



IS YOUR RADIO ACCESS NETWORK COVERED?

Four Must-Ask Questions to Ensure Subscriber Satisfaction and Reduce Troubleshooting Costs

ARE SUBSCRIBERS AT RISK?

An operator's Customer Care ticket summary revealed that nearly **41% of calls required technical support.**

The list below summarizes the source of the reported problems.

Access Issues

- 30% - Coverage/Service Issues
- 16% - Other Data Service Issues
- 12% - Cannot Send/Receive SMS/MMS
- 11% - Cannot Make and/or Receive Calls
- 4% - Cannot Connect

Other Issues

- 6% - iPhone
- 6% - Other Product/Handset Features
- 5% - Other Devices
- 5% - Femtocells
- 3% - Voicemail
- 2% - Other

With nearly **74% of RAN issues never resolved**, service **cancellation rates peaked** to 4.7%.

HOW MUCH ARE VOLTE PROBLEMS COSTING YOU?

With the introduction of commercial VoLTE services, **operators face new challenges** in the RAN as best efforts for retainability often fall short.

Our customers, including Tier 1 mobile operators have revealed that **VoLTE issues are increasingly difficult to resolve** without visibility to the RAN.

- Percentage of all VoLTE drops that originate in the RAN: **80%**
- Average time for chronic VoLTE trouble ticket resolution: **15-20 days**
- Estimated annual spend for VoLTE troubleshooting: **\$28M**

Four Must-Ask Questions to Ensure Subscriber Satisfaction and Reduce Troubleshooting Costs

You've made a significant investment in launching your commercial LTE network. Don't let a little thing like unknown radio access insights undermine all that you've been working for. No matter how well the core network is performing, the radio access network (RAN) can cause significant problems for your subscribers, erode profits and chip away at your brand. The introduction of VoLTE services only magnifies the problems due to inherently higher voice quality expectations by subscribers, lower latency tolerance and additional signaling overhead. In this white paper, we challenge you to consider four critical questions when evaluating the effectiveness of your current and future access network monitoring approach.

1. If the problems are there, why aren't you?

As mobile technologies progress, more and more intelligence is moving out of the core. With smarter phones and more complex signaling, the RAN now plays a major part in your ability to support and adequately serve your subscribers.

So what can go wrong? Quite a lot actually. And, when it does, the subscribers' experience is adversely affected. Industry reports show the RAN is responsible for more than 70% of an operator's poor service quality, there is a growing need to tame this wild frontier, resolve problems and reduce the risk of widespread and debilitating churn.

At the epicenter of these observed and reported subscriber-issues there are a number of contributing factors that make the RAN a natural and prolific breeding ground for problems.

- **RAN signaling isn't easy.** With an estimated ten-fold increase in complexity over data service and core signaling, LTE RAN complexity is largely due to the flattened IP architecture, and the elimination of the RNC node in 3G. In LTE, eNodeBs are connected directly to the MME and are thus responsible for higher signaling loads than traditional 2G/3G SGSNs. Broken down into simpler terms, the majority of the mobility management procedures are handled within the eNodeB in contrast to the 2G/3G BSC/RNC predecessors. This increase in signaling includes paging requests, exposure to all inter eNodeB mobility events, handover management, UE power control, and most importantly, the management of shared radio channels.

Furthermore, unlike other technologies, LTE was designed to coexist, not replace previous technology generations. Coupled with the phased rollout of LTE services, coverage landscapes are spotty at best. The result is a need to successfully navigate between the various radio access technologies without subscriber service interruptions (Circuit Switch Fallback for example), all the while supporting the "always-on" nature of LTE devices. And, that is where the RAN interface comes into play. Without good visibility into this critical "next mile" of service delivery, you risk losing valuable information about your subscribers' experience.

- **RAN environments change.** Unlike the core, the access network is comprised of multiple variables that change day-by-day and, in some cases, minute-by-minute. Dealing with changing subscriber activity and the discovery of rouge and ultra "chatty" handsets are only the tip of the iceberg that awaits unsuspecting RAN troubleshooting and planning teams. Among other factors that must be evaluated on an ongoing basis, are the quality and lifespan of RF power amplifiers, the cabling and connectors used and any existing topological conditions including developing tree lines, seasonal foliage changes and building proximity. This type of criteria, coupled with the RF sensitivity of modern handsets, complex network congestion/load, handset power and handover (intra and inter radio access technology) control can have a real impact on subscriber experience.

WHAT ARE YOUR CHALLENGES?

With Tier 1 RAN Operations Teams experiencing a **30% increase in OPEX**, significant emphasis should be placed on simplifying complexities and improving productivity.

Teams cannot meet aggressive resolution targets when they are **volleying between 15 or more toolsets** to solve a problem. Nor can they take meaningful actions when their work is guided by latent information.

- To improve their success and eliminate costly escalations and ad-hoc drive testing, Tier 1 RAN Operations teams need access to a complete and real-time view of subscriber-based information.

Without the right level of information, Tier 2-3 RAN teams can spend upwards of six months trying to resolve a complex issue like VoLTE audio gaps.

- Often, these **experts lack RAN signaling data** that can be correlated to Non-Access Stratum (NAS) mobility and session management signaling. As a result, these **higher-rate resources log countless hours** manually hunting for a “needle in the haystack” so that they can test their hypotheses.

On the planning front, RAN engineers have resorted to building in **30-40% surplus capacity** as a way to compensate for a lack of understanding of actual cell capacity.

- Without an in-depth, network-wide view to accurately characterize every single square inch of the network, operators have little information to account for changes in topology, indoor coverage challenges, and congestion.
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So what can operators do to better manage these problems? The next section addresses that challenge with some thoughts on why finding a way to get closer to the problem is so important.

2. Are you using outdated tools to solve modern problems?

With LTE, your existing RAN troubleshooting tools are insufficient to isolate the issues. To make matters worse, the majority of these RAN-specific problems cannot be resolved with a core network signaling approach.

Quite simply, **core signaling cannot troubleshoot today's RAN issues**. For one, core signaling is severely limited when identifying the location of a problem. Hindered by 25-30% accuracy, operators cannot rely on core signaling when pinpointing the location of an access issue in order to begin investigation. In addition, Core and User Plane-based QoS analysis (for voice, video and data) may not accurately reflect the QoS received by the subscriber as LTE RAN intelligence can actually buffer, drop or even shape the traffic before it is experienced by the subscriber.

But the limitations with core monitoring extend even further in that the majority of accessibility issues, node-to-node paging failures for example, will never be visible from the core as they simply do not occur nor do they involve that part of the network. The same can be said for understanding and identifying any coverage or congestion performance indicators that could contribute to the degradation of a subscriber's experience. As the core is not involved, such information will not be available without RAN insights.

With so much hidden from the eyes of core network teams, it is no surprise that tickets with RAN-related release causes are simply thrown over the fence to the access teams in order to close the ticket and keep department KPIs green. In a typical scenario, this equates to nearly **41% of tickets that will leave the NOC unresolved** to be handled by the RAN Operations team.

With this escalation trend in mind, it is no surprise that RAN Operations teams are experiencing a growth in ticket backlogs as LTE and VoLTE service uptake continues. Frontline, tier 1 National RAN Operations teams face the brunt of this tsunami with unwavering and aggressive troubleshooting timeframes and inadequate toolsets. As the number of SIM cards continue to increase with mobile-to-mobile and IOT traffic growth, service providers must adapt. **Lean troubleshooting tools and processes are needed.**

For these specialists, traditional access troubleshooting methods and multiple toolsets can no longer keep pace with the rate of escalation experienced. Stalled trouble tickets, the required involvement of higher skilled and more costly personnel, and a “ping-pong” approach to problem resolution can have a negative impact on job satisfaction and ultimately drive up operational costs exponentially.

So what are these organizations doing today? The next section explores the current state of tools and techniques in use by RAN troubleshooting teams, along with some analysis of their major shortcomings.

3. Are you looking at problems through rose-colored glasses?

Cell-based Operational Maintenance Counters (OMC) are one of the most common methods used to measure the performance of the radio access network today. While readily available as part of a mandatory Element Management Systems (EMS) package purchased in conjunction with the network elements, these counters may show KPIs at acceptable levels even when deeper network issues are present.

Tools which rely upon Network Equipment Manufacturer (NEM) counters are based upon cell level information, and are vendor specific. This means they are limited in the scope of their reporting. They can tell you what is happening in a particular cell but without the context of neighboring cells or any link to the subscriber—critical information that may be required when determining the cause and severity of issues. Vendor-specificity or multi-carrier radio networks may also be an issue for mixed vendor deployments when node-to-node metrics, and KPI algorithms do not align for effective and actionable comparisons.

Another major drawback of these counters is that information is typically reported in 15-minute intervals – leaving troubleshooting teams handicapped with information that may no longer be relevant. While such reporting can be useful in optimization studies, **active troubleshooting activities require timely awareness of performance** in order to accelerate isolation and begin resolution steps. When subscribers are truly mobile, 15 minutes is enough time for them to move from the problem area—making recreation or recall of the problem virtually impossible.

In terms of KPIs, while NEM counters do a good job at high-level metrics, they can often mask critical problem indicators. “Hidden drops” or false positives are just one example of how an OMC counter can misrepresent the performance of the network. Typically subscribers lose patience and intentionally hang up due to issues with congestion or coverage issues in a particular area. Unless subscribers actually call in to report their frustrations, operator teams looking at network counters will perceive a 99% call success rate, as the **subscriber initiated ‘hang ups’ do not count as dropped calls**.

In such cases the operator is completely blind to the brewing subscriber dissatisfaction. When and if subscribers do call in, the lack of access to historical subscriber information will often require a drive test in order to recreate the problem experienced. Such ad-hoc truck rolls can drive up troubleshooting costs over time. Furthermore, indoor coverage issues are near impossible to troubleshoot without on-the-ground visual assessments in absence of more meaningful metrics.

As a result of such misleading information and an inability to recreate the problems, operators are finding themselves in costly dialogue with their NEMs and handset vendors in an effort to resolve coverage or congestion issues with capacity expenditure. In addition to the above issues, NEM counters are also limited in their ability to handle the nuances of the activities of a smartphone generation. As a majority of devices now support multiple consecutive connections for voice, data and video streaming, the complex signaling that enables them is not easily visible to these cell-based counters.

This can leave operators with few leads to resolve an issue when something goes wrong in Multi-RAB scenarios. Similarly, in cases where cells are competing to support a UE, pilot pollution causes signaling surges without any noticeable change to NEM counter KPIs. Based on the limitations above, it is no surprise that operators have augmented these counters with unique homegrown tools in an effort to fill in the gaps. Unfortunately these tools only add to the complexity and confusion. With an average of 15 or more tools at their disposal, RAN Operations teams can easily burn resolution-window minutes just logging into each system. And, with no way to link these tools together, **homegrown options fall short** on efficiency, often lacking the scalability to meet growing traffic demands.

4. Are you relying on LTE enhancements to bear the burden of your VoLTE support?

The LTE technology turn continues to challenge operators around the world adding complexity with the introduction of voice. While operators struggle to deliver a best-in-class VoLTE experience in order to realize significant long-term savings, protect brand equity and pave the way for premium rich communications services, the role of the access network remains a key and constant focus.

LTE ENHANCEMENTS AIMED AT SUPPORTING VOLTE

TTI Bundling

As traditional LTE data services focus on downlink coverage, operators needed a way to optimize uplink coverage when dealing with the bi-directional nature of voice—specifically at cell edges and for in-building reception scenarios. TTI bundling made this request a reality.

With it, UEs with limited transmission power and degrading reception are instructed to begin transmitting the same packet in consecutive transmit time intervals.

TTI bundling intends to reduce transmission latency and retransmissions which can lead to excessive signaling overhead. When capacity is monopolized with signaling, additional capacity issues arise.

Semi-Persistent Scheduling

While LTE data service packet transmissions are often big and bursty in nature with regard to UL and DL requests, VoLTE requires a more consistent connection that enables multiple UEs to vacillate smoothly between shared UL and DL channels.

To eliminate the overhead associated with access grant control channel signaling for each transmission, SPS is used. With SPS, access is granted to the UE one time for ongoing use throughout a call.

To help operators, 3GPP Release 8 fortified LTE networks with specific enhancements intended to improve the robustness of RF bearer channels for the real-time, latency-averse nature of packetized, mobile voice communications. These enhancements are featured in the sidebar on the right.

As a general rule, LTE enhancements have improved the coverage, capacity and quality of pilot trials. That being said, many operators have discovered their **commercial deployment results vary**. The reality is that these embedded features are falling short on the front lines making it more important than ever to get as close to the source of signaling between the UEs and the eNodeBs as possible.

Consider the Benefits of 24x7 Radio Access Monitoring.

Introducing GeoSoft RAN-enabled LTE Access Solutions

With so much at stake in the access network, operators can no longer afford to overlook the need for a more effective solution. As a natural extension of core systems, 24x7 monitoring of the access network simplifies troubleshooting process transitions between departments with fully correlated, subscriber-based insights, real-time data and immediate retrieval of historical session information. Such capabilities can **dramatically reduce troubleshooting times, minimize ticket escalations and even eliminate ad-hoc drive tests**. With the introduction of GeoSoft RAN Solutions for troubleshooting, NETSCOUT makes this approach a tangible reality.

By harvesting information directly from inherent element trace ports of multiple vendors, virtualized GeoSoft RAN solutions effectively combine data from multiple elements for presentation in a single integrated display. Building on the strengths of NETSCOUT'S proven network-wide monitoring system, the GeoSoft RAN-enabled offering **leverages existing troubleshooting applications for use with multiple departments**. The benefits of these individual applications are summarized in the following sections.

In totality, GeoSoft RAN-enabled solutions deliver a **highly scalable, vendor independent view** of RAN performance across any deployed LTE access infrastructure. With this enhanced visibility, mobile operators can readily address a variety of complex scenarios:

- Identify and analyze poor coverage areas, obstructions or a need for new sites including small cells.
- Validate benchmarks and maintain Core/Access/Device system functionality by reporting the most pertinent Key Performance Indicators (KPIs) and Key Quality Indicators (KQIs).
- Isolate issues impacting new handset or service QoS/QoE in real time with 24x7 monitoring capabilities, reporting and trending analysis features. Voice over LTE (VoLTE) is just one service example that will require an integration of access and core monitoring solutions.
- Keep higher-tier troubleshooting teams focused on the right priorities. Free valuable resources to address more pressing and unique customer issues.
- Save time and conserve resources by streamlining your trouble ticket process from Customer Care to root cause.
- Reduce the need for costly and time-consuming drive tests by viewing the results of network enhancements and optimization changes in real time.
- Drill down to the subscriber-level and layer-3 messaging to troubleshoot and analyze every call in the network
- Alleviate pilot pollution due to poor cell planning, inappropriate site location, antenna height and uneven terrain.

SOLUTION HIGHLIGHTS

- Low cost virtualized data acquisition delivers unrivaled scalability with support for over 100M subscribers and 1500 4Gps RNCs
 - Correlates Core UP/CP and access CP data for network-wide access-to-core visibility
 - 24x7 real-time monitoring complements on-demand recall of historical information
 - Rich RAN data records feed to CEM, geomarketing and geolocation (RAN visualization) solutions
 - All capabilities are accessible from a single integrated display
 - Supports multiple RAN departments (Planning, Maintenance, Performance and Optimization)
 - APIs allow for lean drill-up and drill-down capabilities and workflows
 - Supports RAN data acquisition and call trace/protocol analysis functions
 - Extends visibility with complete integration of Core monitoring and CEM solutions
 - Effectively combines counters and network signaling for an accurate and actionable view of performance
 - Delivers integrated user plane QoS analysis correlated to the 'active' cell
 - Enables end-to-end assurance and applications portfolio
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Solution Components

TrueCall® for RAN Planning, Operations and Performance & Optimization Teams

Good network design and efficient utilization of resources is compulsory to prevent problems and optimize RAN capacity. As LTE adds additional layers of complexity to these fundamental tasks, RAN Engineering teams have to move forward with clarity and confidence. GeoSoft RAN-enabled solutions offer enhanced visibility and actionable intelligence based on geolocated data to get the most out of the network and personnel.

- **CAPEX Validation:** Adding RAN capacity often requires a significant investment and operators are under pressure to make every purchase count. NETSCOUT'S solutions provide comprehensive RAN Performance Management (PM) KPIs, to accurately characterize RAN performance with effective integrated Operation and Maintenance Counter (OMC) baseline capabilities that can guide network tuning recommendations to improve capacity.
- **Real-Time Insights and Actionable KPIs:** Reactive prioritization of network congestion based on daily top cell reports can keep network engineering teams occupied with issues that may not accurately reflect the impact to subscribers. Only real-time, subscriber insights made visible with TrueCall® can deliver round the clock, geolocated information regarding traffic density and quality.

Iris Session Analyzer for RAN Operations Teams

A single, unified view of subscriber traffic across network boundaries (RAN and Core) and technology domains (2G/3G/LTE), Iris Session Analyzer (ISA) arms Tier 1 RAN Operations teams with the real-time and historical information they need in order to quickly isolate and resolve problems.

- **Real-Time Network Element Data:** Troubleshoot issues from core-to-RAN with real-time information. Continuous, 24x7, cross-element monitoring and data correlation ensures that RAN teams see all that happens, as it happens— dramatically reducing the time to access and analyze information. With ISA, RAN Operations teams can accelerate their response and fault isolation, meeting aggressive troubleshooting time frames and minimizing escalations to more costly support resources.
- **Historical Data Recall On Demand:** Resolve issues that cannot be recreated. When stubborn trouble tickets linger, additional context may be required for resolution. ISA delivers that context with readily-accessible historical information that allows teams to paint a better picture without a costly truck roll.
- **Collaborative Workflows:** Facilitate cross-department resolution with targeted workflows and collaborative capabilities. When multiple organizations are involved in solving a problem the ability to augment escalations and handoffs with meaningful information ensures resolution progress—avoiding ticket stall or “Ping-Pong” troubleshooting. ISA supports a more collaborative approach with flexible export options for internal audiences and vendor mitigation. In addition, seamless drill to lower level troubleshooting tools extends the solution's value to multiple departments.

LOOKING AHEAD

NETSCOUT is committed to deliver a portfolio that will address our customers' need for lean workflows and more sophisticated troubleshooting tools.

With our evolving solutions, service providers will benefit from the following capabilities:

- Radio graphs of user plane QoS/radio environment
- Problem triage/prioritization features
- Knowledge base root cause assessment tools

For more information about the availability of these features, contact your NETSCOUT representative today.

TrendNavigate for RAN Engineering, Planning and Operations Teams

With around-the-clock RAN visibility, TrendNavigate aids operations and engineering teams in proactively identifying issues and accelerating the isolation of root cause. Reactive prioritization of network congestion based on daily top cell reports can monopolize network planning and engineering teams with issues that often fail to address the source of subscriber-facing issues. RAN insights made possible with TrendNavigate deliver timely, 24/7 visibility to traffic radio network quality

- **Comprehensive KPIs and Dashboards:** Adding RAN capacity often requires a significant investment and operators are under pressure to make every purchase count. TrendNavigate provides the statistics necessary to accurately characterize RAN performance with effective Operations Maintenance Counter (OMC) baseline capabilities to guide network tuning recommendations and improve capacity. Dynamic dashboard views serve as the launching point for problem investigation and capacity planning tasks by delivering a composite view of network performance over time.
- **Reports:** KPI Details and Cause Reports complement high-level performance views with failure distributions by network and element and top-worst performing cells for impact analysis and prioritization. Cell Benchmark Reports track the performance of single cells based on accessibility, retainability and mobility KPIs. Such information can reveal coverage and interference issues contributing to observed KPI degradation.

UNRIVALED RAN EXPERTISE

- Collaboration with NEM vendors from initial development and testing stages to formal OSSii agreements
 - Recognized authority on signaling with three published performance and optimization reference books on UTRAN and LTE access technologies
 - Committed to innovation with six patents received for access monitoring and an additional four pending approval
 - Proven ability to scale for large mobile deployments with nationwide mobile voice and data networks serving more than 190 million subscribers
 - Trusted partner with more than 30 successful 2G, 3G and LTE access engagements worldwide
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