



- ✓ real-time, 24/7 network monitoring, data processing and analysis
- ✓ easy-to-use WEB-based user interface; short learning curve
- ✓ high scalable due to distributed and modular design; system grows with the network expansion!
- ✓ custom made, high performance, smart TAP devices
- ✓ very cost-efficient solution; simple licensing mechanism with no hidden costs of ownership
- ✓ open architecture

# NetScan network monitoring system

## System description

NetScan monitoring system enables real-time monitoring of all signalling messages transported over selected interfaces of the Mobile Telecommunication Network (PLMN). Monitored messages are captured, decoded, analysed and correlated with other messages at the various levels of signalling transactions. In addition, system generates a rich set of statistics based directly on these messages from all the completed transactions.

## Key features

- ✓ Complete network monitored with just one system.
- ✓ Information-correlation between all monitored interfaces.
- ✓ Shared-RAN and MOCN support.
- ✓ Reach set of predefined KPI's statistics available.
- ✓ Detailed analysis of any radio-related problems.
- ✓ Drill-down approach for root cause analysis.
- ✓ Correlation between statistics and related transactions

## System architecture

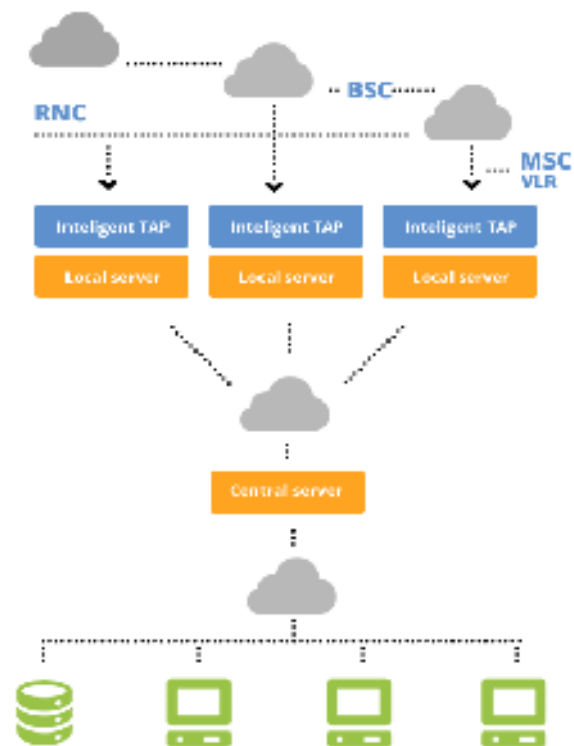
NetScan monitoring system is based on a highly-distributed architecture to cope with high load and to provide high scalability.

Custom-made Smart TAP devices intercept IP traffic, filter it and distribute into dedicated local servers. In case of UP processing – they also perform load balancing.

Local servers process only selected data and then do the additional filtering, decoding and correlation at the level of sessions and transactions. Already processed and indexed messages are stored on local servers for easy and fast access.

Local servers maintain also low-level statistic counters used for higher-level KPI's calculation. KPI's are aggregated over various time-, geo- and infrastructure dimensions. Information about sessions, transactions and counters are stored into local databases.

Multi-interface correlation is supported, including inter-BSC and system HO's. If a given transaction need to be monitored by more than one local server, a central server is involved for assistance.



## Intelligent IP TAP and data processing

Netscan monitoring system is based on very efficient smart IP TAP devices. These elements were developed based on our specific requirements and are manufactured by our partner DGT Poland.

IP-TAP devices filter, groom and distribute traffic into dedicated local server or servers. It is equipped with large number of network monitoring and data transfer interfaces as well as with hardware DPI (Deep Packet Inspection) technology. Low footprint (just 1U with all splitters build-in) simplify system deployment.



### Smart TAP 1 GbE version:

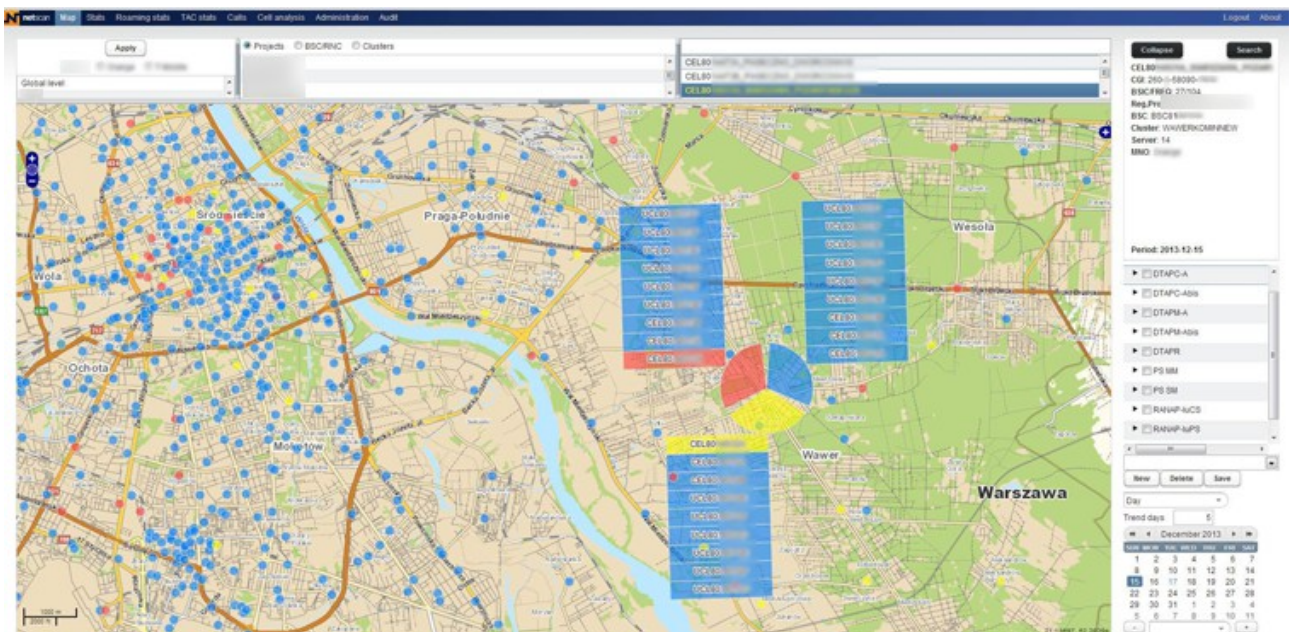
- ✓ 40 inputs 1 GbE optical (splitter 80/20, 20 pairs)
- ✓ 5 outputs (1 x 1 GbE copper, 4 x 10/1 GbE)
- ✓ HW/SW filter
- ✓ Power 48 V DC
- ✓ Size: 1U (E2000) or 1,5 U (SC)
- ✓ 10/40 GbE under development

Captured PDU's are streamed transparently into a file to guarantee lossless data acquisition and buffer peaks of traffic. PDU's from recorded streams are processed, correlated into transactions at various levels and indexed. Records and statistics are stored into a local DB while processed PDU's are kept in indexed files. This ensures quick access to data and short searching time.

NetScan system can interwork with external databases and systems to either feed them with necessary data, or to synchronize information related to network topology, for example.

## User-friendly interface

NetScan monitoring system provides access to user through WEB-based graphical user interface. Therefore – all system user needs to access NetScan GUI is a WEB browser. GUI is highly intuitive and truly easy-to-use. Yet, it provides an essential level of security.



Information available for a given user depends on particular access rights. Access-policy is controlled by a system administrator and allows for geographical- and (in case of SRAN/MOCN) MNO- data isolation. Complete end-user activity is logged and can be audited. Audit data also includes all potentially sensitive data used, for example, for search operations (like IMSI, MSISDN etc.). Such functionality helps to detect potential frauds or misuse of the system.

## Network status indication

The Network-status Screen displays status of KPI's with colours marking violation of defined thresholds.

All elements on screen are active – with a single mouse-click one can see statistical details, detailed cell analysis or related signalling transactions (calls, sessions)



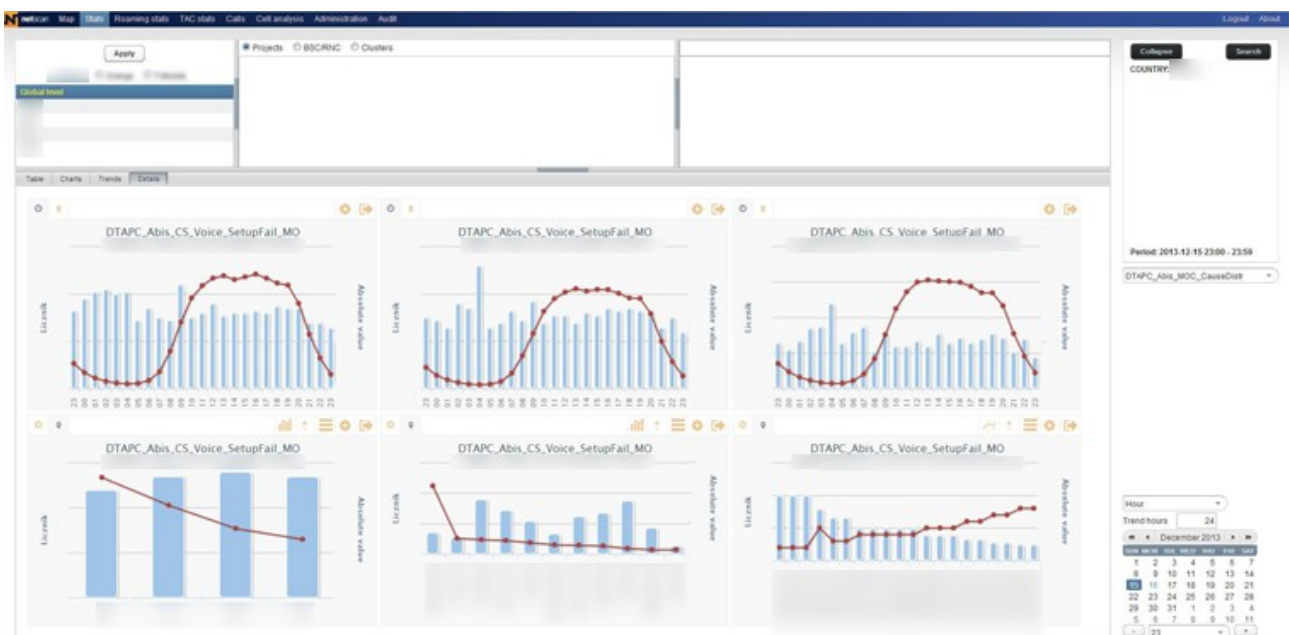
## Statistics

NetScan provides rich set of KPI's and counters for analysis of the network status and service quality. KPI's and counter are provided for a specified period of time and specified geographical and infrastructural aggregation, in hourly or daily aggregations. Other periods can be added on demand. Results are presented as minimum, average and maximum value.

User can use a drill-down functionality to narrow observed time- or geo- context. Starting from a multiple statistic view in one table user and drill down into:

- ✓ graphical visualisation of many statistics in common geo- and time context
- ✓ graphical visualisation of a single statistic in many geo- and time contexts

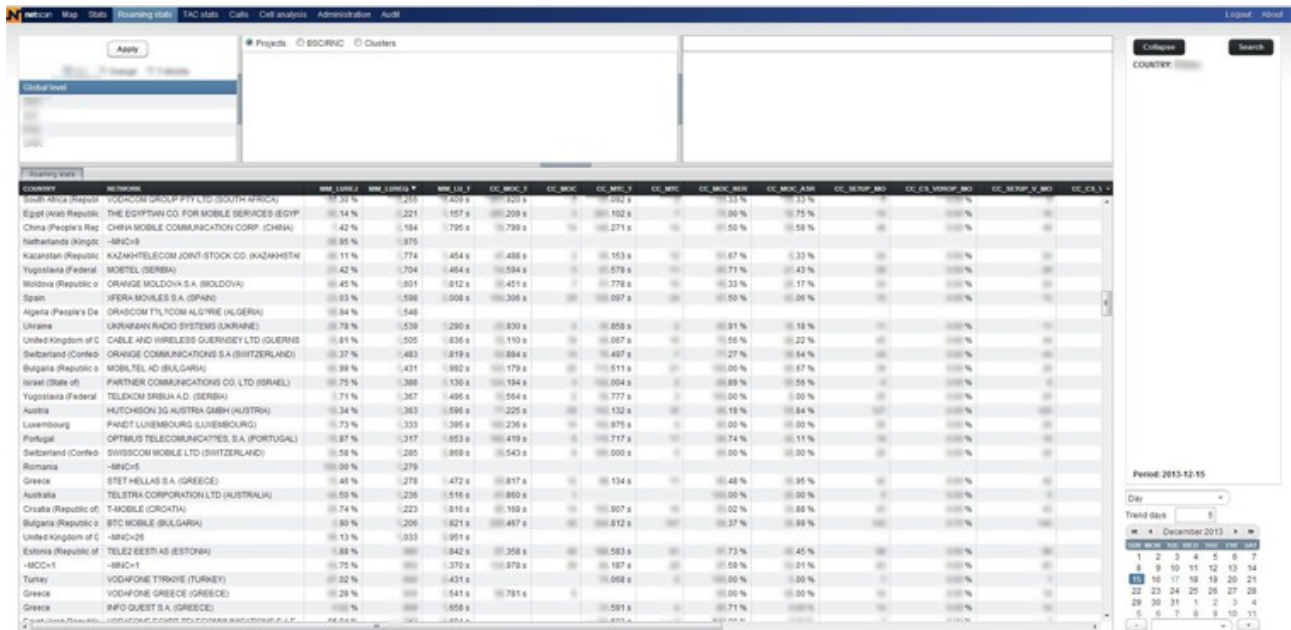
At statistic level user can individually select warning/error thresholds for each statistics. If those thresholds are violated – respective statistic graph will be marked on yellow/red colour.



## Roaming and Handset statistics

NetScan provides statistics for roaming- and handset-related analysis:

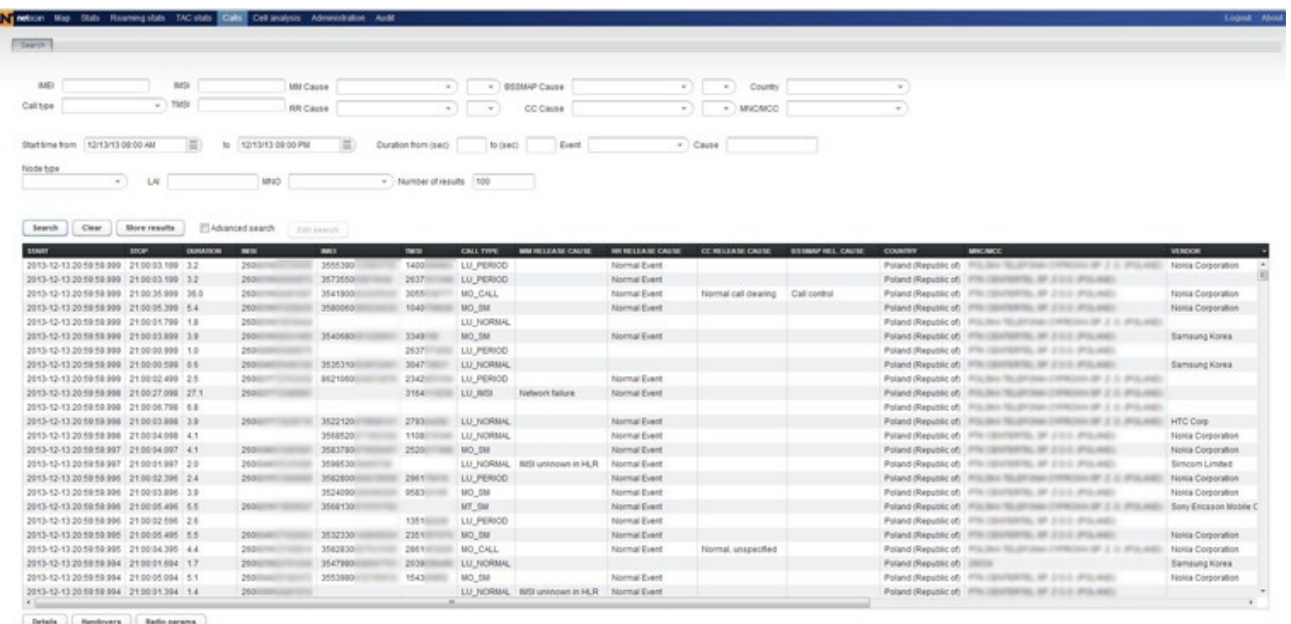
- ✓ roaming statistics are calculated per each Home Network of the mobile user and can be narrowed into specific area of monitored network or particular BSC/RNC,
- ✓ handset statistics are calculated per terminal model and vendor based on IMEI-TAC



Country	Operator	MM_LIM1_U	MM_LIM1_S	MM_LU_U	CC_MNC_U	CC_MNC_S	CC_MNC_T	CC_MNC_B	CC_MNC_A	CC_MNC_M	CC_MNC_N	CC_MNC_W	CC_MNC_Z	CC_MNC_X	CC_MNC_Y	CC_MNC_V	CC_MNC_U	CC_MNC_I
South Africa	VODAFONE GROUP PTY LTD (SOUTH AFRICA)	0.30 %	1453	443 s	00203	00203	00203	00203	00203	00203	00203	00203	00203	00203	00203	00203	00203	00203
Egypt (Arab Republic of)	THE EGYPTIAN CO. FOR MOBILE SERVICES (EGYPT)	0.14 %	221	157 s	00209	00209	00209	00209	00209	00209	00209	00209	00209	00209	00209	00209	00209	00209
China (People's Republic of)	CHINA MOBILE COMMUNICATION CORP. (CHINA)	0.42 %	154	795 s	00299	00299	00299	00299	00299	00299	00299	00299	00299	00299	00299	00299	00299	00299
Netherlands (Kingdom of)	-MNC-5	0.95 %	075															
Kazakhstan (Republic of)	KAZAKHTELECOM JOINT-STOCK CO. (KAZAKHSTAN)	0.11 %	774	454 s	00488	00488	00488	00488	00488	00488	00488	00488	00488	00488	00488	00488	00488	00488
Yugoslavia (Federal Republic of)	MOBTEL (SERBIA)	0.42 %	704	454 s	00584	00584	00584	00584	00584	00584	00584	00584	00584	00584	00584	00584	00584	00584
Moldova (Republic of)	ORANGE MOLDOVA S.A. (MOLDOVA)	0.45 %	501	812 s	00451	00451	00451	00451	00451	00451	00451	00451	00451	00451	00451	00451	00451	00451
Spain	SPAIN MOBILE S.A. (SPAIN)	0.23 %	588	008 s	00306	00306	00306	00306	00306	00306	00306	00306	00306	00306	00306	00306	00306	00306
Algeria (People's Democratic Republic of)	ORANGCOM TUNISIA ALGERIA (ALGERIA)	0.34 %	548															
Ukraine	UKRAINIAN RADIO SYSTEMS (UKRAINE)	0.78 %	539	290 s	00330	00330	00330	00330	00330	00330	00330	00330	00330	00330	00330	00330	00330	00330
United Kingdom of Great Britain and Northern Ireland	CABLE AND WIRELESS GUERNSEY LTD (GUERNSEY)	0.81 %	505	836 s	00110	00110	00110	00110	00110	00110	00110	00110	00110	00110	00110	00110	00110	00110
Switzerland (Confederation of)	ORANGE COMMUNICATIONS S.A. (SWITZERLAND)	0.37 %	483	819 s	00884	00884	00884	00884	00884	00884	00884	00884	00884	00884	00884	00884	00884	00884
Bulgaria (Republic of)	MOBILTEL AD (BULGARIA)	0.89 %	431	962 s	00179	00179	00179	00179	00179	00179	00179	00179	00179	00179	00179	00179	00179	00179
Israel (State of)	PARTNER COMMUNICATIONS CO. LTD (ISRAEL)	0.75 %	380	130 s	00184	00184	00184	00184	00184	00184	00184	00184	00184	00184	00184	00184	00184	00184
Yugoslavia (Federal Republic of)	TELEKOM SRBIJA A.D. (SERBIA)	0.71 %	367	496 s	00564	00564	00564	00564	00564	00564	00564	00564	00564	00564	00564	00564	00564	00564
Austria	MUTSCHBACH & CO. (AUSTRIA)	0.34 %	383	596 s	00255	00255	00255	00255	00255	00255	00255	00255	00255	00255	00255	00255	00255	00255
Luxembourg	FINET LUXEMBOURG (LUXEMBOURG)	0.73 %	333	389 s	00236	00236	00236	00236	00236	00236	00236	00236	00236	00236	00236	00236	00236	00236
Portugal	OPTIMUS TELECOMUNICACOES S.A. (PORTUGAL)	0.87 %	317	853 s	00419	00419	00419	00419	00419	00419	00419	00419	00419	00419	00419	00419	00419	00419
Switzerland (Confederation of)	SWISSCOM MOBILE LTD (SWITZERLAND)	0.58 %	285	809 s	00543	00543	00543	00543	00543	00543	00543	00543	00543	00543	00543	00543	00543	00543
Romania	-MNC-5	0.00 %	279															
Greece	ETE HELLAS S.A. (GREECE)	0.46 %	278	472 s	0017	0017	0017	0017	0017	0017	0017	0017	0017	0017	0017	0017	0017	0017
Australia	TELSTRA CORPORATION LTD (AUSTRALIA)	0.50 %	235	516 s	00800	00800	00800	00800	00800	00800	00800	00800	00800	00800	00800	00800	00800	00800
Croatia (Republic of)	T-2000 (CROATIA)	0.74 %	223	816 s	00188	00188	00188	00188	00188	00188	00188	00188	00188	00188	00188	00188	00188	00188
Bulgaria (Republic of)	ETC MOBILE (BULGARIA)	0.90 %	206	821 s	00487	00487	00487	00487	00487	00487	00487	00487	00487	00487	00487	00487	00487	00487
United Kingdom of Great Britain and Northern Ireland	-MNC-3	0.13 %	133	993 s														
Estonia (Republic of)	TELE2 EESTI AS (ESTONIA)	0.80 %	98	242 s	00358	00358	00358	00358	00358	00358	00358	00358	00358	00358	00358	00358	00358	00358
Turkey	-MNC-1	0.75 %	88	379 s	00187	00187	00187	00187	00187	00187	00187	00187	00187	00187	00187	00187	00187	00187
Turkey	VODAFONE TURKEY (TURKEY)	0.82 %	88	431 s	008	008	008	008	008	008	008	008	008	008	008	008	008	008
Greece	VODAFONE GREECE (GREECE)	0.28 %	88	541 s	00781	00781	00781	00781	00781	00781	00781	00781	00781	00781	00781	00781	00781	00781
Greece	INFO QUEST S.A. (GREECE)	0.06 %	88	658 s	00581	00581	00581	00581	00581	00581	00581	00581	00581	00581	00581	00581	00581	00581

## Call trace

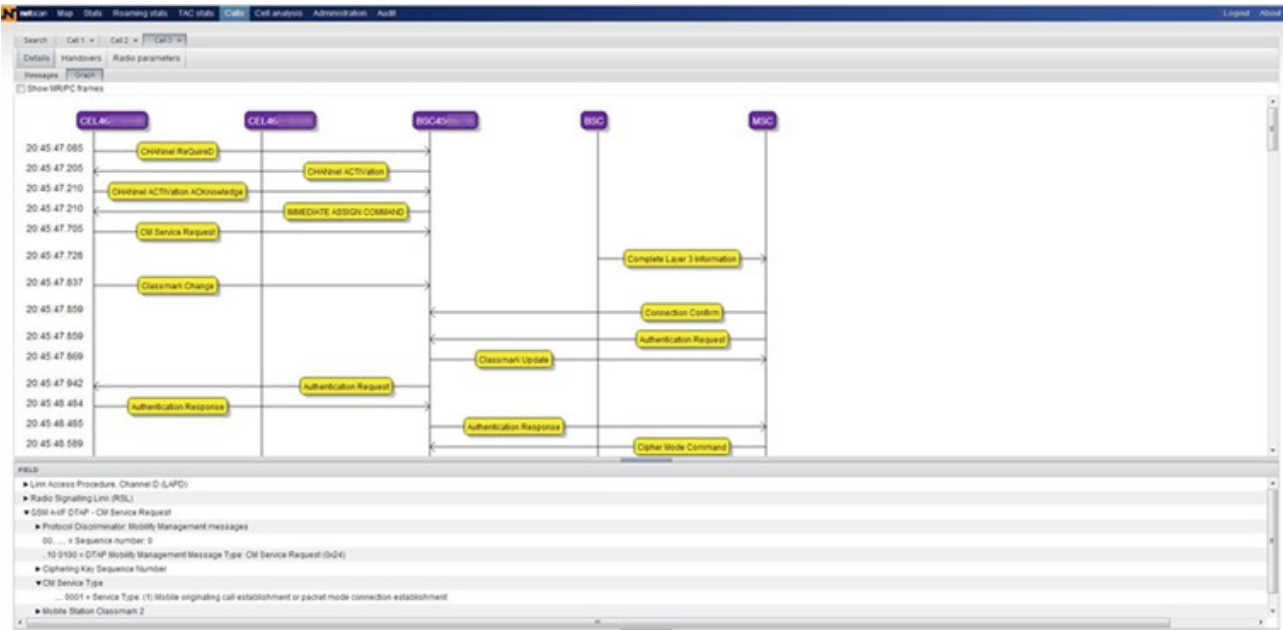
NetScan monitoring system offers call & transaction tracing with in-depth drill-down analysis functionality. User can search for a specific call based on various criteria, using advanced search tools and select it for detailed analysis.



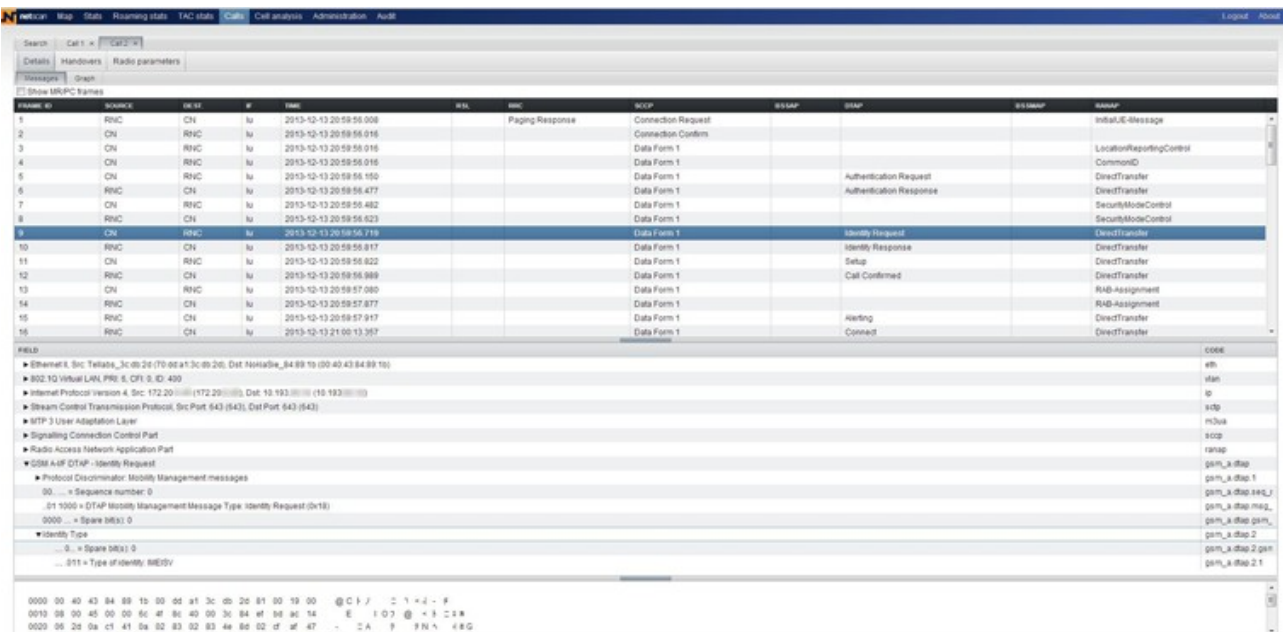
Search filters: IMEI, IMSI, IMI Cause, BSSMAP Cause, Country, Call type, TMSI, RR Cause, CC Cause, MNC/MCC, Start time, Duration from (sec), Event, Cause.

Time	IMSI	IMSI Cause	IMSI	IMI	IMI Cause	IMI Cause	BSSMAP Cause	Country	MNC/MCC	Vendor
2013-12-13 20:58:59	21003199	3.2	250	355330	1400	LU_PERIOD	Normal Event	Poland (Republic of)	00203	Nokia Corporation
2013-12-13 20:58:59	21003199	3.2	250	357350	2637	LU_PERIOD	Normal Event	Poland (Republic of)	00203	Nokia Corporation
2013-12-13 20:58:59	21003199	36.0	250	354190	3055	MO_CALL	Normal Event	Poland (Republic of)	00203	Nokia Corporation
2013-12-13 20:58:59	21003539	5.4	250	358060	1040	MO_SM	Normal Event	Poland (Republic of)	00203	Nokia Corporation
2013-12-13 20:58:59	21003179	1.8	250			LU_NORMAL	Normal Event	Poland (Republic of)	00203	Nokia Corporation
2013-12-13 20:58:59	21003199	3.8	250	354580	3349	MO_SM	Normal Event	Poland (Republic of)	00203	Nokia Corporation
2013-12-13 20:58:59	21003199	1.8	250			LU_PERIOD	Normal Event	Poland (Republic of)	00203	Samsung Korea
2013-12-13 20:58:59	21003559	5.6	250	353570	3047	LU_NORMAL	Normal Event	Poland (Republic of)	00203	Samsung Korea
2013-12-13 20:58:59	21002149	2.6	250	882180	2342	LU_PERIOD	Normal Event	Poland (Republic of)	00203	Nokia Corporation
2013-12-13 20:58:59	21002798	27.1	250			LU_RRS	Network failure	Poland (Republic of)	00203	Nokia Corporation
2013-12-13 20:58:59	21003678	6.8	250				Normal Event	Poland (Republic of)	00203	Nokia Corporation
2013-12-13 20:58:59	21003888	3.8	250	352210	2793	LU_NORMAL	Normal Event	Poland (Republic of)	00203	HTC Corp
2013-12-13 20:58:59	21003498	4.1	250	356820	1108	LU_NORMAL	Normal Event	Poland (Republic of)	00203	Nokia Corporation
2013-12-13 20:58:59	21003497	4.1	250	353790	2520	MO_SM	Normal Event	Poland (Republic of)	00203	Nokia Corporation
2013-12-13 20:58:59	21003197	3.8	250	356830		LU_NORMAL	Normal Event	Poland (Republic of)	00203	Nokia Corporation
2013-12-13 20:58:59	21003236	2.4	250	358280	2941	LU_PERIOD	Normal Event	Poland (Republic of)	00203	Nokia Corporation
2013-12-13 20:58:59	21003306	3.8	250	352490	9583	MO_SM	Normal Event	Poland (Republic of)	00203	Nokia Corporation
2013-12-13 20:58:59	21003495	4.5	250	356810		MT_SM	Normal Event	Poland (Republic of)	00203	Sony Ericsson Mobile C
2013-12-13 20:58:59	21003258	2.6	250			LU_PERIOD	Normal Event	Poland (Republic of)	00203	Nokia Corporation
2013-12-13 20:58:59	21003495	5.5	250	353230	2351	MO_SM	Normal Event	Poland (Republic of)	00203	Nokia Corporation
2013-12-13 20:58:59	21003439	4.4	250	358280	2861	MO_CALL	Normal Event	Poland (Republic of)	00203	Nokia Corporation
2013-12-13 20:58:59	21003184	1.7	250	354780	2039	LU_NORMAL	Normal Event	Poland (Republic of)	00203	Samsung Korea
2013-12-13 20:58:59	21003594	5.1	250	355380	1543	MO_SM	Normal Event	Poland (Republic of)	00203	Nokia Corporation
2013-12-13 20:58:59	21003139	1.4	250			LU_NORMAL	Normal Event	Poland (Republic of)	00203	Nokia Corporation

Selected calls can be easily viewed both in tabular and graphical format.



All messages are fully decoded up to the field level. In addition – messages are also shown in raw (hex) format.



Frame ID	Device	Dir	Time	Msg	Msg	Msg	Msg	Msg	Msg	Msg	Msg
1	RNC	CN	2013-12-13 20:58:008		Paging Response						Initial UE-message
2	CN	RNC	2013-12-13 20:58:016								LocationReportingControl
3	CN	RNC	2013-12-13 20:58:016								CommonID
4	CN	RNC	2013-12-13 20:58:016								SecurityModeControl
5	RNC	CN	2013-12-13 20:58:150								DirectTransfer
6	RNC	CN	2013-12-13 20:58:477								DirectTransfer
7	CN	RNC	2013-12-13 20:58:482								SecurityModeControl
8	RNC	CN	2013-12-13 20:58:623								SecurityModeControl
9	CN	RNC	2013-12-13 20:58:717								DirectTransfer
10	RNC	CN	2013-12-13 20:58:817								DirectTransfer
11	CN	RNC	2013-12-13 20:58:822								DirectTransfer
12	RNC	CN	2013-12-13 20:58:989								DirectTransfer
13	CN	RNC	2013-12-13 20:58:7080								RAB-Assignment
14	RNC	CN	2013-12-13 20:58:7877								RAB-Assignment
15	RNC	CN	2013-12-13 20:58:917								DirectTransfer
16	RNC	CN	2013-12-13 21:00:13:387								DirectTransfer

Calls can be traced based on:

- ✓ localization (network area → BSC/RNC → cell)
- ✓ handset or user identity (IMEI, IMSI, TMSI, MSISDN)

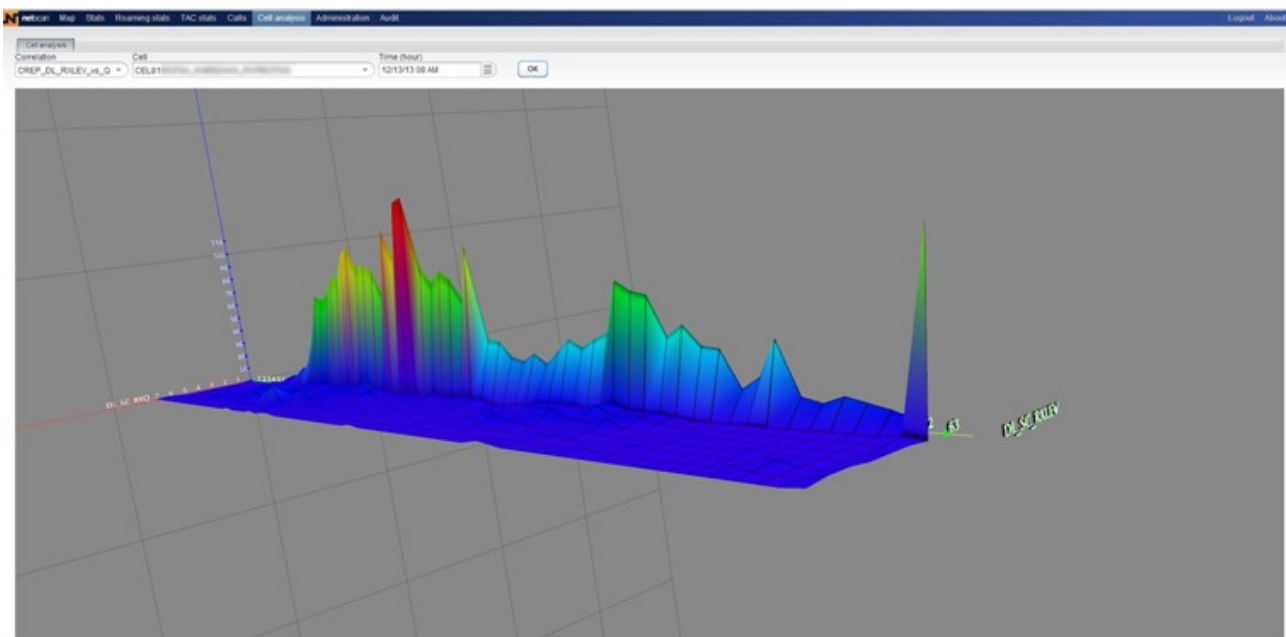
- ✓ transaction-specific parameters (termination cause, type of transaction, etc.)
- ✓ events – such as an unsuccessful HO.

In addition to message-based call analysis, a parameter-based view is provided. On the example below, parameters from MR (measurements report) messages and all important RAN events are visualized. Measurements are correlated with particular cells.



## Advanced 3D graphical visualisation

Three-dimensional graphs allow for simplified analysis of advanced problems.

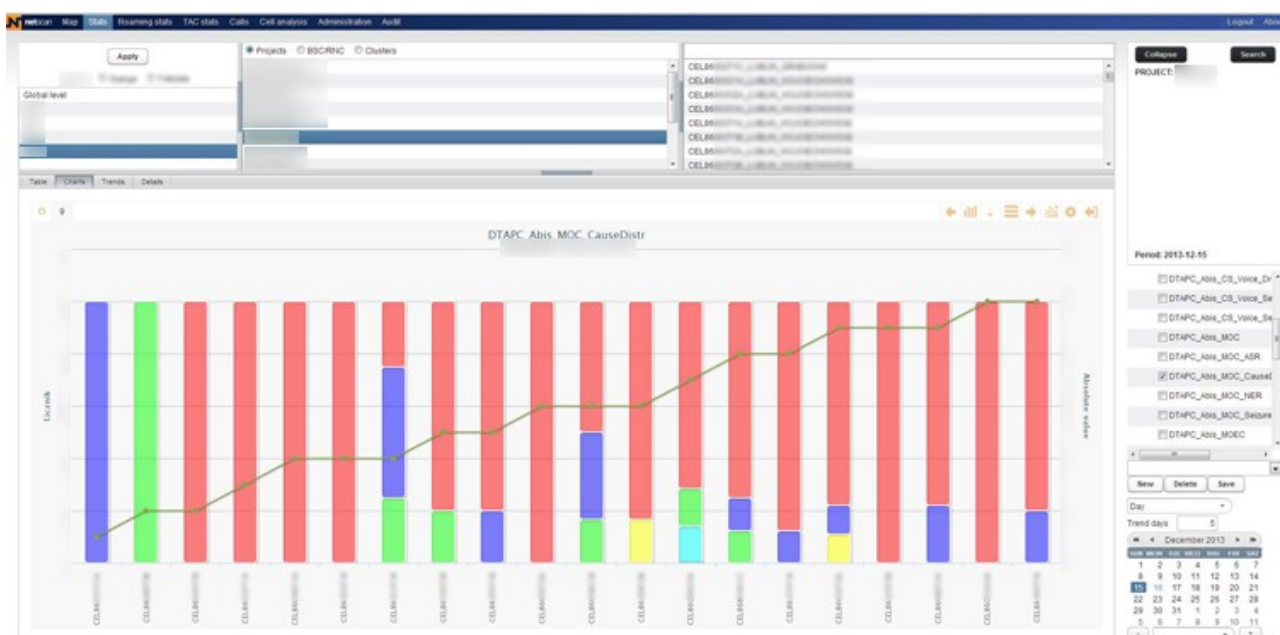


As an example, NetScan provides analysis of cell radio conditions. A single graph shows the correlation between various parameters, such as reported UL or DL quality and timing advance (i.e. distance).

## Data export

NetScan monitoring system can export collected data into external systems. Both statistical information and event- or transaction- based information can be exported.


Communication with external system can be configured based with on-demand push or pull mechanism, or alternatively, real-time streaming. Format of external data can be modified for hassle-less integration.



## Our team

Our team's expertise in mobile network technology and state-of-the-art IT solutions also cooperates with various R&D teams to ensure advanced analytical applications in the overall system. NetScan monitoring system is fully developed in Poland.

## Contact us

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