Evolving network testing – an eBook of 12 use cases

Find out how network testing is combining with orchestration and analytics to automate next-generation network testing processes
# Contents

5G site verification 4  
Network troubleshooting and optimization 5  
Competitor benchmarking 6  
User experience testing 7  
Indoor mobile network testing 8  
Drone-based testing 9  
Special event monitoring 10  
Strategic location monitoring 11  
Regression testing 12  
Private 5G network assurance 13  
Network testing post-processing and analytics 14  
Centralized management of network testing 15  
The TEMS™ Suite 15  
TEMS™ Cloud 15  
TEMS™ Investigation 15  
TEMS™ Paragon 15  
TEMS™ Pocket 15  
TEMS™ Sense 15  
TEMS™ SSV 15  
TEMS™ Discovery 15
5G is not only transformational in terms of network performance, with improved throughput, spectral efficiency, latency and reliability compared to previous generations of telecommunications infrastructure, but also in how it impacts the entire mobile operator organization.

To realize the benefits of 5G, you need to be able to quickly roll out your network and efficiently operate it. But with higher cell density, a larger number of spectrum options, and far more sophisticated antenna systems, the complexity of deploying and optimizing new 5G networks and sites is potentially more time-consuming, more costly, and more of a resource drain than any previous technology.

In this e-book we bring together use cases which mobile operators are deploying today to improve the efficiency and accuracy of their testing routines, enabling them to deliver improved network performance through next-generation, data-driven network testing.

For over 25 years, and through multiple generations of network technology, TEMS™ has been recognized as the benchmark for network testing solutions by mobile network operators and vendors worldwide.

Bringing together orchestration and analytics with multi-mode network testing, the TEMS Suite provides a comprehensive portfolio of solutions, including:

**TEMS Cloud**: to provide remote control and management of TEMS field devices as well as real-time data analytics

**TEMS Investigation**: to perform drive tests to verify, optimize and troubleshoot all mobile network technologies

**TEMS Pocket**: to walk test indoor locations and drone test hard-to-reach places

**TEMS Paragon**: to streamline mobile network benchmarking campaigns

**TEMS Sense**: to proactively monitor wireless network services end-to-end with active testing

**TEMS SSV**: to automate your site verification for faster 5G roll-outs with fewer personnel

**TEMS Discovery**: to turn network test data into analytics and actionable insights for optimization

Figure 1. The TEMS suite.
5G site verification

**Solution: TEMS SSV App + TEMS Cloud**

Whether it’s rolling out a new 5G network, a new technology overlay, or expanding your network coverage footprint, accurately assessing pre-launch performance is critical. Only by testing and optimizing the network from your subscribers’ perspective can you be confident that the network is going to deliver the promised 5G user experience. This is where site verification comes in.

**What is site verification?**

Site verification involves validating that new 5G sites and clusters provide the intended coverage and that all voice and data services are working as expected before subscribers are allowed to access the network.

Within a mobile operator’s organization, the responsibility for initial site tuning and verification sits with the network deployment team. The challenge is one of complexity and scale. For every new site that is built, the network deployment team needs to ensure it is well integrated with its neighbors in the existing network and performing optimally. In the case of most 5G network roll-outs, this will involve many thousands of sites each requiring comprehensive drive testing. A time-consuming and expensive process, where finding efficiencies is critical.

The network deployment team has responsibility for not only validating, troubleshooting and optimizing the deployment, but they also need to be able to provide reports to the business on the status of the 5G network rollout. With operators’ CAPEX and OPEX under pressure and scrutiny, the network deployment team is on the front line to ensure the rollout is completed quickly, cost-effectively and accurately.

**The benefits of site verification with TEMS SSV and TEMS Cloud**

TEMS SSV combined with TEMS Cloud enables automation and centralization of management for 5G site verification. The solution leverages Precision Drive Testing to centrally define testing routines and criteria, identifying what to test, where to test and how to get there. When in the field, it automatically conducts the tests, meaning even people with no RF expertise can test for you and reports results back to HQ for analysis. This simplified and guided drive testing approach helps you get your 5G network to market faster.

- Improve site verification efficiency with centralized orchestration of testing projects and detailed guidance for drive testers
- Improve the time taken for a site verification by automating testing routines and leveraging machine learning to predict where tests should be done
- Reduce reliance on your skilled engineers with guidance and automation that enables anyone to do site verification
- Evaluate site verification in real-time so that issues can be detected early and corrected, preventing time-consuming re-drives

“For operators that are racing to deploy new 5G sites, while continuing to optimize and expand existing network coverage, this new network testing approach is a game-changer.”

Nokia
Network troubleshooting and optimization

Solution: TEMS Investigation

Once deployed, optimizing and troubleshooting the network is an ongoing process, and network KPIs must be constantly tracked. The network must be optimized and pushed to the boundaries of its performance. Effective, accurate and efficient network troubleshooting and optimization will, to a large extent, define the success or failure of your 5G investment.

What is network troubleshooting and optimization?

Mobile network troubleshooting and optimization involves drive-testing both new and existing cell sites to understand the experience your network delivers, identify and resolve issues, and make informed decision-making around future network investments.

The quality of a subscriber’s experience relies on your ability to identify and solve network problems quickly and reliably. This requires end-to-end network testing that allows you to validate every new function and feature in your network. Not only this, but you also need to understand how the network performs on the devices your customers are using. This means drive-testing the network using the latest smartphones from all the major manufacturers.

It is also important that network troubleshooting and optimization is carried out for the most popular over-the-top (OTT) applications which your subscribers are using – for example streaming services such as Netflix and voice services such as WhatsApp. Testing of native and OTT voice quality, OTT applications and user interactivity ensure a comprehensive view of your subscribers’ experience.

The benefits of network troubleshooting and optimization with TEMS Investigation

TEMS Investigation is a powerful drive testing solution capable of in-depth troubleshooting of the most difficult problems. Through our partnerships with device and chipset vendors, we support the latest technologies, features and handsets your customers are using. This means you can reliably test and improve your subscriber quality of experience.

- We partner with key vendors to ensure faultless support for the latest chipsets and 5G handsets, including access to Layer 3 messages so you can reliably test with the devices your customers use
- Understand your customers’ experience via testing of native and OTT voice quality, OTT applications and user interactivity for a comprehensive view of subscribers’ experience
- Be in control of your testing with powerful device-forcing features, scripting and workflow integrations to enable efficient network testing and analysis
- Align with global best-practice with TEMS Investigation’s standards-based testing which employs the latest test methodologies and recommendations from ETSI and ITU-R

“Measuring end-user experience is a crucial tool not only to verify network performance but also for informing decision-making around planning future network investments.”

Zain Jordan
Competitor benchmarking

Solution: TEMS Paragon

To provide a competitive network, you need to measure subscriber experience across different network technologies, handsets, and services. But more than that, you need to be able to benchmark your network performance against that of your competitors. Only then can you be confident that your network is performing to its true potential and delivering a subscriber experience that is truly market-leading.

What is competitor benchmarking?

Competitor benchmarking enables you to compare your network quality to that of other mobile operators, in your home market.

To measure subscriber experience across multiple operators, handsets, and services requires a drive-test solution that is optimized for mobile network benchmarking projects. This means a multi-device configuration, supporting both iOS and Android handsets, along with in-depth service quality level testing including all the popular OTT applications, so you can perform a deep market comparison.

A competitor benchmarking project requires extensive drive-testing to build a baseline view of how network assets are performing relative to competitors across different areas and at different times. This means benchmarking can be expensive. To reduce your benchmarking costs means minimizing field effort, and this requires automation. With centralized orchestration and enough automation, each benchmarking vehicle can be reduced to only a single driver saving significant costs.

The benefits of competitor benchmarking with TEMS Paragon

TEMS Paragon is a multi-device benchmarking solution that enables you to compare the service quality of your network to the competition. It is highly scalable, enabling you to test multiple use cases across all your competitors in a single drive test. Seamless integration to TEMS Cloud means testing can be managed, controlled and monitored in real-time by engineers back at HQ.

- Improve your competitor benchmarking efficiency with TEMS Paragon’s purpose-built user interface that allows non-technical drivers to perform advanced network testing meaning each vehicle needs just a single driver
- Compare your network quality to the competition with TEMS Paragon’s scalable multi-device support that allows you to benchmark and analyze multiple operators simultaneously in a single drive test campaign
- Benchmark customer experience by testing voice quality, OTT applications and user interactivity to ensure a comprehensive view of subscriber experience across competitors
- Manage your benchmarking campaigns centrally through seamless integration with TEMS Cloud, enabling your engineers back at HQ to manage, control and monitor your benchmarking campaigns in real-time

Together, umlaut communications and Infovista are providing the most comprehensive mobile network benchmarking services globally.

umlaut
User experience testing

Solution: TEMS Investigation, TEMS Pocket, TEMS Paragon, TEMS Sense

Today’s networks need to successfully support a vast array of services, everything from simple text messages to services characterized by demanding requirements, ranging from high bandwidth 4K video streaming to very low latency e-gaming. User experience (UX) testing is critical if you are to ensure your network is delivering the quality expected by customers for any of the apps or services they are using. By combining machine learning algorithms with sophisticated traffic modeling, UX testing enables you to understand the user experience for all these applications and services.

What is UX testing?

UX testing enables you to innovatively combine various generic testing techniques, sophisticated real live service traffic pattern emulations and machine learning (ML) algorithms to fully test not only your network, but also the user experience of any native or OTT applications and services running over them. This means you can test the user experience of high bandwidth, low latency 5G services such as the e-gaming genre of First-Person Shooter (FPS) games, OTT voice applications including WhatsApp, and video-on-demand streaming services like Netflix.

Thanks to the variety and volume of OTT apps and the ever-expanding range of devices, it's simply not practical or financially viable to test every device, every OTT app and every interactive service. Instead, by testing the network against the key parameters of the most demanding and/or most commonly used OTT application/service, you can have confidence that you are not only delivering a network capable of supporting less intensive and/or less common OTT apps and services, but making user experiences promises, safe in the knowledge that your network will deliver.

The benefits of UX testing with TEMS

Our user experience testing portfolio enables you to understand, and improve, the user experience for all applications and services. It includes solutions for native and OTT voice services, OTT applications, and interactive services such as mobile gaming.

- Ensure 5G user experience by accurately measuring quality of experience for all native and OTT applications and services.
- Benefit from network-centric voice quality testing with sQLEAR, the world’s first machine learning-based standard for 5G VoNR voice quality testing approved by ITU and that provides a device, and device settings, agnostic, view of true voice quality without the need to test every individual device.
- Ensure subscriber QoE across all apps with our generic testing approach that is highly correlated to real-world testing for a more practical and cost-effective solution.
- Test any standard OTT application without the requirement for customized OTT applications to be able to successfully test.

The challenge with testing OTT apps today is that parameters change with every release update. How to login or the layout and behavior of the app can change without any notice, and can differ between devices, countries and even networks.
Indoor mobile network testing

Solution: TEMS Pocket

With over 80% of all mobile data traffic occurring indoors, the in-building performance of your network can make or break your subscribers’ mobile experience. From the high-rise offices of key enterprise clients to high-footfall shopping malls, it is vital that you can verify, optimize and troubleshoot your mobile network with optimal efficiency.

What is indoor mobile network testing?

Indoor mobile network testing involves verifying, optimizing and troubleshooting your in-building network coverage so you can ensure your subscribers have a good quality of experience indoors. Using a highly portable smartphone-based network testing solution, engineers can walk-test indoor environments such as malls, stadiums, offices, airports and other large venues.

Subscribers expect your network to deliver a flawless user experience indoors. This means you need to be able to verify the subscriber experience on the devices and the apps that they are using. A portable phone-based mobile network testing solution with support for both 5G devices, scanners and OTT application testing means you can generate the insights you need to troubleshoot and optimize the subscriber experience indoors and across campuses.

Advanced indoor mobile network testing provides actionable insights based on both the subscriber experience (QoE) and the network performance (QoS), giving you the accurate information you need to be able to troubleshoot, optimize and ultimately improve your subscribers’ mobile experience.

The benefits of indoor mobile network testing with TEMS Pocket

TEMS Pocket is a powerful, yet highly portable phone-based mobile network testing solution with support for 5G devices and scanners. It allows you to verify, optimize and troubleshoot your mobile network in environments requiring portability, such as malls, stadiums, and offices. Its advanced testing capabilities provide actionable insights to improve your subscribers’ mobile experience.

- Be in control of your testing with powerful device-forcing features and scripting to automate actions, allowing you to efficiently test what you need to
- Install TEMS Pocket on standard consumer devices so field engineers only need to carry a single phone
- Benchmark indoor coverage against all your competitors with a multi-device solution carried in a single backpack
- Streamline all walk-testing routines by integrating TEMS Pocket with TEMS Cloud, allowing you to remotely control and manage a fleet of TEMS Pocket units

“When rolling out a new indoor system or adding 5G to an existing one, you need to efficiently and accurately ensure that network performance meets your expectations.”
Drone-based testing

Solution: TEMS Pocket

Mobile network testing can be difficult if your coverage area has limited accessibility. But just because validating network coverage across an industrial site can be dangerous or along popular a tourist beach can be slow, the network testing must still be done. These locations are often high revenue generators, with premium enterprise customers, or see a lot of potential inbound roaming revenue. You require advanced testing capabilities that provide actionable insights to improve your subscribers’ mobile experience.

What is drone-based testing?

Drone-based mobile network testing provides a portable testing and troubleshooting solution to enable you to validate network performance in hard-to-reach places. Drone testing can also drive efficiency as it is often faster than walk testing when validating coverage, for example in large stadiums or along popular tourist beaches.

Mounting a portable phone-based mobile network testing solution on a drone enables efficient testing of places such as industrial complexes, where walking about freely is not possible, and emergency services’ flight corridors, where testing without a drone or helicopter is not feasible.

Drone testing can also be an efficient way to validate the performance of 3D beamforming antennas, where beams are radiating in 3-dimensions. Gaining access to the high-rise buildings these 3D beams are meant to serve can be tricky and time-consuming. Being able to verify that the 3D beams function as planned by using a drone is significantly faster.

The benefits of drone-based testing with TEMS Pocket

TEMs Pocket is a powerful, yet highly portable phone-based mobile network testing solution with support for 5G devices and scanners. Its small form factor makes it ideal for mounting on a drone. It allows you to verify, optimize and troubleshoot your mobile network in environments with limited accessibility. Its advanced testing capabilities provide actionable insights to improve your subscribers’ mobile experience.

- Test hard-to-reach locations with drone-mounted TEMS Pocket units and deliver efficient testing of sites places such as industrial complexes and emergency services’ flight corridors
- Reduce the time and cost of walk-testing large areas, such as stadiums and public spaces such as beaches by using TEMS Pocket mounted on a drone
- Be in control of your testing with powerful device-forcing features and scripting to automate actions, allowing you to efficiently test what you need to
- Streamline drone-testing by integrating TEMS Pocket with TEMS Cloud, allowing you to remotely control and manage a fleet of drone-mounted TEMS Pocket units

With TEMS Pocket mounted on a drone we can test the coverage of the Emergency Services Network along flight corridors and around key emergency services locations such as hospital helipads

ESN
Special event monitoring

Solution: TEMS Pocket + TEMS Cloud

Large events, such as music festivals, football matches and special events at large indoor arenas will typically see the mobile network extremely stressed. A high volume of people, many of whom at any one time will be uploading content to social media, using OTT apps to communicate with friends, or streaming live content will place immense strain on the network. Verifying, optimizing and troubleshooting the mobile network in these types of environments is important, but resources are stretched and dispatching engineers to every large event is tricky. You need to be able to mobilize your non-technical staff in support.

What is special event monitoring?

Special event monitoring involves testing the quality of the network and gathering valuable data at large-scale special events where networks are typically extremely stressed. Skilled engineering resources are finite and the demands on their skillset mean they are already being pulled in many directions. To address this, special event monitoring can be supported in the field by non-technical staff, with specialist engineers remotely managing testing centrally from HQ.

For this approach to be successful requires a highly portable network testing solution that can be easily taken to venues, and, crucially, it must work without requiring any engineering expertise to be on hand when out in the field.

The solution is to equip non-technical staff who are already attending an event with a portable network testing solution in the form factor of a phone that they can simply pop in their bag or pocket, and do nothing more, other than enjoy the event.

While colleagues are at the event, engineers can remotely control the test phones, deciding what scripts should be executed and generating real-time data analytics, enabling them to verify and troubleshoot the mobile network without ever leaving the office.

This not only allows you to cost-effectively scale your network testing capabilities to cover special events, but it also enables you to better manage your team, improving efficiency and removing the need to deploy engineers to special events.

The benefits of special event monitoring with TEMS Pocket and TEMS Cloud

TEMS Pocket is a powerful, yet highly portable phone-based mobile network testing solution with support for 5G devices and scanners. Its small form factor makes it ideal for carrying in a bag or packet to an event. TEMS Cloud allows you to remotely manage and monitor TEMS Pocket devices from a centralized back-office.

- Verify, optimize and troubleshoot the mobile network in environments requiring portability
- Leverage non-technical staff to support network testing in the field using TEMS Pocket, with no action, other than carrying the device, needed by them.
- Maximize efficiency and effectiveness of finite engineering resources by using TEMS Cloud for remote management and monitoring of TEMS units and execution of test routines in the field.
- Be in control of your testing with powerful device-forcing features and scripting to automate actions, allowing you to efficiently test what you need to.

You cannot expect general staff to role-play being network engineers. Effective special event monitoring requires them to be able to simply take a device, pop it in their bag, travel to the event, and then do nothing more.
Strategic location monitoring

Solution: TEMS Sense

Your retail stores are quite literally the shop window for your network, showcasing the latest devices and connected experiences. These retail stores and other strategic locations such as airports and shopping malls must showcase the very best experience that your network can deliver. Additionally, a proactive approach to monitoring subscribers’ quality of experience means staying ahead of potential issues and giving your customers the experience they deserve.

What is strategic location monitoring?

Strategic location monitoring enables voice and data service quality to be continuously monitored and validated across important locations in your network, such as your retail store network, to ensure that services are being provided at the highest possible level. This automated, remote monitoring provides early issue detection and root-cause analysis and allows network engineers to quickly correct service-impacting issues that might occur in the mobile network.

Your sales and marketing team need to be confident that network quality is always at the highest level, but they can likely neither justify the additional cost of dispatching network engineers to repeatedly test network quality at retail locations, nor risk being left unaware of any degradation in the network quality in-between scheduled visits.

Active subscriber QoE monitoring means issues can be immediately detected and remote diagnostic testing can be done, reducing troubleshooting to mere minutes without ever putting an engineer in the field.

The benefits of strategic location monitoring with TEMS Sense

TEMS Sense is a phone-based remote testing solution delivering fully automated monitoring and real-time analytics from locations across the network. It can be mounted in fixed locations such as airports and stadiums, or in vehicles such as taxis and public transport. Units are remotely managed and controlled. A proactive testing approach means staying ahead of potential issues and giving your subscribers the quality they deserve.

- Take advantage of robust and reliable hardware that is designed to be left unattended, and with built-in intelligence, including temperature and charging control to ensure successful 24x7 data collection
- Ensure early detection and correction of issues with 24x7 monitoring to enable quick correction of service impact issues that occur in your network
- Accurately validate network upgrades and changes by leveraging a TEMS Sense unit in a fixed location to compare network performance before and after upgrades and changes
- Reduce your troubleshooting time and costs by connecting remotely to a TEMS Sense unit to perform ad-hoc tests. Troubleshoot in minutes without ever having to send a technician out to the field

In strategic locations such as retail stores, your sales and marketing team can’t afford to wait for potential new subscribers to discover network and service issues. Early detection and correction are essential.
Regression testing

Solution: TEMS Sense

When making changes to your network, you need to make sure all your services continue to perform reliably and without any degradation. Deploying active testing devices in key strategic locations such as stadiums, airports and shopping malls makes it possible to validate network upgrades, new feature activations, and any other changes that are made to the network. Continuous testing done at these fixed locations provides a perfect baseline to confirm network changes have not adversely affected the network (or that they have improved it as intended), and it is easy to see if changes have degraded performance.

What is regression testing?

Regression testing is the validation of network upgrades, new feature activations and any other changes that are made to the network to confirm they have either not adversely affected the network or have improved it as intended.

The rapid evolution of 5G services and accelerating pace of network roll-outs, make network optimization and the constant effort to improve the network an ongoing challenge. This means validating upgrades to the network is essential to ensure continued improvement.

However, your network optimization team does not want to have to conduct costly and time-consuming repeat field visits every time a network upgrade is released, or a new feature is activated. By deploying active monitoring at key strategic locations, your team can manage both benchmarking and continuous location testing centrally from HQ – minimizing cost and resource waste on unnecessary testing.

The benefits of regression testing with TEMS Sense

TEMS Sense is a phone-based remote testing solution delivering continuous and fully automated monitoring and real-time analytics from locations across the network. It can be mounted in fixed locations such as airports and stadiums, or in vehicles such as taxis and public transport. Units are remotely managed and controlled. A continuous testing approach provides the perfect baseline to confirm network changes have not adversely affected performance.

• Take advantage of robust and reliable hardware that is designed to be left unattended and featuring built-in intelligence, including temperature and charging control to ensure successful 24x7 data collection

• Accurately validate network upgrades and changes by installing TEMS Sense units in strategic locations such as airports, shopping malls and stadiums to provide the perfect baseline to compare network performance before and after upgrades and changes

• Validate every aspect of your network with advanced device-forcing features and scripting, as well as the ability to test OTT services and applications, giving you full visibility of your network

• Reduce your troubleshooting time and costs by connecting remotely to a TEMS Sense unit to perform ad-hoc tests. Troubleshoot in minutes without ever having to send a technician out to the field

The rapid pace of evolution in 5G services, coupled with the accelerating pace of network roll-outs, make network optimization and the constant effort to improve the network an ongoing challenge.
Private 5G network assurance

Solution: TEMS Sense

Mobile operators are deploying private 5G networks for many of their enterprise customers across industry verticals such as manufacturing, mining, and power utilities. The business-critical nature of these networks means end-customers want visibility into the network performance and confidence that it is continuously performing up to standard. Mobile operator service assurance solutions are large and complex, and it is often not feasible to give private network customers a view into the performance of their network via this avenue. Automated remote network monitoring enables a customer to confirm that their private network is performing as expected without the need to be an RF expert.

What is Private 5G network assurance?

Private 5G network assurance uses automated remote network monitoring to continuously validate the performance of a private network. For private networks, active monitoring of service performance is the perfect solution to understand the performance of the network.

The growth of private mobile networks in verticals such as manufacturing, education, mining, and power utilities is presenting a fresh challenge to these organizations. Monitoring an RF network typically isn’t part of the in-house expertise they have. That’s why private 5G network assurance requires an automated, remote monitoring solution which can be installed on-site and then left to continually monitor the performance of the network, presenting the results in an easy-to-understand format and immediately raising the alarm to the mobile network operator if a problem is detected.

A proactive testing approach means private network customers can stay ahead of potential issues by continuously validating the network performance and have peace of mind their critical communications will deliver for the business 24x7.

The benefits of Private 5G network assurance with TEMS Sense

TEMS Sense is a phone-based remote testing solution delivering fully automated monitoring and real-time analytics. It can be mounted in key locations across a private 5G network. Units are remotely managed and controlled. A proactive testing approach means staying ahead of potential issues and ensuring the business can rely on its critical private 5G network communications.

- Private 5G network customers can have peace of mind that their network is delivering the business-critical service required
- Take advantage of robust and reliable hardware that is designed to be left unattended and with built-in intelligence, including temperature and charging control to ensure successful 24x7 data collection
- Ensure early detection of issues with 24x7 monitoring to enable quick escalation and correction of service-impacting issues that occur
- Automatically alert your mobile network operator or system integrator if a network performance problem is detected

While 5G private mobile networks are typically small, they are also business-critical. Traditional service assurance solutions, however, are large, complex and expensive, and not a feasible option to validate performance for a network of just 10s of cells.
Network testing post-processing and analytics

**Solution: TEMS Discovery**

It can take just as long to manually analyze network testing data and troubleshoot the issues as it did to collect it. Whether it’s detailed analysis and reporting for initial tuning and site/cluster acceptance projects or quickly finding what issues are arising where in the network and implementing the solutions needed, speed and accuracy are vital if you are to use network test data effectively to ensure the best possible customer experience. The key lies in being able to turn network test data into analytics and actionable insights for optimization, at scale and across all your network’s technologies, bands and vendors.

**What is network testing post-processing and analytics?**

Comprehensive network testing post-processing and analytics give you the ability to turn network test data into analytics and actionable insights for the optimization of your network performance. Only by having insights into network performance as perceived by your subscribers at the device, application and network level can you identify problems, troubleshoot performance issues and accurately analyze the subscriber experience at multiple levels.

As your 5G network grows in scale and complexity, your network testing generates ever-larger test data sets. Network issues are hard to identify – with the need to review massive data sets and analyze the data in multiple ways. As your network evolves, issues will unquestionably arise, and you need to quickly identify and fix those issues before they degrade your subscribers’ quality of experience.

Network testing post-processing and analytics must not only provide insight across all your network technologies and bands, it must also support logfiles from other network testing vendors so you can benefit from advanced analytics whatever your data collection method.

Comprehensive network testing post-processing and analytics give you the ability to exceed network and subscriber experience KPIs by quickly finding what issues are arising where in the network and accurately and efficiently implement the solutions needed.

**The benefits of network testing post-processing and analytics with TEMS Discovery**

TEMS Discovery is a comprehensive network analytics and optimization solution based on mobile network testing data. It provides you with unparalleled insights into network performance as perceived by your subscribers. In addition to supporting the complete TEMS suite, TEMS Discovery also supports logfiles from other network testing vendors so you can benefit from its advanced analytics whatever your data collection method.

- Analyze and troubleshoot your 5G network with in-depth UE/scanner cell measurements and NR cell configuration analysis to efficiently address any 5G NR issues
- Efficiently manage large network test data sets by automating data processing functions, from file import to script execution, categorization of problem sets and the generation and sharing of reports
- Quickly identify and solve network issues by leveraging TEMS Discovery’s analytics dashboards, reports and RF diagnostics tools to uncover issues affecting subscribers faster
- Deep dive into network test data by drilling down into the network test data at the device, application or network level to troubleshoot the most difficult problems

"Network issues are hard to identify. You need to review massive data sets and analyze the data in multiple ways."
Centralized management of network testing

Solution: TEMS Cloud

Whether it’s configuring drive test routes, monitoring remote network test equipment, or managing portable devices in the field; the remote control and management of a fleet of test units can be costly, labor-intensive and inefficient. It is important that you can orchestrate, monitor and report on your network testing projects while both your network testers and test equipment are in the field. Centralized test fleet management gives you remote oversight of field devices, as well as the real-time data analytics your team needs to efficiently coordinate testing projects.

What is centralized management of network testing?

Centralized test fleet management enables you to orchestrate, monitor and report on your network testing projects so you can plan and manage multiple projects across a variety of network testing solutions, all from a centralized back-office. This means you can create work orders containing test routines and drive routes and distribute these to field test teams, monitor testing progress in real-time, analyze the captured data and create customized dashboards for real-time analysis and reporting from C-level to engineering.

The ability to monitor field units prevents wasted time and the need for re-drives which can result in costly project delays. Orchestration software must provide real-time visibility of the location and the testing status of all your network testing units in the field, alerting you to any suspected issues so you can quickly rectify them and minimize disruption to testing.

To cost effectively and efficiently orchestrate and report on a distributed network of test equipment, your solution must allow you to remotely manage all your fixed network testing units, from distributing standardized work orders, testing routines and drive routes to mobile units, to deploying software upgrades or remotely running tests on static units.

The benefits of centralized management of network testing with TEMS Cloud

TEMS Cloud allows you to orchestrate, monitor, analyze and report on multiple network testing projects across a variety of TEMS network testing solutions, all from a centralized back-office. It enables the creation of work orders containing test routines and drive routes and distributes these to field test teams. It allows you to monitor testing progress in real-time and quickly address any problems, and it analyzes the captured data and creates relevant reports and dashboards.

- Reduce your network testing costs and the amount of fieldwork required by your skilled engineers with a complete set of back-office orchestration capabilities
- Orchestrate a fleet of test devices via the remote configuration and distribution of work orders to test devices in the field, instructing devices what to test and drivers where to drive
- Improve the quality of your testing with standardized testing routines and TEMS’ ‘definition of done’ to ensure testing is aligned across teams, and testers know when their testing is complete
- Monitor drive test project progress and address operational issues quickly and reliably through real-time visibility of all your TEMS units and a comprehensive alarm system

"The challenge with the old way of doing things was individual highly-skilled engineers conducted siloed network testing. 5G demands a next-generation approach to network testing."
The TEMS Suite

The TEMS Suite is our portfolio of solutions that allow you to address every aspect of testing and troubleshooting your network from a subscriber’s perspective, whether it be just 5G or a combination of multiple technologies. If you are looking to verify the performance of new 5G sites, walk test strategic indoor locations, benchmark your network performance against your competitors, or any one of numerous other network testing use cases, TEMS has a solution to meet your needs. For more on the TEMS Suite, please visit https://www.infovista.com/tems

TEMS Cloud

With TEMS Cloud, you can plan and manage multiple network testing projects across a variety of TEMS network testing solutions, all from a centralized back-office. TEMS Cloud’s web interface enables you to create work orders containing test routines and drive routes and distribute these to field test teams. It allows you to monitor testing progress in real-time and quickly address any problems, and once testing is complete it analyzes the captured data and creates the relevant reports and dashboards.

TEMS Investigation

TEMS Investigation is a powerful drive testing solution for initial tuning, 5G site acceptance, software upgrade verification, new feature validation, network troubleshooting and more. Through our partnerships with device and chipset vendors, we support the latest technologies, features and devices your customers are using. This means you can not only reliably test and improve your subscriber quality of experience, but you can also accelerate your 5G roll-out and gain a competitive edge.

TEMS Paragon

TEMS Paragon is a multi-device benchmarking solution that enables you to compare the service quality of your network to the competition. Its purpose-built user interface allows non-technical drivers to perform advanced network testing. TEMS Paragon is highly scalable, enabling you to test multiple use cases across all your competitors in a single drive test. While seamless integration to TEMS Cloud means testing can be managed, controlled and monitored in real-time by engineers back at HQ.

TEMS SSV

The time and skills required for validating new sites are often a significant bottleneck in 5G roll-outs. The TEMS SSV app leverages Precision Drive Testing to centrally define testing routines and criteria, identifying what to test, where to test and how to get there. When in a location it automatically conducts the tests, meaning even people with no RF expertise can test for you. This simplified and guided drive testing approach helps you get your 5G network to market faster.

TEMS Pocket

TEMS Pocket is a powerful, yet highly portable phone-based mobile network testing solution with support for 5G devices and scanners. It allows you to verify, optimize and troubleshoot your mobile network in environments requiring portability, such as malls, stadiums, offices, and areas with limited accessibility where drone-based testing is the best approach. Its advanced testing capabilities provide actionable insights to improve your subscribers’ mobile experience.

TEMS Sense

TEMS Sense is a phone-based remote testing solution delivering fully automated monitoring and real-time analytics from locations across the network. It can be mounted in fixed locations such as airports and stadiums, or in vehicles such as taxis and public transport. Units are remotely managed and controlled. A proactive testing approach means staying ahead of potential issues and giving your subscribers the quality they deserve.

TEMS Discovery

TEMS Discovery is the wireless industry’s most comprehensive network analytics and optimization solution based on mobile network testing data. It provides you with unparalleled insights into network performance as perceived by your subscribers at the device, application and network level. In addition to supporting the complete TEMS suite, TEMS Discovery also supports logfiles from other network testing vendors so you can benefit from its advanced analytics whatever your data collection method.
Infovista is the global leader in network lifecycle automation (NLA) for the next-gen networks era. With its unique NLA approach, Infovista allows communications service providers (CSPs) and enterprises to improve their network performance and customer experience, optimize their productivity, and reduce their costs, while maximizing return on their investments. Spanning the entire network lifecycle, Infovista’s products and solutions leverage an open, integrated, cloud native portfolio that automates tasks, flows, analytics, and decisions to the greatest extent possible. More than 1,000 customers, including 400 Mobile Network Operators, around the world rely on Infovista to plan, design, deploy, test, operate, support, optimize, evolve, report on and monetize their networks.