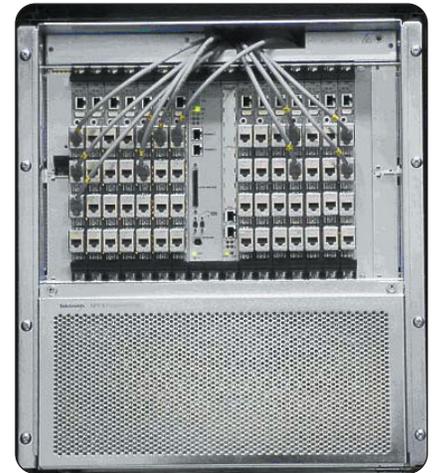


- ▶ Evaluation and storage of call and transaction related information
- ▶ Communications and synchronization with other monitoring probes for multi-protocol distributed call-trace
- ▶ Transmission of the relevant information to the central unit

These are the main functionalities of the central unit:

- ▶ Management and control of all the monitoring probes
- ▶ System wide measurement data collection, correlation and storage
- ▶ Elaboration of network wide information based on individual site's data
- ▶ Data presentation to the user(s)
- ▶ Interface to other applications

The central unit comprises a UNIX server equipped with an ORACLE relational database and one or more thin clients workstations, providing the graphical user interface to control the system. The client workstations can be either in the same site as the server or in different geographical sites and connected to the server via a WAN. The UNIX server is a SUN SPARC server whose configuration depends on the number of monitored links and the amount and type of applications running. If more processing power is required, more servers can be used to share applications or database and network management functions. Through the client workstation, the NET-7 system provides you with a graphical representation through multi-layered maps and alarm-



management features that pinpoint in real-time any major problem in the network. You can obtain network-wide-correlated information and you also can troubleshoot by drilling down to a single event or element in the SS7/GPRS network.

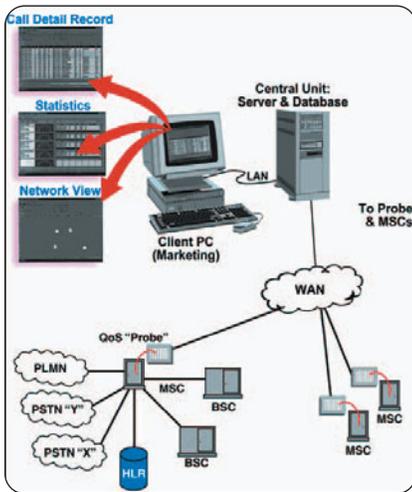
### Data Collection

The monitoring probes provide simultaneous monitoring of a number of signaling data links, collecting and decoding signaling information and alarms.

Monitoring probe connections to the telecommunications network are made through protected monitoring points or at the Digital Distribution Frames (DDF) level by means of T pieces that provide a high-impedance connection.

The monitoring probes interface with both directions of the E1 and 10/100 Mb/s Ethernet links.

The NET-7 system can be used with different common channel signaling systems, both in fixed and mobile network environments. No user intervention is required for normal operation of the system. In fact, once a monitoring probe has been configured, it becomes completely autonomous. It analyzes and stores data that are then collected by the central unit.



### Data Analysis and Storage

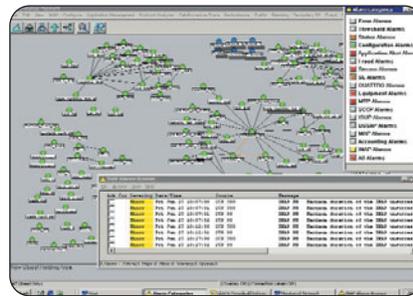
Signaling information is decoded at different layers of the protocols to provide both on-line, real-time information to the operator and off-line analysis from recorded data.

Statistical measurements, counters and KPIs are provided at different intervals based on specific protocol messages to evaluate the performance of the signaling network. Call or transaction related information is as well provided by the system to allow Call Detail Records (CDR) for every call or call attempt in the network.

Data storage can occur either in the central unit or in the monitoring probe hard disk for a limited time period, in order to buffer data locally in case of communications problems over the WAN. Local storage capability, coupled with data elaboration performed at the monitoring probe level, decreases the amount of data required to be transferred over the WAN.

Data from the monitoring probes can be further processed by the central unit to obtain additional information about network status and performance of the network.

To be able to interpret and consolidate collected data, information about the



network structure is stored in the system. This allows the NET-7 system to determine, for instance, the origin and destination of each call. By using OLAP technology, users can drill data up to the details they need in order to detect and pinpoint problems and derive guidance for a fast resolution. An optional feature, the raw data storage, provides a file server with a large disk array at the monitoring site. This allows storing every single protocol message unit for many days.

Different monitoring probes access the same file server via LAN. The central server and client can access these data without the need to transfer large files in advance.

### Data Synchronization and Correlation

Data collected by different monitoring probes need to be synchronized across the entire network to ensure a correct interpretation of the information. To do so, a GPS is provided in each of the monitoring sites so that information gathered by the central unit can be analyzed in the correct sequence. Moreover, to avoid duplication of information across the system, data correlation might be required among different monitoring probes. Once configured, monitoring probes can communicate with each other without any user intervention, and reconstruct all the relevant information without any duplication before sending data to the central unit.

## Graphical User Interface (GUI)

### Elementary Information

The elementary information processed by the system is SS7 signaling and GPRS signaling and user payload. By analyzing this flow, the monitoring probes generate, in real time, protocol data (dump of MSUs), CDRs, statistic counters, KPIs and alarms. MSUs feed the protocol analysis and call trace applications; all the messages are time stamped and displayed in real time to the operator, who can choose the level of details with which the information is displayed. Besides being displayed in real time, the information can be stored for subsequent off-line analysis. It is also possible to filter out whichever information is not relevant, according, for instance, to the message types or the physical link and to trigger the analysis process based on specific conditions.

With optional hardware equipment, the system is able to capture and store every single protocol message (raw data feature). For analysis at the individual call level, complete Call Detail Records (CDRs) are displayed containing the detailed information for each call as measured by the monitoring probes. It is also possible to choose which CDRs to display. For instance, it's possible to select only the CDRs of calls with no answer or calls with a transmission performance above or below a certain threshold or calls related to a certain circuit group or destination. This allows top-down analysis for maintenance purposes, and permits problem identification such as wrong network configurations, interworking problems, poor echo performance, circuit blocking and so on. Statistic counters can be correlated with user defined thresholds to generate specific events and alarms, that are then displayed on network maps and can be searched for with the alarm browser.

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### Presentation of Processed Data

The NET-7 system provides several methods of presenting information at different levels to fulfill each user's analysis requirements.

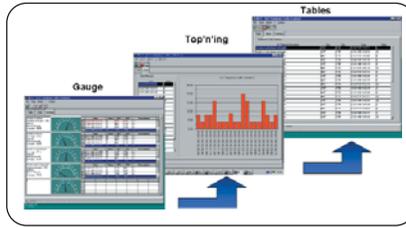
### Maps and Alarms

Hierarchical maps provide a global view of network performance and behavior. These maps represent both the monitored and the monitoring network (the NET-7) in terms of nodes and connections among them.

Depending on the status of the network and/or on the values of the parameters associated with a specific connection, you can have a quick indication (color change) of the status of the connection. By clicking on the map's elements, you can then display all the alarms associated with their status. An alarm browser is available to search and acknowledge alarms. The severity of alarms is configurable. Map and alarm management is based on OpenView Network Node Manager.

### Reports: Tables and Graphs

Starting from elementary information (like individual CDRs or SS7/GPRS statistical counters), it is possible to evaluate complex parameters and measures for different origins and destinations of signaling and traffic along the network.



The information presented in a tabular form or on the maps can be displayed, as well as graphical diagrams, to give another representation of network behavior.

You can plot, for instance, how a certain performance parameter varies according to the time of day or the physical circuit or the destination of the calls. A best-carrier analysis can be achieved as well by monitoring the interconnection links and providing valuable tables and graphs reporting the effectiveness and the quality of the interconnection with your counterparts and matching their costs and charges of the routed calls. GPRS Data Service analysis can be done up to cell level for any used service like HTTP, FTP, Telnet or others.

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