White Paper

Telecom, Software & Network Solutions

Digis Squared, Intel Use AI to Reduce Time Needed for Cellular Drive/Walk Tests

INOS software uses AI to achieve best network cell coverage and capacity. Proof of concept test using 4th Gen Intel® Xeon® Scalable processor-based servers reduced model training time from 24 hours to 54 minutes[1]

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Fine tuning of cell transmission power and antenna parameters are critical aspects of maximizing cell coverage and capacity and ensuring quality of service (QoS).

To achieve optimum network performance, mobile network operators (MNOs) use drive/walk testing to collect data from the network. Drive/walk tests allow MNOs to get radio frequency (RF) coverage data that takes into consideration roads, clusters, buildings and other obstructions or landscape features.

This collected data includes many parameters and messages across all operating technologies. Examples of this data include reference signal received power (RSRP), signal to interference and noise ratio (SINR), throughput, layer 3 signaling, network events and others.

These drive/walk tests are also used to identify the impact of terrain, clutter, heights and buildings on network coverage and network performance.

Drive/walk testing is an iterative process that involves measurement collection, analysis of the measurements, identifying network pain points, and assessing the status of necessary actions and the impact of these actions on cell power and antenna parameters (azimuth, tilt, height). With this information, MNOs make changes to the antennas and transmission power, and then redrive the areas to collect the measurements again and reassess the situation again and again until the network reaches optimum coverage.

Running this process manually is time consuming and far from cost effective. With the continued growth and densification of 4G and 5G networks and the emerging growth of 5G standalone networks, drive/walk testing becomes more complex and more essential.

Drive/walk testing is also critical in the new site/cell acceptance process, which is very important after any new site, new cell, or new sector deployment. Also, acceptance could be initiated after changing any part of the antenna system, or after swapping traditional radio access network (RAN) systems with open RAN technologies.

Drive/walk testing is also initiated in response to customer QoS complaints, the addition of a new large node in the network, or periodic migration activities done to assess network performance or customer experience.

Artificial intelligence (AI) can play a vital role in the drive/walk testing process by providing models that lead to a reduction in the number of needed iterations to accept or optimize the network performance, coverage and QoS.

[1] Intel does not control or audit third-party data. You should consult other sources to evaluate accuracy.

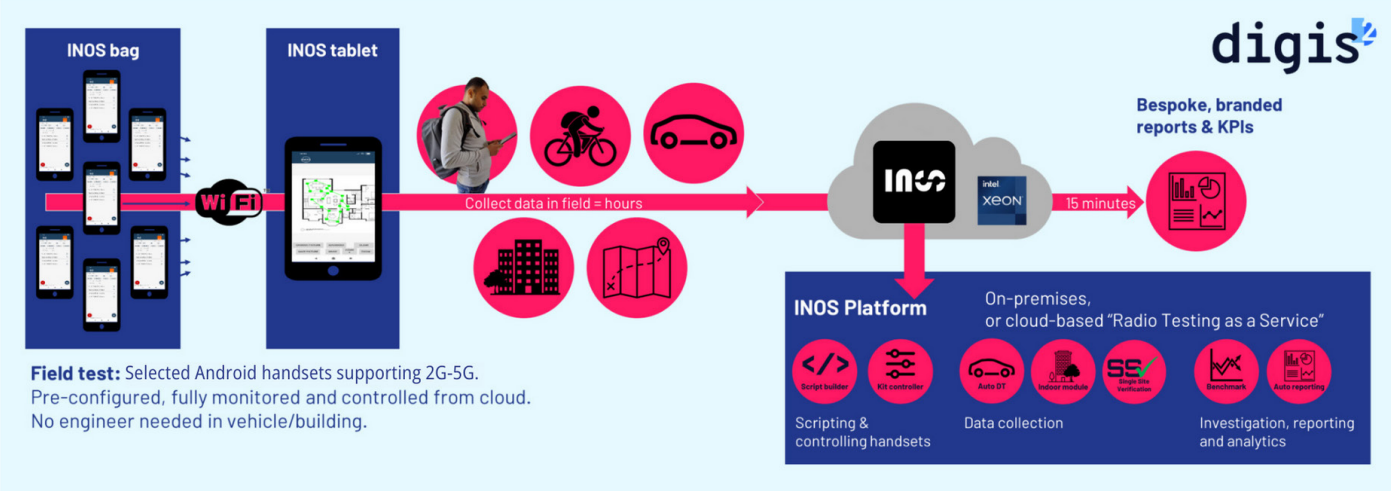

Figure 1. Drive testing process using INOS AI-based software.

Digis Squared is an Intel® Network Builders Gold Tier ecosystem member, and a leading provider of drive/walk testing tools, solutions, and services to MNOs worldwide. The company is at the forefront of using AI to simplify the drive/walk testing process.

Digis Squared uses its state-of-the-art INOS AI tool to help MNOs correctly predict the impact on network coverage and performance of any change of RF parameters, like transmission power, or antenna settings related to height, tilt and azimuth.

INOS makes its predictions on the collected data from drive/walk testing, which reduces the number of drive/walk testing iterations, leading to a real leap forward in operational efficiency and staff time utilization. Using INOS also reduces the dependency on humans in the overall optimization process.

INOS is in use at tier one MNOs in the UK, Middle East and at tier one and tier two MNOs in Africa. Recently, Digis Squared conducted a proof of concept (PoC) at one of its tier one African MNOs to measure the predicted and actual accuracy of the INOS models and to assess the reduction in AI training time when servers based on 4th Gen Intel® Xeon® Scalable processors were used in the testing[2].

INOS Uses AI for Drive Testing

INOS is an automated, cloud-based cellular network drive test, post-processing and field optimization solution for voice, video and data traffic. INOS is vendor agnostic and uses AI to minimize the time-consuming work of drive testing a newly installed base station or responding to performance or coverage issues or complaints.

As seen in Figure 1, the INOS app provides scripting and control of the handsets, which relay the drive/walk test data to the cloud.

INOS also monitors data collection and creates an AI model representing the network. These capabilities can be used for investigating a service issue, reporting on base station performance and analytics. MNOs can also develop their own custom reports and key performance indicators (KPIs).

INOS Features and Benefits

- Speeds up problem detection
- L1, L2, L3 and packet capture (PCAP) support
- Full customization and RAW data availability (structured database)
- Large number of pre-defined KPIs built into the platform
- Enables MNOs to create their own unique KPIs
- Customizable analytics dashboards including maps, tables, events, messages and deep filtering options
- On-screen analysis including coverage, quality and interference analysis
- Throughput analysis
- Cross-sector detection
- Analytics exports in a wide range of formats (KML, .xlsx, etc.)

INOS Reduces Drive Testing Iterations

With INOS, the time-consuming and iterative job of drive testing is reduced dramatically. The INOS process starts with the collected data from a drive test that is used to build a baseline model of the area in and around the path of the RF signal. This baseline model includes all obstructions, such as buildings or mountains, and any RF overlap caused by neighboring cell towers.

Normally, the results of the drive test are used to make changes to the transmission power or direction of the antennas to fill in gaps or adjust for obstructions. But these changes are based on estimates and experience and must be confirmed with another drive test. This iterative process continues until the

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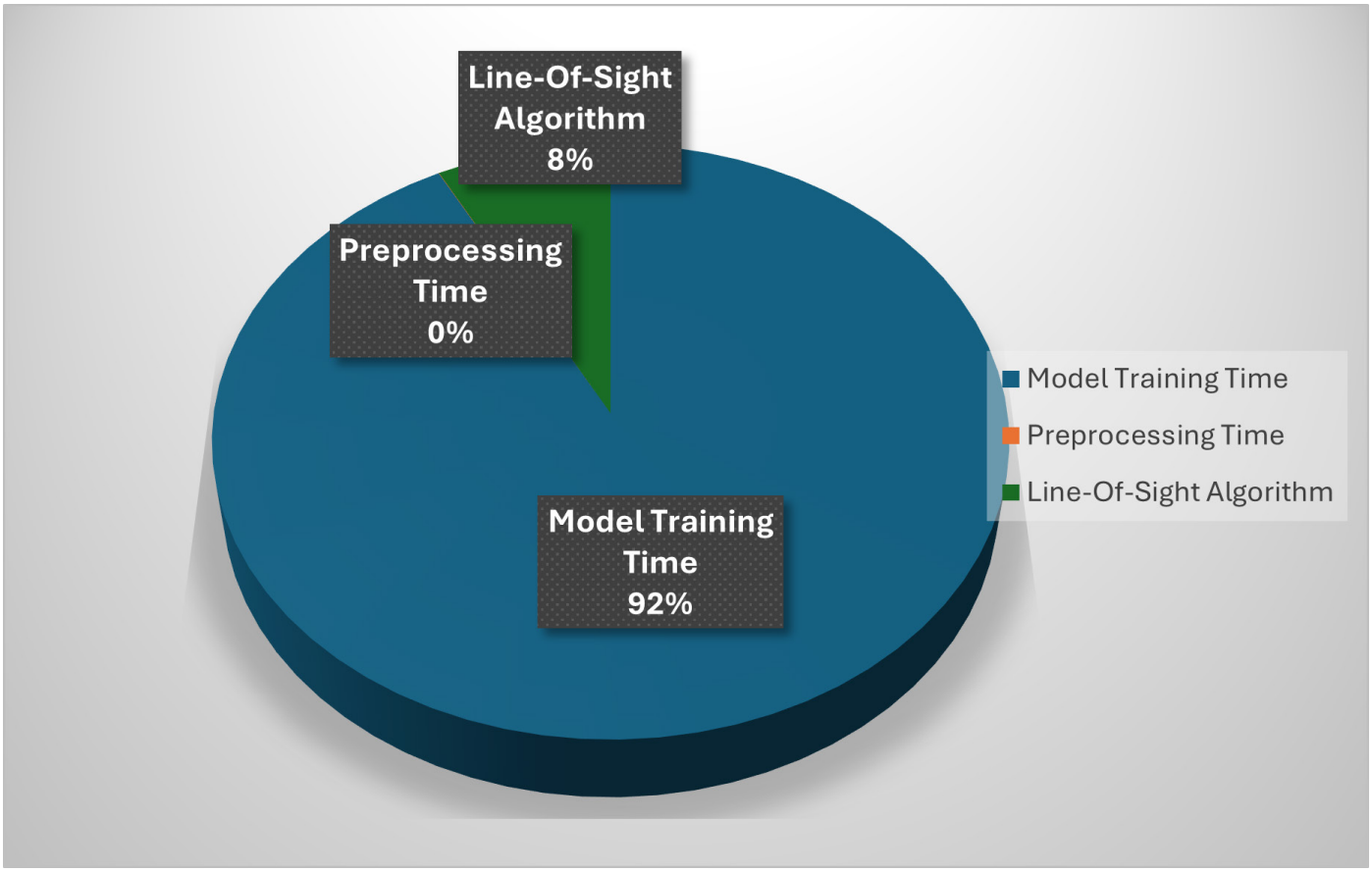

Figure 2. Total time needed for INOS AI model processing by percentage. At 92.21%, AI training takes the most processing time.

RF coverage is optimized and any overlap with adjacent cell sites is minimized.

INOS reduces that iterative process. It uses the model developed by the initial drive test to recommend changes that will optimize the coverage – both for acceptance testing of initial deployments and for future changes that impact the coverage or capacity.

INOS eliminates the need for multiple drive tests to confirm intermediate changes, with an additional drive test only needed at the end of the process.

PoC Confirms Model Accuracy

Digis Squared, using Intel-based servers, tested the model accuracy through this PoC using the network of a tier 1 MNO in Africa.

The goals of the PoC were to reduce the time needed for AI model training and to confirm that the RF changes made to the model were accurate as shown by a low mean absolute error (MAE).

AI model training consumes over 92% of the time needed to process the model (see Figure 2). Normally, AI model training is done using onsite laptop computers. As part of the PoC, the Digis Squared team replaced the laptops with cloud access to a server based on 4th Gen Intel Xeon Scalable processors.

4th Gen Intel Xeon Scalable processors combine up to 64 high-performance processor cores with up to eight built-in accelerators for maximum performance efficiency. Integration of accelerators into the processor redefines CPU architecture and provides a more efficient way to achieve higher performance than relying solely on increasing the CPU core count for workload processing.

This architecture delivers scale and performance for compute-centric AI applications. Access to processing power and fast memory is important because INOS consumes large quantities of both. The high number of Ultra Path Interconnects (UPI) enables connections to memory and high-speed access to other features. For the PoC, the CPU's support for multithreading and multicore processing and support for large memory capacity made the difference. The use of this server reduced the time needed for model training from 24 hours to 54 minutes.[3]

Figure 3 shows the accuracy predicted by the training model and the real-world accuracy that was realized by drive testing. The model predicted a MAE distribution with a median accuracy of 2.6 dB. The median MAE accuracy for the real-world testing was 3.3 dB.

The variation in the model's performance comes from the variation of the quality and amount of drive test data. Both error numbers are very good and show that the model doesn't

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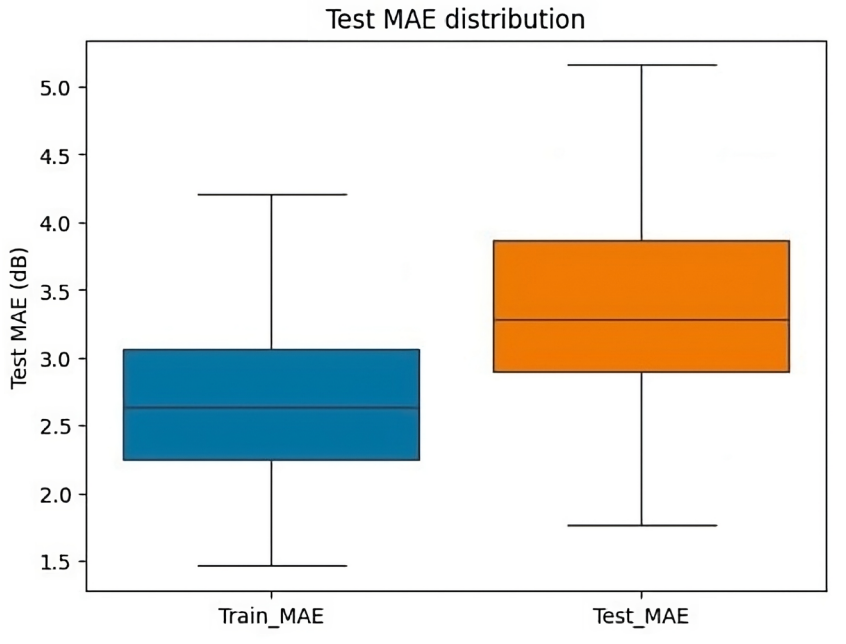

Figure 3. MAE results show high accuracy of RF changes proposed by INOS. The results on the left-hand side are predicted by the AI model and the results on the right-hand side are from actual tests (lower is better).

suffer from overfitting. The results prove that INOS predictions can be trusted, allowing MNOs to reduce their drive test iterations.

Conclusion

Drive/walk testing plays a growing role in getting full capacity and coverage performance from cellular base stations. But the process relies on a costly and time-consuming cycle of testing and then making RF and antenna changes. INOS from Digis Squared uses baseline drive test results to make recommendations that can be implemented without any further hit or miss iterations.

INOS is cloud-based, which enables lower cost drive/walk testing kits and simplifies the drive test data collection process. In the cloud, INOS can use high performance servers based on 4th Gen Intel Xeon Scalable processors which provide the compute and memory capacity needed to dramatically reduce the AI training time. The accuracy of INOS was confirmed in a PoC that showed very low MAE that was confirmed by actual drive test results.

INOS, powered by Intel architecture processors, represents the next generation of cellular drive test solutions.

Learn More

Digis Squared Home Page

INOS Product Page

Intel® Network Builders

Intel® Xeon® Scalable Processors

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