Analysis and Simulation Software NetHawk™

For all modern telecommunication systems like ISDN, GSM, GPRS, EDGE, UMTS

NetHawk™ products comprise plug-in cards for PCs and **analysis and simulation** software for measurements on the interfaces commonly used for modern telecommunication systems such as

◆ GSM
◆ ISDN
◆ GPRS
◆ UMTS/ATM

The software analyzes and simulates all interfaces used for modern telecommunication networks:

◆ E1, T1, J1
◆ V5.1 and V5.2
◆ GSM: A and A_{bis}
◆ GPRS: G_n and G_b
◆ 3G: Iub, Iu and Iur

NetHawk™ servers allow the integration of user-generated programs into telecommunication systems via a flexible TCP/IP interface.

Common features

◆ Windows-based tools
◆ Standard PC or laptop
◆ Data output in ASCII to file or printer
◆ Extensive help texts for applications and protocols
◆ Generation of automatic test routines for simulators by means of script languages
◆ Remote control

Detailed protocol analysis

◆ Online in real time or offline with free software licence
◆ Separate representation of uplink and downlink
◆ Scanner function
◆ Call trace feature
◆ Extensive trigger functions
◆ Colour-highlighted protocol details
◆ Filtered display of protocol details
◆ Storage of protocols with complete setups
◆ Statistical analysis

ROHDE & SCHWARZ

NetHawk™ cards for mobile use with laptop PC

Designation	Interface	Data bus	System	CPU
N2 5400	E1, T1, J1 RJ 45/BNC	Card bus slot II 32 bit	Windows 98	Pentium 266 MHz 64 Mbyte RAM 10 Mbyte free
N3 5500-s	STM-1 optical SC single mode			
N3 5500-m	STM-1 optical SC multimode	Card bus slot II 32 bit	Windows 2000	Pentium 266 MHz 64 Mbyte RAM 10 Mbyte free
N3-i 5804	inverted single mode			
N3-i 5805	inverted multimode			

NetHawk™ cards for stationary use with desktop PC

| Designation	Interface	Data bus	System	CPU
NAP 5200	E1, T1, J1 RJ 45	PCI	Windows NT Windows 2000	Pentium 266 MHz 64 Mbyte RAM 10 Mbyte free
G3-Adapter 5302-s	STM-1 optical SC single mode			
G3-Adapter 5302-m	STM-1 optical SC multimode	PCI via ATM card	Windows NT	Pentium 500 MHz 128 Mbyte RAM 20 Mbyte free
D3-s 5802	STM-1 optical SC single mode			
D3-m 5803	STM-1 optical SC multimode	PCI	Windows 2000	

Analysis or simulation of network elements made easy: install the software, insert the NetHawk™ card into the PC slot and go ahead.

Mobile networks

GSM analyzer

The GSM analyzer is a PC-based protocol analyzer for monitoring and analyzing all layers in GSM networks. Data traffic in the network is transmitted to the analyzer via the PCM card and a ring memory. The analysis software displays the layers on the screen (physical layer and higher). Its key features include:

Applications of GSM Analyzer NetHawk™

◆ Monitoring of GSM signals at A, A_{bis} and G_a, G_b interfaces
◆ Monitoring of half rate (HR), full rate (FR), enhanced full rate (EFR) and optionally of TRAU frames and AMR codex
◆ Monitoring of data and fax protocols and supplementary services
◆ Optional SS7 MAP analysis
◆ GSM phase 1, 2, 2+, ITU-T and ANSI modes for SS7 common channel signalling protocol layers (MTP and SCCP)
◆ Analysis of up to 16 different PCM timeslots
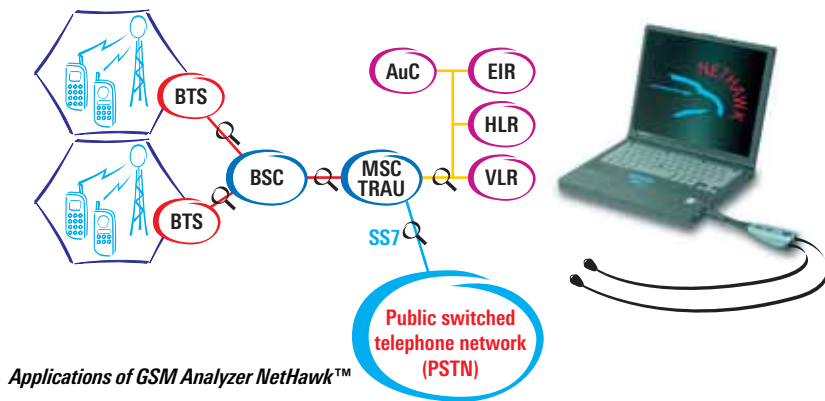
Graphics display of analysis results

GSM Analyzer NetHawk™ provides real-time graphics display of the RxLev and RxQual parameters of the uplink and downlink measurement reports during a call. This allows transmission quality monitoring and protocol analysis at the same time.

GSM GPRS analyzer

For simultaneous monitoring of the G_b interface a software upgrade can be installed. Some of the extra features included are BTSM, SNDCP, BSSGP, LLC, PCU frames and RLC/MAC analysis.

GPRS LAN and A$_{bis}$ interfaces
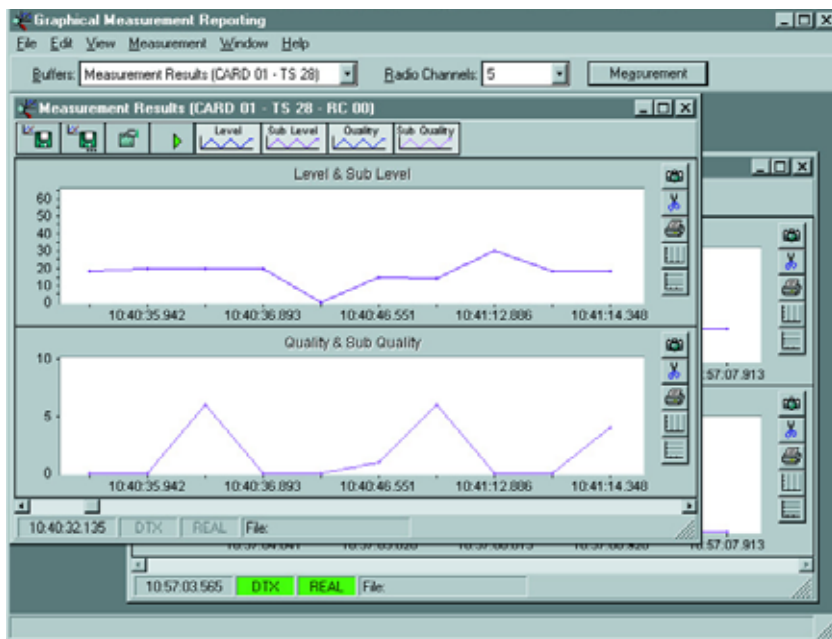
GSM/IP analyzer

In addition to the GSM- and SS7-based protocols over IP, the following Ethernet-based protocols are decoded:

◆ MAC of 10/100 Mbit/s Ethernet
◆ IP (Internet protocol)
◆ TCP/UDP
◆ H.323 version 2 with Q.931, H.225.0, H.245, RAS
◆ RTP/RTCP
◆ GSM/UMTS handover

The GSM analyzer comprises a PC adapter card and the associated software for analyzing the A and A_{bis} interfaces.

Simultaneous display of RxLev and RxQual with GSM analyzer

The adapter card is either a PC-bus-compatible N2 card for laptops with Windows 98/2000 or a PCI-compatible NAP card for desktop PCs with Windows NT.

An Ethernet card is supplied for the G_n/G_i interfaces. The IP, TCP and UDP protocols as well as WAP over IP and the GTP analysis of the G_n/G_p interface are fully supported.

All GSM/GPRS-relevant interfaces and their protocols can be displayed on a single PC screen.

3G UMTS analyzer

The high UMTS bit rates are realized by using ATM for the data feed; data rates of 2 Mbit/s and 155 Mbit/s are specified. The 2 Mbit/s correspond to E1 for ATM and are transmitted on shielded electrical lines. For 155 Mbit/s, fiber-optic cables are used to carry ATM cells using SDH technology and the STM-1 interface.

The 3G UMTS analyzer is able to simultaneously analyze up to 64 ATM channels with different VPI/VCI addresses for UNI and NNI; the PDU types AAL0, AAL2 and AAL5 are supported. The analysis is to 3GPP standard and – for the signalling – to SSCOP, MTP3B, AAL2, SCCP, B-ISDN, UNI 3.1 and 4.0.

In addition to the software, an ATM card with PCI slot is supplied for the **STM-1 adapter G3**. The STM-1 adapter G3 has three interfaces for uplink and downlink at 155 Mbit/s. The data from one interface is passed on to the PC, while the other two interfaces are available as test inputs.

Each **PCI plug-in card D3** has an input and output for the uplink and downlink at the Iu or Iub interfaces. The RNC or Node-B simulator software also activates the optical transmitters to test, for instance, different handover scenarios at two UMTS base stations.

3G cards E1 and STM-1 with card bus

For laptops with a conventional N2 card suitable for the bit rates E1, T1 and J1, the 3G analysis software can handle measurements with ATM at 2 Mbit/s.
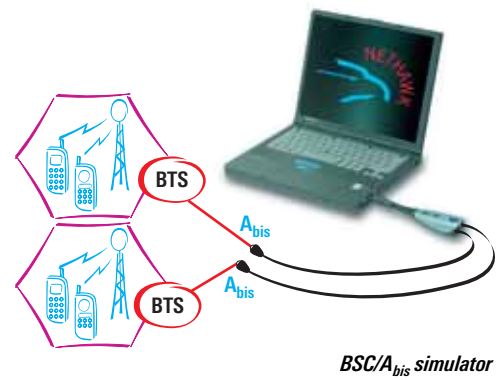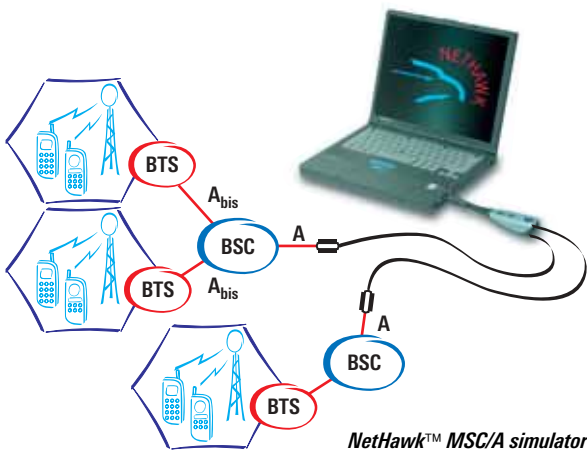
Fitted with the new N3 card, a laptop can analyze both interfaces – E1 electrical and STM-1 optical. The optical connection is made via SC connectors for the uplink and downlink of a 155 Mbit/s ATM line.

Optical and electrical 3G analysis performed together on a laptop
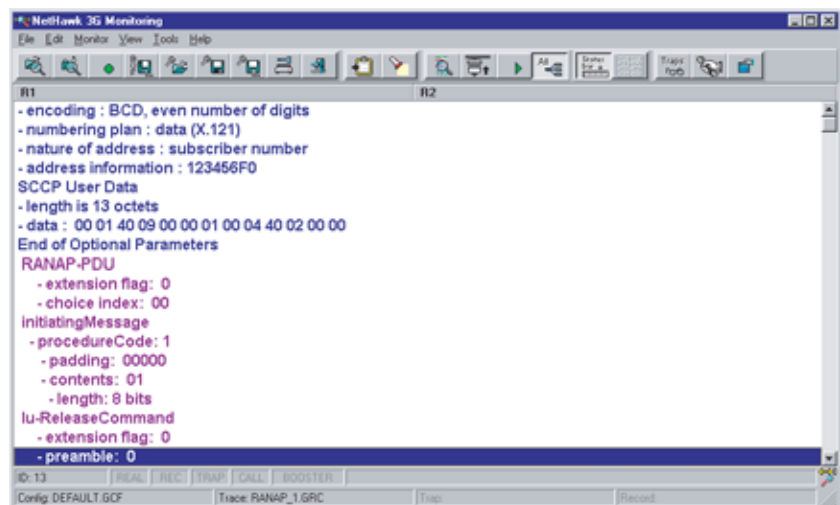
UMTS protocol analysis window

NetHawk™ MSC/A simulator

BSC/A$_{bis}$ simulator

GSM simulator

The simulator consists of three components

◆ Link layer service with LAPD protocol
◆ Simulator (reacts automatically to incoming signals)
◆ User interface

The user interface comprises a command menu, a graphics window to monitor the simulation blocks, a status window showing all current connections and a script viewer displaying all active scripts.

◆ MSC/A
 – Simulates MSC and VLR towards BSS (BSC and BTS)
 – A interface
 – Tests on BSS and mobiles
 – Max. 30 voice links within the same BSS
 – Max. eight voice links between two BSS
◆ BSC/A$_{bis}$
 – Simulation of BSC/MSC/VLR towards BTS
 – A$_{bis}$ interface
 – GPRS or EDGE as an option
 – Tests on BTS and mobiles
 – Max. 25 simultaneous calls

Supported GSM procedures

◆ Location updating
◆ Call setup and cleardown
 – mobile-originated (MO)
 – mobile-terminating (MT)
 – mobile-to-mobile
◆ Emergency call setup
◆ Handover
 – intra-BTS
 – inter-BTS
◆ Transmission of MT point-to-point SMS
◆ Reception of MO point-to-point SMS
◆ SMS cell broadcast
◆ Voice links

RNC simulator

The RNC simulator is a function tester for the UMTS base station and is operated via the Iub interface. The software can be used with the N2 card (E1, T1, J1) or N3 card (STM-1) in mobile applications and with the STM-1 adapter G3 in stationary applications.

The simulator initializes the base station, generates the signalling, sets up and clears calls and allows monitoring of the protocol. It contains the ATM-specific protocols AAL0, AAL2, AAL5 and SSCOP.
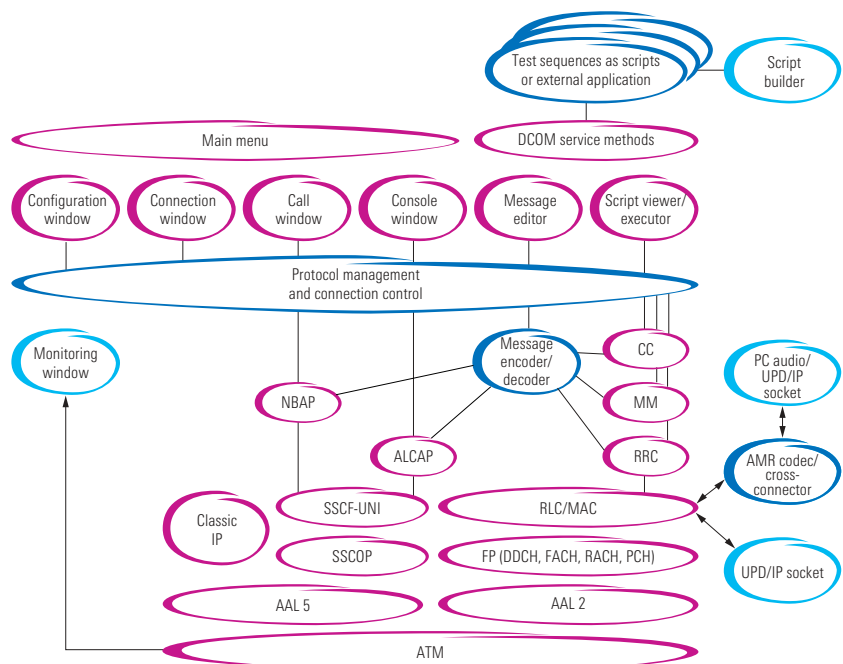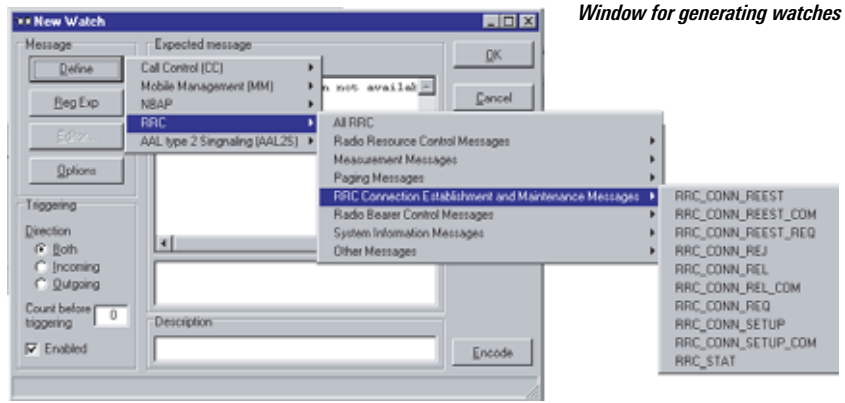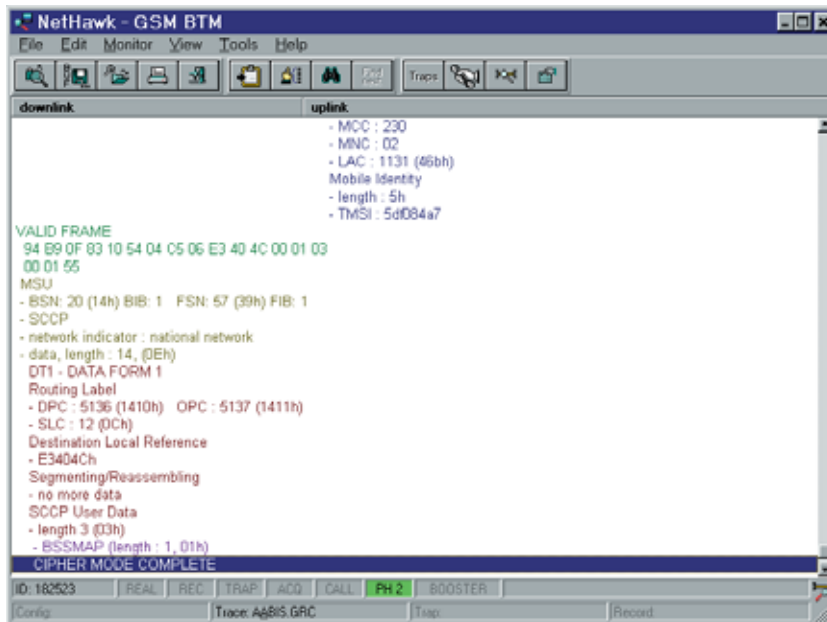

Protocols for RNC/Iub simulator

3G simulators

The 3G simulators are function testers for the Iub interface in both directions. They simulate the RNC for the UMTS base station and the base station for the RNC. The software can be used with the N2 (E1, T1, J1) and N3 (STM-1 optical) cards for mobile applications and with the PCI cards G3 and D3 for stationary applications.

The **Node-B simulator** simulates an UMTS base station and permits operation of an RNC without a true Node B. The software contains the relevant protocols of the RNC simulator, as shown in the illustration below, for testing signalling as well as traffic data.

The **RNC Iub simulator** initializes the base station, generates signalling, sets up and clears calls and allows protocol monitoring. It contains the ATM-specific protocols AAL2 and AAL5 and generates PN9 sequences for BER measurements. WCDMA/WCDMA handover as well as GSM with UMTS can be tested.

Scripting and watches can be used to generate comprehensive command rou-

Window for generating watches

Assignment of colours for layer detail identification

tines. To remote-control the simulator via a LAN network, for instance the user plane can be accessed via UDP/IP, the control plane via DCOM.

Scripting

All NetHawk™ simulators have versatile scripting facilities for creating customized automatic test routines. User interfaces can be programmed with an HTML editor. Complete script libraries can be created

and easily integrated into all test routines. Customer's test scenarios can be programmed in JScript or VB-Script from Microsoft; they are commonly used languages – especially on the Internet. The simulators have command blocks for simulation or test routine control. These command sequences can be used as procedures in scripts and as modules in larger test sequences.

Watches

Watches are used to modify bytes in protocol sets and to redefine protocols. The Skip, Delete, Insert and Replace commands cause the simulator to modify the protocol that has been found.

A typical application is the insertion of national protocol characteristics into the general protocol.

Watches can also be used with scripting, for instance to synchronize a script command set and the current protocol.

GSM protocol with layer details

V5 access networks (LAN, WAN, WLL, trunked radio)
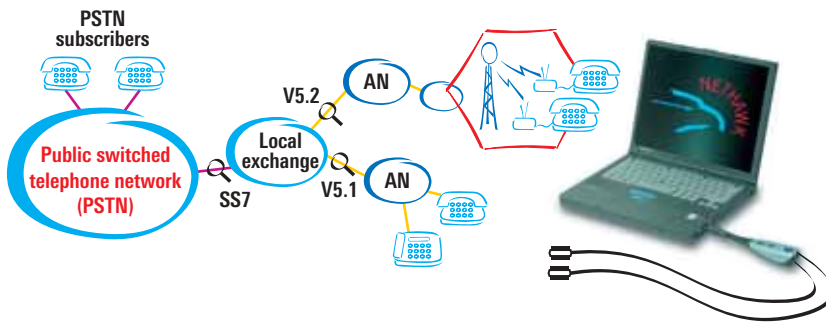
Applications of NetHawk™ V5 analyzers

Main applications

NetHawk™ simulators and analyzers for V5 networks are designed for the following typical applications:

◆ Wireless local loop (WLL) in GSM and DECT
◆ PSTN access control
◆ Cable TV operators, public utilities and transport companies providing telephone services
◆ PSTN type approval tests

PC-based V5 simulator

◆ Simulation of
  – LE functionality towards AN
  – AN functionality towards LE
◆ Supports both V5.1 and V5.2
◆ Max. six timeslots for signalling
◆ Max. 60 simultaneous calls

V5 analyzer

The NetHawk™ V5 analyzer is a PC-based protocol analyzer for monitoring and analyzing the signalling protocols of V5.1 and V5.2 networks. Its key features include:

◆ Support of ISDN via V5
◆ Support of ISDN supplementary services
◆ Analysis of up to 16 different PCM timeslots

V5.1

◆ Fixed traffic channel allocation (30 subscribers per PCM channel)
◆ Standard interface for multiplexer
◆ 1 PCM channel
◆ Protocols:
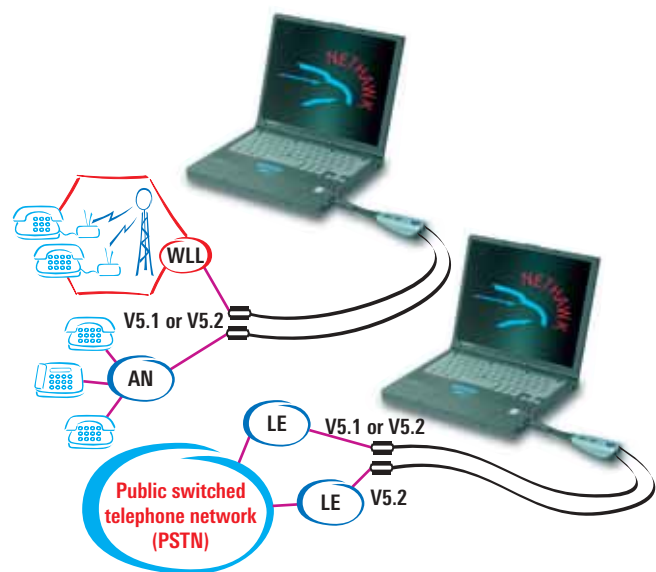 – References
  – LAPD
  – LAPV5-EF
  – LAPV5-DL
  – PSTN
  – Control

V5.2

◆ Dynamic traffic channel allocation
◆ Up to 16 PCM channels
◆ Applications with up to 1600 subscribers
◆ Same protocols as V5.1, plus:
  – BCC
  – Protection
  – Link control
  – ISDN
◆ V5.2 signalling, second edition

*Top: NetHawk™ V5 simulator, access network end; bottom: local exchange*

Fixed networks

ISDN and SS7 analyzers

SS7 analyzer

The SS7 analyzer is a PC-based protocol analyzer for monitoring and analyzing all the SS7 signalling protocols used by the fixed network. Its key features include:

◆ Supports several national ISUP and TUP protocols
◆ Analysis of up to 16 PCM timeslots
◆ SIGTRAN analysis over IP
◆ Camel 2+ and Camel 3 decoding
◆ Up to 16 PCM links simultaneously with four NAP cards
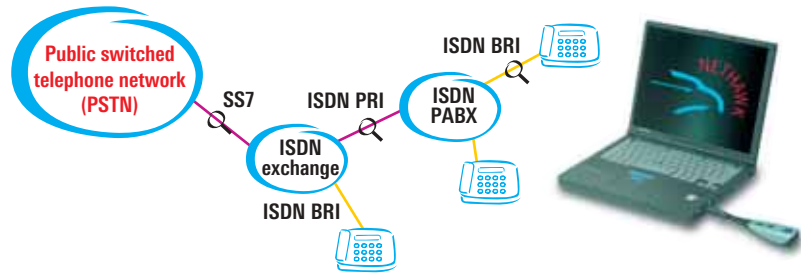
Applications of NetHawk™ ISDN and SS7 analyzers

ISDN PRI analyzer

The ISDN PRI analyzer with PC card is a protocol analyzer for monitoring and analysis at S_{2M} interfaces. Its key features include:

◆ Analysis of up to 16 PCM timeslots
◆ Supports ISDN supplementary services

Common features

◆ Windows-based GUI
◆ Extensive trap feature for setting filters and triggers
◆ Statistics counters for each layer, plus definition of counters for trigger events
◆ Data output in ASCII to file or printer (using the colours defined)
◆ Detailed, context-sensitive help in Windows help format for user interface and protocols

*Selection and definition of timeslots to be monitored on GSM analyzer*

Channel selection

Setup of connections

Setup facilities for the 16 timeslots which can be monitored with the PC or NAP card:

◆ Activation of monitoring functions
◆ Selection of timeslot
◆ Selection of bit rate
◆ Definition of subchannel
◆ Definition of PC card
◆ Protocol to be used
◆ Other parameters

Server
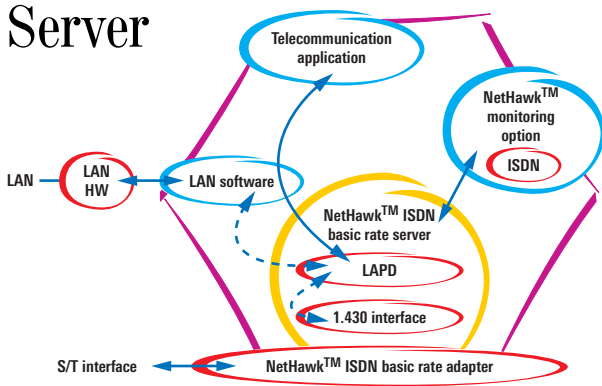
Basic structure of NetHawk™ server

Typical application of NetHawk™ GSM server
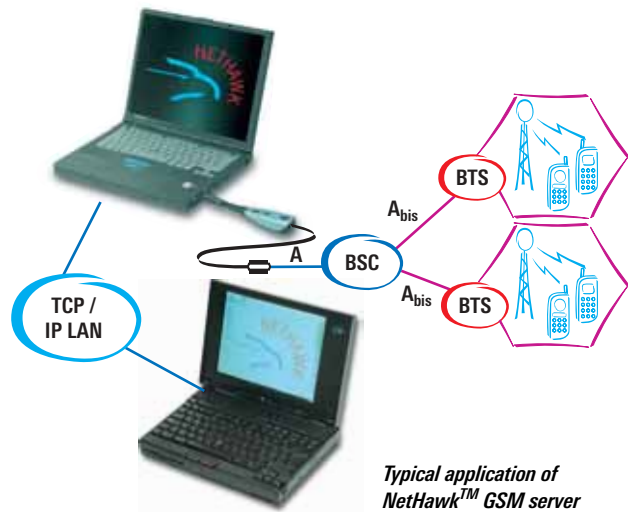
Characteristics

NetHawk™ servers allow the integration of PC programs into telecommunication systems via a flexible TCP/IP interface. In product development, they are reliable components of automatic test systems. They enable service providers to minimize the time to market of their PC-based telecommunication services because they allow the development of higher layers in effective workstation environments. Moreover, they can be used as stable link layer interfaces in telecommunication networks.

The frame relay server for GPRS is hyperchannel-compatible. It supports up to twelve 64 kbit/s links or a 1984 kbit/s link by allocating all timeslots except timeslot 0.

The SAAL server features an ATM/UNI interface based on STM-1 and can convert (SAR) user data into ATM cell streams and vice versa. An AMR coder provides voice coding for UMTS and prevents any transmission in silent periods.

The 3G server provides the lower protocol layers of the Iu, Iub and Iur interfaces. The server emulates SAAL and MTP3B. It comprises an AMR codec and supports soft handover. The server is the basis of large UMTS test systems with upper protocol layers provided by the user. The systems run on the same PC or externally over TCP/IP-API. The physical interfaces of common 3G cards are used.

Overview

Server	Max. number of channels	Max. number of timeslots	Max. number of logical links	Monitoring (option)
G703	4	12	12	V5, GSM, ISDN
MTP3/MTP3b	4/4VCI	4	4	GSM, SS7, SAAL
LAPD PRI	4	12	12	GSM, ISDN
LAPV 5	4	12	12	V5
Frame relay	4	31	12 LAPF	GSM, GPRS
SAAL/UNI	1 STM-1	14 links	22 AAL2	SSCOP/FP

The number of supported channels can be doubled using a second plug-in card

Trigger selection

Traps

Traps are used to define triggers which initiate a defined action on a defined event. An event can be a value or a protocol parameter. When a particular event occurs, the associated action, chosen from a list of more than 30 actions, will be performed.
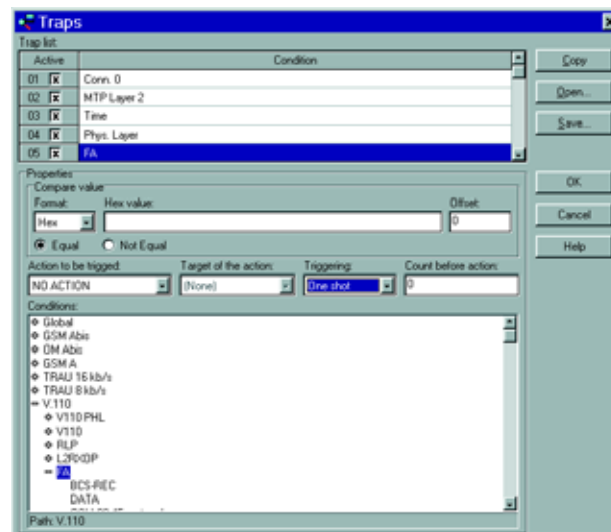

Definition of traps on GSM analyzer

Protocol analysis and simulation with NetHawk™

GSM
BTS A_{bis} BSC
G_b SGSN

GPRS Internet
G_p G_i
GGSN

V5 Access WLL
AN
V5.2
LE V5.1
AN

HLR
EIR
VLR MAP MSC TRAU
A
G_s G_b
A
IWU IWU
SS7
PSTN SS7
SS7
SS7

WCDMA
BS Iub
RNC Iu Iu
Iur

WCDMA
BS Iub RNC
UMTS, 3G

ISDN PRI
ISDN PABX ISDN BR
ISDN exchange
ISDN BRI **ISDN**
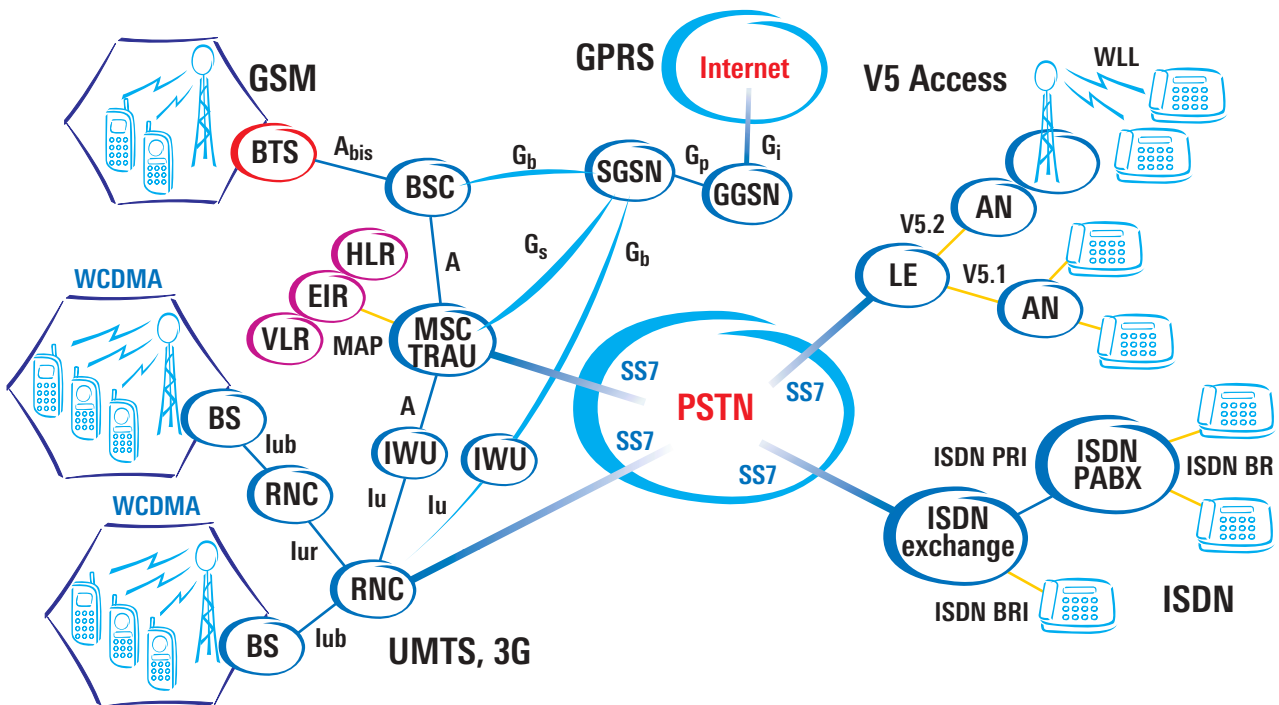
Long-standing experience in mobile radio measurements and radiocommunications

Rohde & Schwarz offers an unrivalled range of test instruments and systems for all international mobile radio standards: analog and digital, terrestrial and satellite; for base station and mobile phone producers, for network operators and specialized dealers.

Mobile radio test systems from Rohde & Schwarz ensure high production through-put and minimized production costs. Our type-approval systems are setting the pace worldwide: they verify that mobile phones comply with all relevant standards.

The **NetHawk™ products** enhance the RF GSM test systems from Rohde & Schwarz on the wired end by providing detailed protocol analysis and simulation of the A, A_{bis} and also of the GPRS and UMTS interfaces to the fixed network. Systems for comprehensive final testing of base stations are supplied on this basis. The high acceptance of NetHawk™ is based on the early availability of this measurement and simulation tool. New technologies like GPRS/EDGE and UMTS require flexible measuring equipment such as NetHawk™ to comply with the latest requirements of the 3GPP standard in development and production.

Certified Environmental System
ISO 14001
REG. NO 1954

Certified Quality System
ISO 9001
DQS REG. NO 1954

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