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an Aubay product

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# Service Assurance

## Mobile services: a competitive advantage, if quality and reliability are guaranteed

Switching their strategic focus from customer acquisition to revenue and margin development, telecommunication operators in highly competitive mature markets are pressed to develop new services to retain their customer base while increasing revenue. Innovative offerings such as video and file sharing, video conferences and message services, integrated communication and other mobile office functionalities for business users have emerged.

At the same time a strong monitoring process for operational cost control and compression is mandatory.

In such a scenario, Quality of Service (QoS) management has become mission-critical for network operations that must meet stringent QoS targets and Service Level Agreements (SLAs) on an ever-expanding portfolio of services.

Quality of Service is a consolidated indicator that is closely related to customer preferences, particularly in the business segment.

Automatic E2E testing can play an integral role in overcoming this challenge, being powerful to handle complex services scenarios while at the same time agile enough to adapt rapidly to new services offerings.

ANTS is a proven solution enabling Telecom Operators to implement agile and industrial operations to verify Service Quality via End-to-End testing enriched with CDRs, Logs and Counters analysis and verification.

A huge amount of raw data are gathered providing a real and fully integrated view of information mined from various sources and the capability to analyze those information from different perspectives:

**Quality of Service:** CDRs, XDRs Logs and Counters in combination with E2E tests are a rich data source to evaluate the offered QoS to the complete customer base. Using the information extracted from this data, the solution provides analysis on Usage, Performance and Faults with reference to reasons and explored by Network Elements and over the time.

**Usage Analysis:** extraction of statistics on network usage, failures based on network element topology. Mobile types usage reports for strategic marketing decisions. Peak/off peak traffic analysis with critical path identification.

**Fraud Detection:** SIM Boxing/bypass, massive traffic generation.

**The solution is based on a unique integrated environment of Business Intelligence and Big Data, allowing the users to autonomously create reports, analysis and dashboard.**

## ANTS UBIQUITOUS END-TO-END TESTING

The ANTS for Service Assurance End-to-End testing solution enables operators to verify the QoS delivered by their network and service infrastructure. Tests are available from pre-built libraries or designed by the Users with ANTS graphical Test Procedure Editor without needing knowledge of the infrastructure topology. With a few clicks, tests can be instantaneously run or scheduled for a later date, once or periodically, on a subset of network elements and user profiles. The scheduling and resource management engine then seamlessly coordinates the execution across the Remote Test Units (RTU) deployed throughout the network in all the needed locations.

All call destinations (inbound, outbound) and services including Voice, SMS, video, Web navigation, contents download/streaming and IVR/VAS are supported on home and roaming networks with all access technologies (GSM, GPRS, Edge, UMTS, 4G+, 5G and PSTN, ISDN, LAN, WiFi, etc.). New service testing is enabled by the Remote Test Units (RTU) including VoLTE, VoWifi, RCS and 5G networks reproducing customers' real-life use conditions.

Any user profile, postpaid and prepaid, including visitors in roaming areas, can be tested – simply choosing pre-defined SIM categories when planning a test. The centrally located SIM/USIMs will be virtually dispatched to the appropriate RTU when required.

## FROM MEASURES TO KEY PERFORMANCE INDICATORS

The test progress is displayed on an animated flow chart, including the measures collected (check points, counters, timers) and traces generated.

Standard and user-defined Key Performance/Quality Indicators (KPI/KQI) are evaluated on collected measures including Service Availability, Accessibility, Integrity, Retainability.

Alarms are raised when KPI/KQIs exceed specific preset thresholds.

Test results are also available offline for many different interactive analyses using ANTS BI dashboards to diagnose potential issues and produce reports that monitor the actual QoS performance against engagements towards customers, partners (e.g. roaming partners), or regulatory authorities.

Via the air interface, all Public Land Mobile Networks (PLMNs) accessible by the deployed RTUs can be tested, thereby supporting competitive benchmarking.

## AGILITY & INDUSTRIALIZATION

ANTS provides both agility and industrialization on the testing process.

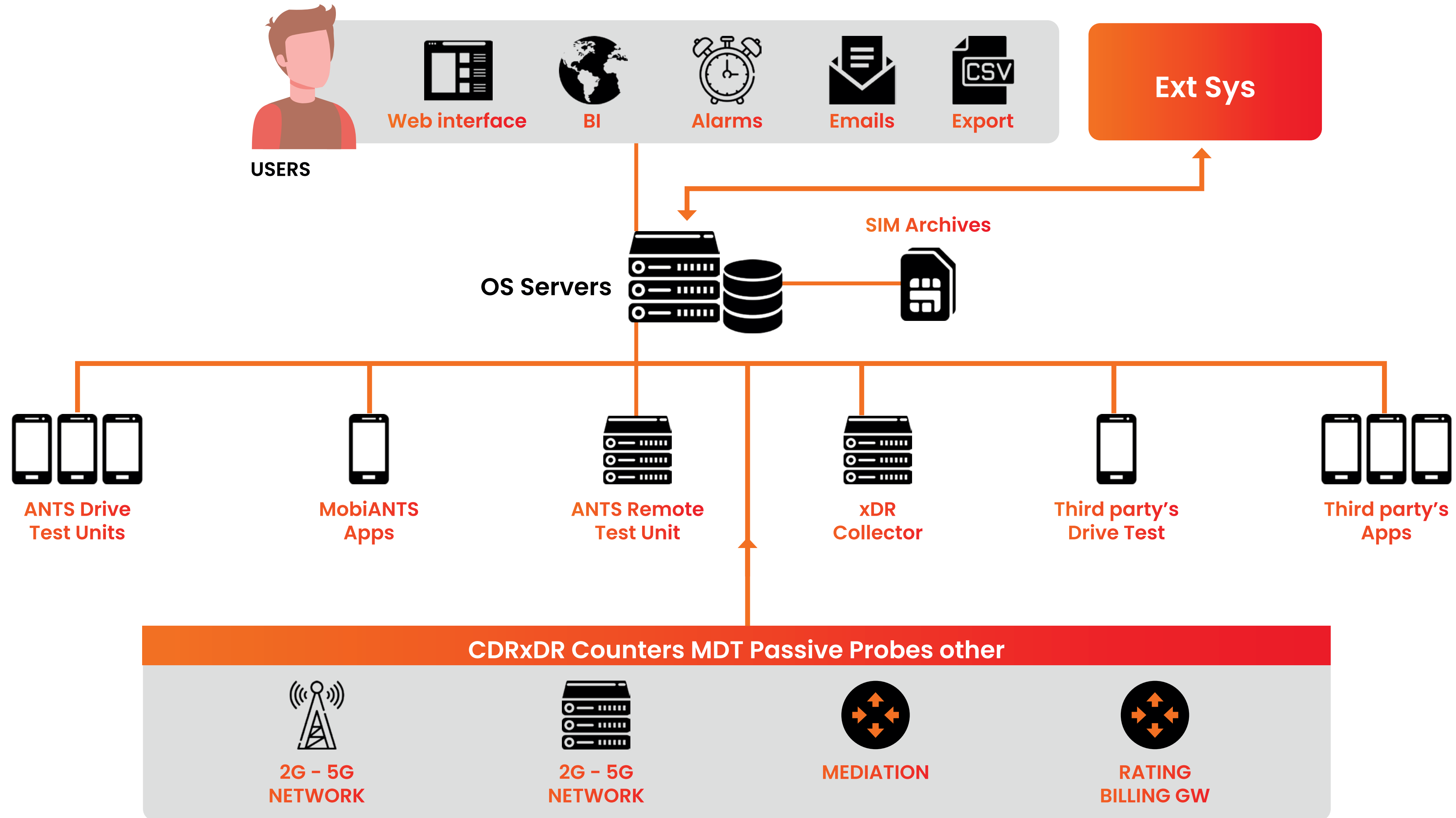
ANTS extensive process automation enables massive testing and real-time monitoring of QoS (24/7 Service Assurance). In addition, the test management repository module, combined with advanced user management, ensures capitalization and leverage of knowledge and expertise.

ANTS highly modular test design approach allows for creating new service tests on-the-fly, changing test SIM cards without interrupting the test process, launching ad-hoc tests instantaneously to accelerate a diagnostic, defining new KPI/KQIs, etc. ANTS supports users' day-to-day needs in a high speed business environment where a proactive service focus is key to survival.

Extraction of statistics on network usage, failures based on network element topology, mobile types usage reports are key for operation and strategic decisions. Peak/off peak traffic analysis with critical path identification efficiently enables network resource optimizations.

Through web-services ANTS can be easily integrated in a wider full automation process and, on the other way, ANTS can communicate and control any other external system or application.





# Drive Test

## Mobile services: support network transformation with optimization and benchmarking

ANTS DT is the Drive Test application of ANTS fully integrated with all other ANTS applications, available for optimization and benchmarking based on android smartphones.

The offer from Telecom Operators and Service Providers is today enriched with more and more services supported by the new available access technologies including 5G and FWA based on 5G.

At the same time a re-organization of radio spectrum and allocated bands is ongoing to optimize older technologies including 4G+, 3G and 2G.

In such a scenario, Quality of Service (QoS) management has become mission-critical for network operations that must meet stringent QoS targets and Service Level Agreements (SLAs) on an ever-expanding portfolio. Quality of Service is a consolidated indicator that is closely related to customer preferences, particularly in the business segment. Performance Monitoring, Drive Test and Benchmarking are essential activities in the overall Quality Assurance process.

ANTS Drive Test solution can play an integral role in overcoming this challenge, being powerful to handle complex services and access networks scenarios while at the same time agile enough to adapt rapidly to new services offerings.

ANTS DT is based on the MobiANTS App. Smartphones can be organized in units with up to 12 synchronized devices each. A tablet console is available to control the test campaigns. Just one click is needed to start or stop executions.

In addition each smartphone can be used as a stand-alone measurement tool with its own user interface. The measurements performed can be viewed directly on the smartphone as statistics, graphs or on geographical maps.



**The solution is based on a unique integrated environment including Geo ANTS post processing tool allowing the users to autonomously create reports, dashboards and go deep inside the collected measurements.**



## NETWORK OPTIMIZATION

The deployment of new 5G access and reorganization of other technologies like 4G+, 3G and 2G requires demanding network optimization and troubleshooting activities. To ensure high level quality of experience (QoE) and network performance, Drive Test tools need to off.



## BENCHMARKING WITH COMPETITORS

Benchmarking against the competition is an effective way of measuring the gap or the advantage that a mobile network service has in a specific area. Benchmarking can also be performed among different technologies. When improvements are necessary and Operators have to address specific investments, a reliable and qualified tool like ANTS DT is mandatory to properly address any action.





## NETWORK MONITORING

Continuous optimization is a relevant part of network activities, particularly in today's times when networks have dynamic configurations.

The network capacity has to continuously change due to an ever-growing traffic demand and on different locations, network elements are regularly updated and coverage is extended.

Continuous optimization can be seen as a cyclic process involving data collection and data analytics.

Using ANTS and ANTS DT, network performances and end-to-end services can be assessed and all the necessary data collected. The inputs are collected from various sources ranging from statistical counters generated in the network elements, to measurement data obtained during drive and walk tests.

Geo ANTS provides automatic data processing and analysis, resulting in accurate insights of the network. Based on these elements, corrections and network changes are proposed, decided and implemented.

## ANTS DT FEATURES

The tool, in a backpack version, can be used for Indoor & Outdoor measurements configured with 1x Tablet, 12x test terminals, 1x RF scanner with relative antennas, 1x GPS, internal battery pack. User will operate and control multiple devices through a single interface.

Simultaneous measurement of UE and Scanner is supported.

## FROM MEASUREMENTS TO ACTIONABLE PERFORMANCE INDICATORS

Test results are available offline for many different interactive analyses using Geo ANTS dashboards to diagnose potential issues and produce reports that monitor the actual QoS performance against engagements.





# Geo ANTS

## Mobile services: a competitive advantage in access network transformation

Geo ANTS is the Aubay designed application to support analysis and investigations from geo-referenced information for outdoor and indoor environments. Geo ANTS can collect data from ANTS DT, other drive test systems or Apps, MDT and network counters. Fully integrated with all other ANTS applications, supports optimization and benchmarking activities. Any other data source can be easily added.

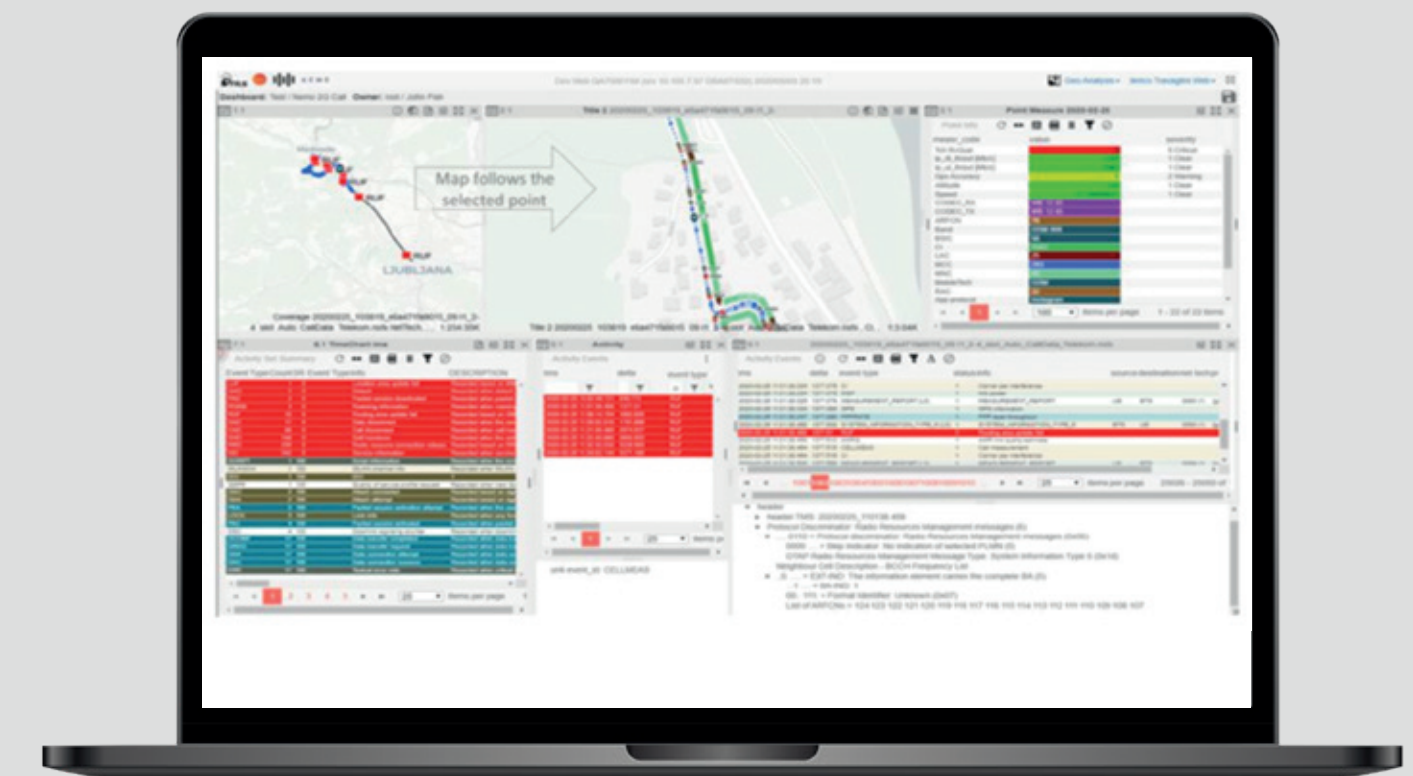
Today Network Operators deal with multiple technologies including now the 5G, different vendors and service layers within a unique mobile network. Engineering and Operation need a solution that can optimize both the network and the end-to-end subscriber experience. Geo ANTS analyzes, and optimizes RAN performance while at the same time troubleshoots issues and provides with a clear view of the subscriber experience thanks to its powerful network measurementbased analysis environment. Extensive analytics capabilities provide insights across devices, subscribers, and locations.

Geo ANTS supports in a unique full-web environment QoS/QoE analysis including voice calls with POLQA-MOS voice quality, OTT (YouTube, WhatsApp, ..), Ping, FTP, HTTP, iPerf. Geo ANTS offers support for all major wireless technologies, including 5G NR, NB-IoT, LTE-M, LTE-A CA, VoLTE/ViLTE, VoWiFi, and mMIMO in a real multi-user cooperative environment. Geo ANTS solution can play an integral role in overcoming this challenges, being powerful to handle complex services and access networks scenarios while at the same time agile enough to adapt rapidly to new services offerings.

GEO ANTS dashboard supports path analysis for optimization and benchmarking with synchronized views.



A rich set of views include log and trace files investigations down to single message decoding.

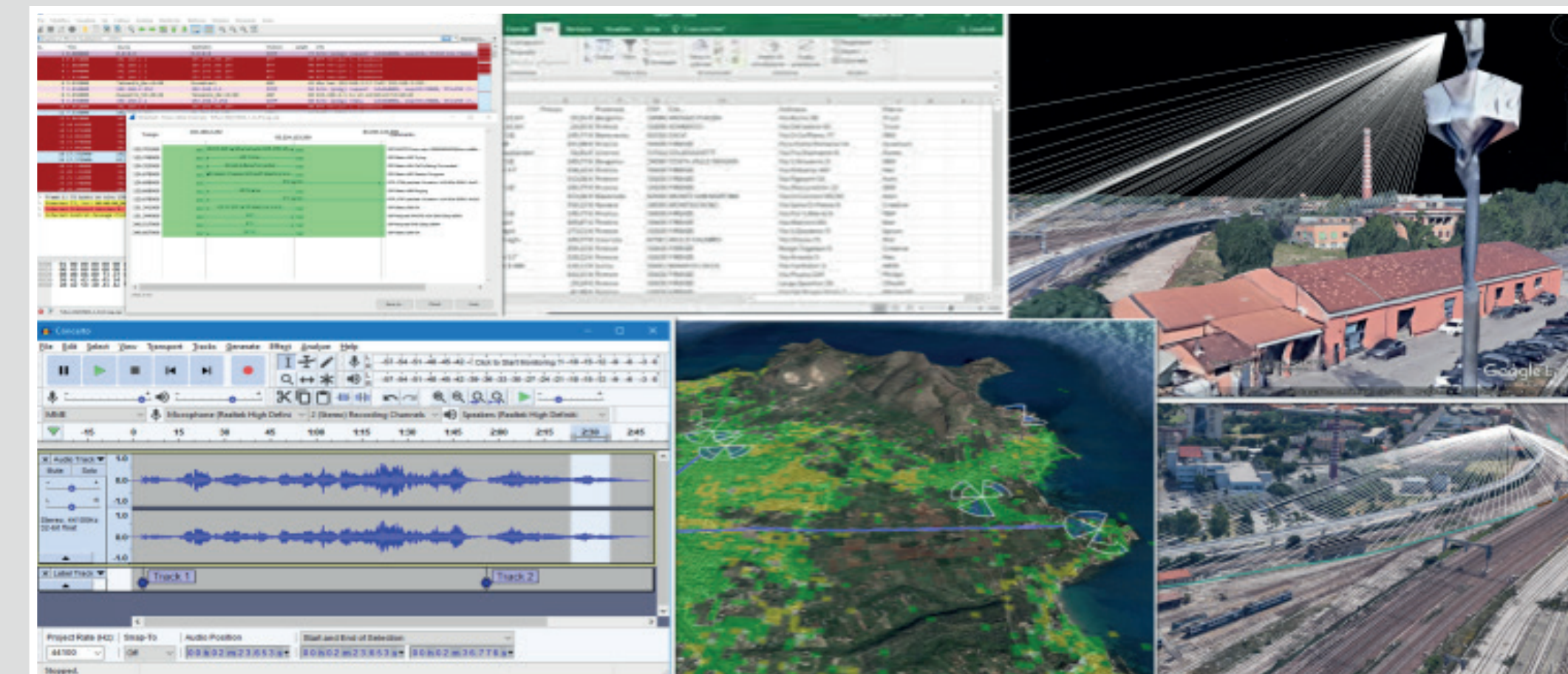




## NETWORK OPTIMIZATION

The deployment of new 5G access and reorganization of other technologies like 4G+, 3G and 2G requires demanding network optimization and troubleshooting activities. To ensure high level quality of experience (QoE) and network performance, Analysis tools need to offer reliable data collection and extensive drill-down capabilities.

5G NR beams can be visualized on a 3D map to detect the attenuation of buildings and trees on the signal level and to evaluate beam width and coverage in real environment.



## BENCHMARKING WITH COMPETITORS

Benchmarking against the competition is an effective way of measuring the gap or the advantage that a mobile network service has in a specific area. Benchmarking can also be performed among different technologies.

Geo ANTS benchmarking feature provides recommendations to improve performances and compares the network against local or global references.

## NETWORK MONITORING

Continuous optimization is a relevant part of network activities, particularly in today's times when networks have dynamic configurations.

The network capacity has to continuously change due to an ever-growing traffic demand and on different locations, network elements are regularly updated and coverage is extended. Continuous optimization can be seen as a cyclic process involving data collection and data analytics.

**Geo ANTS provides automatic data processing and analysis, resulting in accurate insights of the network. Based on these elements, corrections and network changes are proposed, decided and implemented.**



# GEO ANTS FEATURES

- Full-web application with no need for local component installation. Storage and computation resources are shared on server side. Platform can therefore be accessed from window, MAC, Linux, PC, Smartphones and can be translated into different languages (a feature of google chrome for suited web application).
- Fleet management to monitor and control agent testing activities and fw updates. It allows to centrally schedule test plans on group of agents. Users can add new tests to the library using a flow chart visual editor.
- Fully based on open source: GeoANTS adopts best in class open source technology (postgis, geoserver, angular, ELK..).

- Antenna and cell import, including coverage area, primary secondary cell, planned power. Cell includes height, tilt and other elements for 3D rendering. Planned coverage area are compared to data gathers from the MobiANTS agents. Cell historical data are kept to analyze measure with the time related cell context.
- GeoANTS adopts modern product life cycle CI/CD enabling continuous development continuous delivery (docker, kubernets...), shortening time to satisfy enhancement request from our customer base.
- Available both on premises and as a service on Cloud. Architecture are horizontally scalable.

- Supports a comprehensive set of Uses Cases being continuously enhanced. Predefined and user-defined Use cases are built on top of a reach set of analysis and visualization components and MobiANTS devices ranging from app for unrooted smartphones to rooted mobile and dedicated boxes for trains AV, industrial sites.
- User management to assign different functional profiles and to organize them into a group hierarchy to limit data visibility and allow usage from different departments.
- SLA management to colors (from very bad to excellent areas). Same data can be analysed applying different SLA.

- Integrates different source of measures e.g. MobiANTS, fixed probes, cell, antenna, coverage map, MDT, Network Counters, crowd data from third party. The use of standard interfaces simplifies data source integration (e.g. OGC for external GIS, REST, json).
- Cluster Area Set to aggregate KPIs geographically, for example to get specific analysis for each train stations, airports, tunnels, urban rural area, highways, benchmark RAT vendors.
- Open REST API to integrate with external systems.

# Global Roaming Assurance

## Assuring quality of service for roaming customers

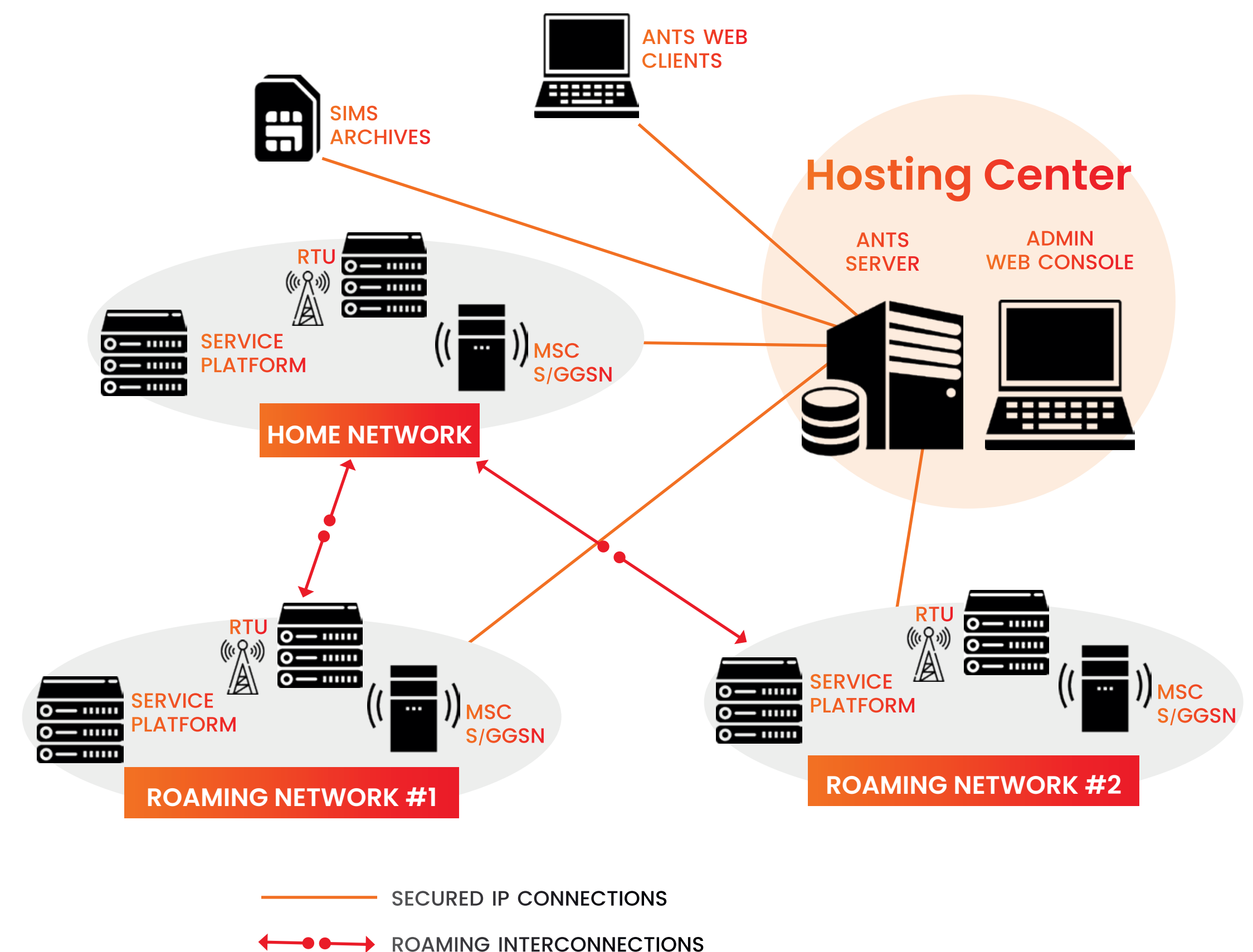
International roaming is a critical component of telecom operators' business. It accounts for a significant amount of revenue and margin. International roaming users are usually high value customers often having influence on corporate accounts and are willing to pay a premium to use voice and data services provided they receive outstanding Quality of Service (QoS) wherever they may be.

While operators are pressed to develop new services to support their growth, delivering these services is becoming increasingly more challenging. Mobile office functionalities for business users, information and entertainment services, and videoconference are all complex services that involve multi-player delivery chain and rely on complex infrastructures – a complexity that increases exponentially in roaming.

How does an operator verify QoS for customers abroad? One solution is implementing a system capable of simulating and testing customer use-cases from foreign countries, provided that a wide geographical scope can be efficiently covered with the agility, scaling and automation capabilities required to handle many often changing services, customer profiles and roaming partners.

## FOCUS ON WHAT MATTERS

The ANTS for Global Roaming Assurance solution for telecom operators guarantees that their services are delivered with high-quality to their customers abroad based on an outsourced end-to-end testing infrastructure pre-deployed across most countries.



# SEAMLESS DEPLOYMENT NO INFRASTRUCTURE MANAGEMENT

ANTS eliminates the need for infrastructure operation & maintenance.

- ANTS for Global Roaming Assurance arrives as a service on a scalable pre-deployed infrastructure that liberates telecom operators from the cumbersome operations and maintenance of Remote Test Units (RTU) deployed in more than 150 countries and the administration of the server systems. A simple web browser is all that is required for users to access this service via a secured connection.
- ANTS Virtual SIM Displacement technology enables test SIM/USIMs to be placed in SIM Archives on the operators’ premises – the unique component possibly installed onsite.
- Easily controlled and managed by users, the SIMs are virtually dispatched to the appropriate RTU at test execution time.
- Implementing the ANTS for Global Roaming Assurance service consists in defining the tests to be run, relevant KPI/KQIs, and reports to be produced – the solution can be rapidly deployed and “live” within a few weeks.
- The shared platform supporting the ANTS for Global Roaming Assurance solution has extended customization & integration capabilities ensuring deployment of a solution that exactly meets operators’ needs and requirements. Customization can include defining specific tests, KPI/KQIs, or reports. Interfacing with various systems such as alarm management systems requires minimal integration due to the support of open standards.
- TAP files and Call Data Records (CDR) acquisition and verification are integrated as well.

## KEY BENEFITS

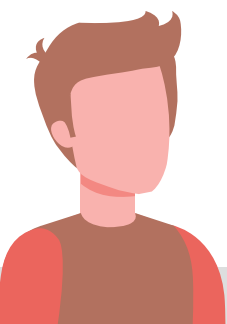
Web-based service approach: 24/7 accessibility with no infrastructure management.

Standard test and reporting packages.

Business and technical support.

Operators can focus on their mission-critical tasks and leverage their expertise without expending time, energy and resources to the operations and maintenance of a testing infrastructure abroad.

- ANTS is a GSMA certified GRQ End-to-End test solution.
- ANTS ensures Virtual Home Environment (VHE) testing using pre-built libraries of test procedures and KPI/KQIs that provide extensive service coverage (voice, SMS, MMS, voice-mail, CLI/CAMEL-based services, web navigation, etc.), predefined standard IREG and GRQ test suites on all networks technologies (from additional or more specific testing needs).
- ANTS for Global Roaming Assurance streamlines process automation by automatically running defined tests according to your individually designed scheduling plan, processing the results, and generating the KPI/ KQIs and associated alarms, if any.
- GSM to 4G+ and ISDN, PSTN, Ethernet for fixed networks).
- Customizations can be implemented in order to address



## USERS CAN:

1. modulate their interaction with the platform accordingly to different service levels.
2. focus on roaming data relying on professional support service and reporting (solution agnostic).
3. access the solution via their web browsers with support for investigation and analysis by interactive dashboard analysis, access to detailed traces, ad-hoc scheduling of complementary tests in order to support the overall roaming assurance process agility.



# Revenue Assurance

## The revenue assurance challenge

The inherent complexity of mobile operators' business in highly competitive markets and the continuous evolution of services offered pose a constant challenge in assuring revenue integrity and billing accuracy. The massive use of mature services, and the intrinsic risk of the not-yetmatured ones require maximum care in timely detecting leakages that, if ignored, might quickly and significantly impact revenues.

Switching their strategic focus from customer acquisition to revenue and margin development, telecommunications operators in highly competitive mature markets are pressed to develop new services to retain their customer base while increasing revenue. Innovative offerings such as video call, push e-mail, integrated communication and other mobile office functionalities for business users have emerged. At the same time a strong monitoring process for operational cost control and compression is mandatory.

Furthermore regulatory and other governing requirements, impose stricter and more detailed controls over the revenue generation chain. To minimize revenue leakage and meet stringent regulatory requirements, operators should ensure constant monitoring on CDR generation and rating, leveraging a highly industrialized and agile solution to implement controls on their network and all their services since the earliest phase of their life cycle.

## INTEGRATED END-TO-END TESTING & CDR/RATING VERIFICATION SOLUTION

The ANTS for Revenue Assurance solution enables telecom operators to industrialize agile and robust revenue assurance operations integrating both end-to-end testing and CDR/Rating verification.

End-to-end testing controls whether a service use case generates the expected CDRs and is properly rated, according to the relevant charging cases and price plans. Pre-built or user-defined tests can be run over the air on a subset of network elements and user profiles (SIM/USIM). The scheduling and resource management engine seamlessly coordinates their execution across Remote Test Units (RTU) deployed throughout the network. In parallel, Remote Record Selectors (RRS) capture the data generated at various network/IS nodes so that it can be matched with the relevant charging cases and price plans.

CDR verification also controls CDR availability, integrity and accuracy on real traffic. From multiple points (network nodes, service platforms, mediation, etc.) across a network, RRSs capture the CDRs designated to be verified, check the user-defined verification rules and produce the related indicators, and filter the CDRs to be forwarded to ANTS Server for further analysis.

## MASSIVE TESTING AND EXPERTISE LEVERAGE

Many factors contribute to the exponential growth of the number of revenue assurance tests to be conducted, such as the number of service use-cases, price plans and user profiles, and the frequent network and service platform upgrades. At the same time, designing such tests requires in-depth expertise on the services and related charging rules.

To help operators to overcome this challenge, ANTS industrialization capabilities include:

Extensive process automation to enable massive testing, from the design of use-cases, charging cases and verification rules to the production of Key Performance Indicators (KPI).

Virtual SIM Displacement technology allowing end-to-end testing executed over the air by RTUs while all test SIM/USIMs remain centrally managed in SIM Archives – a must to efficiently cover all customer profiles on significant deployments.

Capitalization of experts' knowledge through powerful editors that enable test use-cases and charging cases, as well as CDR verification rules and price plans, to be modeled and stored in an open Test Management Repository.

## AGILE REVENUE ASSURANCE

The time factor is critical for revenue assurance success:

Early leakage detection and diagnosis is available via automatically produced KPIs and alarms when thresholds are crossed, enabling managers and operators to prevent (with non-regression testing, for example) or identify immediately the leakage issue. Interactive exploratory OLAP analysis, detailed end-to-end test traces and ad-hoc testing then provide assistance and accelerate the diagnosis and resolution.

Rapid integration of new services – pre-built libraries of end-to-end service use cases and KPIs providing extensive service coverage including Voice, SMS, video, WAP/HTML navigation, contents download/streaming and IVR/VAS on all networks (GSM, GPRS, Edge, UMTS, 4G+, 5G, PSTN, ISDN, LAN, WiFi, etc.) can be easily expanded by users with ANTS powerful graphical editors to ensure a “zero-hole” revenue assurance. New functionalities available for VoLTE, VoWifi, RCS, ViLTE and 5G.

## MULTIDIMENSIONAL COUNTERS

CDRs contain a reach set of information suitable for several type of analysis: fraud detection, network usage, network failures, marketing strategic decisions based on real customer data. Users can autonomously create a multidimensional storage, selecting the CDR fields, for reporting, analysis, and dashboard. Examples of counter usage are:

Extensive revenue assurance controls integrating customer traffic and artificial traffic analysis.

“Zero-hole” verification: any service, any network, any SIM, anywhere.

Massive SMS used to auto-recharge (Fraud detections) Number of SMS above threshold for each Msisdn.

Roaming Traffic (number of calls, duration, data downloaded) for the different visitors and LAC.

Sequence of Calls: Answered calls between the same A-number and Bnumber.

Traffic type for different mobile types.

Cell Sleeping Analysis: cells not performing any traffic in a given time interval.

Network error for different mobile types.

Traffic routing analysis.





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