SAND TECHNOLOGIES

Expand the Network without Expanding Costs

How AI and digital twins solve the telecommunication industry's need for cost-effective network buildouts

A World, and Industry, in Flux

Technology is constantly evolving. Yesterday's groundbreaking gadgets are today's drab devices. This striking reality has implications for consumer and industrial markets alike. The always-on world in which we live requires constant connectivity. Yet as end users clamor for the latest tech, telecommunications companies are in a continuous struggle to build and maintain networks that meet the capacity and high-speed demands of millions of connected vehicles, smart buildings and even smarter handheld products.

Sustainable operation and growth in the telecommunications sector are essential ingredients in a connected society. As new advancements push the boundaries of what's possible in an IoT world, network operators must identify efficient, cost-effective strategies to upgrade and expand their networks to accommodate the needs of consumer, enterprise and public-sector users.

Investing in infrastructure is more than just a critical strategy for growth. It is necessary for survival. But in a challenging economic climate, industry leaders must strike a delicate balance between the rising costs of network planning and new technology while delivering a clear ROI on those capital expenses. Artificial Intelligence (AI) and digital twins can help quickly identify the most cost-effective expansion strategies while uncovering opportunities to optimize the network and build new revenue streams.

Key Takeaways

- The **profitability landscape** in the telecommunications industry has become more complex
- AI is redefining traditional **network planning methods**
- AI-based models develop **network expansion plans** within days, not months
- With AI-based network planning, telecommunications operators will change how they think about and manage their **digital infrastructures**

DIFFICULT ECONOMIC CLIMATE

The telecommunications industry has thrived on low borrowing costs for years, facilitating aggressive network expansion. Today's global economic environment adds complexity and increases capital costs, challenging operators' already difficult profit landscape and straining their ability to invest in the network expansion necessary to meet current and future connectivity demands.

Rising interest rates globally threaten to reshape the telecommunications sector, making it even more expensive for companies to fund new infrastructure projects and upgrade existing networks.[1] Telecommunication companies are already among the world's most indebted companies (3 of the top 10).[2]

This new challenge risks slowing the pace of expansion. As a result, it is more important than ever for operators to evaluate and validate their network expansion plans quickly.

AI ADDRESSES NETWORK PLANNING CHALLENGES

Building and maintaining vast telecommunications networks requires continuous investment. This colossal expenditure is not just a financial burden but a technological necessity in an increasingly digital world.

Many telecommunications companies turned to AI to reduce operations and customer service costs.

Now, this same technology can provide significant savings in one unexpected area: network planning.

> AI-based models and digital twins can create highly accurate plans in days, not weeks.

Multiple telecommunications companies are already achieving massive cost reductions in network planning by using AI-based models and digital twins to develop strategic network expansion plans. These tools can create highly accurate plans in hours, not weeks.

1. Jekaterina Beljankova, "The Global Ripple Effect: What The Surge In Interest Rates Means For Businesses And Investors," Forbes.com, 2024.
2. Luca Ventura, "The World's Most Indebted Companies 2023," gfmag.com, 2023.

Traditional Network-Planning Approaches are Insufficient

Network expansion decisions are based on diverse datasets. Evaluating data such as demographic analyses, market demand studies, population density, income levels and geographical constraints has historically been a valuable and necessary step in determining where to expand the network and identifying the regions with the highest potential return on investment.

These comprehensive surveys and feasibility studies are meticulously prepared to ensure effective resource allocation, allowing telecommunications companies to expand their infrastructure strategically. However, as the connected world generates more and more data, telecommunications leaders can no longer afford to spend months completing these labor-intensive processes.

Network data traffic volumes are skyrocketing. User expectations about speed, latency and uptime for seamless experiences are at an all-time high. Outdated tools and methodologies simply can't keep pace with the connectivity demands of modern markets. Operators must rethink their network-planning strategies.

> The traditional approach to telecommunications network planning is very labor-intensive and can take months to complete.

AI and advanced analytics can help drive smarter, faster and more adaptive network management while accurately determining cost-effective expansion plans.

A New Approach: AI-driven Network Planning

Artificial intelligence transforms network planning from a manual and time-consuming task to a dynamic and highly efficient process. AI leverages advanced algorithms and machine learning to help network operators develop the most cost-effective expansion plans. It can also help identify opportunities to optimize existing towers for greater profitability.

AI-driven network planning allows telecommunications companies to manage their network growth strategically and proactively, doing both with great speed and accuracy and changing how operators manage their digital infrastructure.

> AI network planning changes how operators manage their digital infrastructure.

THE ROLE OF AI IN NETWORK PLANNING

Network planners must consider an increasing amount of data when making network investment decisions. AI can help by integrating and analyzing data and providing scenario modeling to help operators evaluate multiple options to make the most prudent choices.

Predictive Analytics

By analyzing historical network traffic data, AI identifies complex trends and accurately anticipates future demand to determine the best expansion strategy.

Optimization

AI can integrate and analyze many datasets quickly and accurately, significantly reducing the time it takes for traditional network planning.

Automation

AI automates complex planning tasks, reducing the manual effort required by network engineers.

Simulation and Modeling

AI-driven simulations allow operators to run what-if scenarios and see the results of each option, including the financial impact.

How Does the Model Work?

Accurate expansion plans require many datasets, including high-quality, high-fidelity 3D models of clutter data. Clutter data is information about environmental features or physical obstructions affecting radio signal propagation. This data is essential for planning and optimizing telecommunication networks.

Preparing expansion plans with clutter data at scale takes teams of people and a lot of money. The result yields a good map but quickly becomes obsolete if a new building goes up next week. Considering the rapid growth in cities, this manual process is unsustainable.

With AI, telecommunications companies can keep their models accurate.

AI's ability to harness spatial data expands the network planning process from simple maps and coordinates to an exercise in understanding the intricate ways elements work together to drive smarter decisions and improved expansion strategies.

3D clutter modeling can also help telecommunications companies understand and optimize network performance. By creating three-dimensional representations of data clusters, operators can visualize complex relationships between network parameters like signal strength, user density and interference patterns. The model can predict how physical obstructions affect signal propagation by analyzing various forms of data (geographic features, building footprints, vegetation density and existing infrastructure).

With this detailed spatial data, operators can identify the optimal locations for new cell towers, small cells and other network elements that can expand and enhance coverage and performance. This advanced AI modeling technique allows for more precise and efficient network planning, minimizes interference, maximizes signal quality and ensures that users experience reliable connectivity even in densely populated or geographically complex areas.

AI Network Planning Tools

Network planning is an unsung hero in the telecommunications field. With strategic network planning, operators can respond to ballooning network traffic demands and anticipate expansion needs in the future. This process considers capacity, coverage and performance to maintain a seamless user communication experience.

Much like AI-enabled tools are changing user-focused aspects of the telecommunications landscape, they are also transforming the world of network planning. The shift toward AI-driven tools and solutions sets new benchmarks that assist telecommunications companies in meeting the growing demand for reliable and high-speed communication.

AI AND DATA ANALYTICS PLANNING MODEL

An AI and analytics-based **network planning model** helps telecommunications companies optimize their network expansion plans. The model uses machine learning, network graphs, geospatial analytics and other data to provide granular insights that maximize investments.

The model has two prominent uses: optimizing each tower to maximize reach and signal strength and finding the most cost-effective expansion strategies.

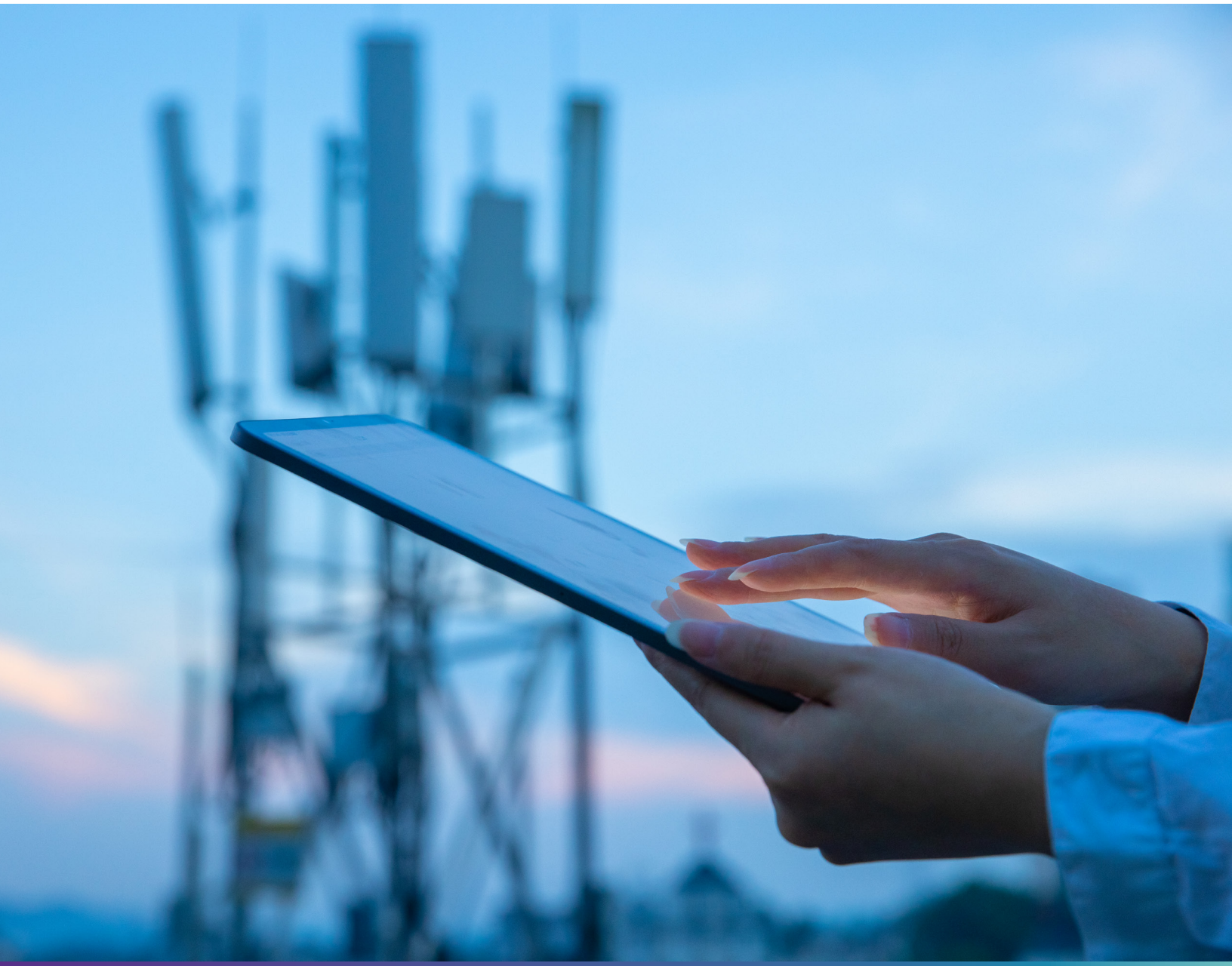
NETWORK DIGITAL TWIN MODEL

Digital twins have powerful capabilities that benefit any industry. Imagine the improvement in decision-making with the ability to run multiple what-if scenarios in a simulated real-world model and evaluate their impact before making a change. Scenario testing does that, leading to better decisions and more impactful investments.

The **Network Digital Twin** can model complex networks to uncover patterns, anomalies and opportunities for growth. Telecommunications companies can experiment in real time to determine how to improve network configurations. The model can also guide fiber rollout strategies to capture the most value.

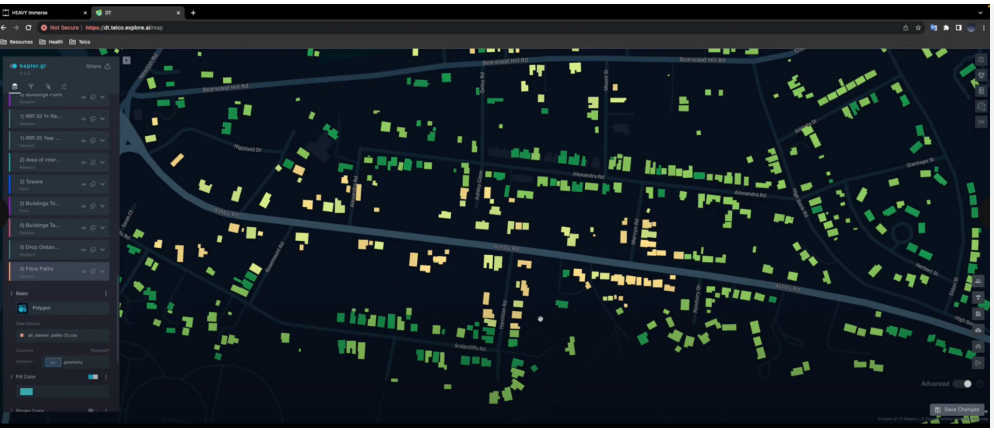
Real-world Telecom Examples with AI-driven Network Planning

Prioritizing network resources is critical for telecommunications companies looking to maximize ROI when expanding their networks. AI models can provide network planners with detailed investment roadmaps to optimize their rollout strategy at the home-by-home, street-by-street and tower-by-tower levels. These plans enable operators to optimize CapEx investments for maximum impact.

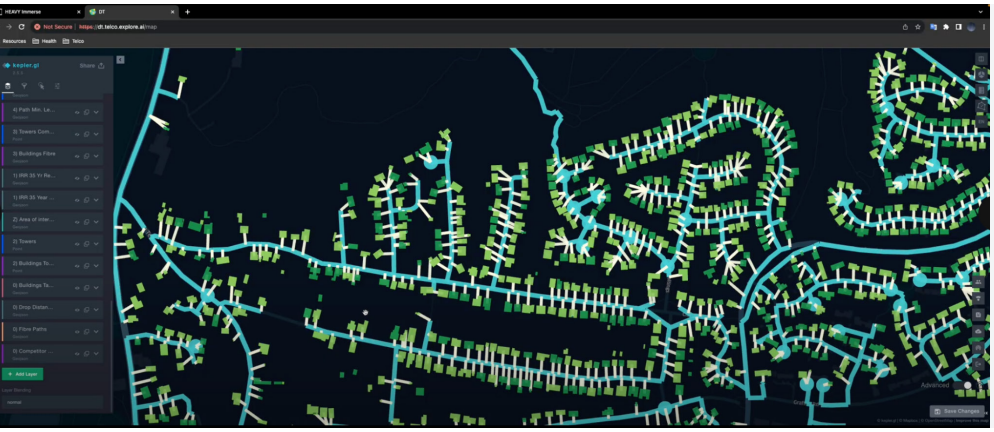


EXAMPLE

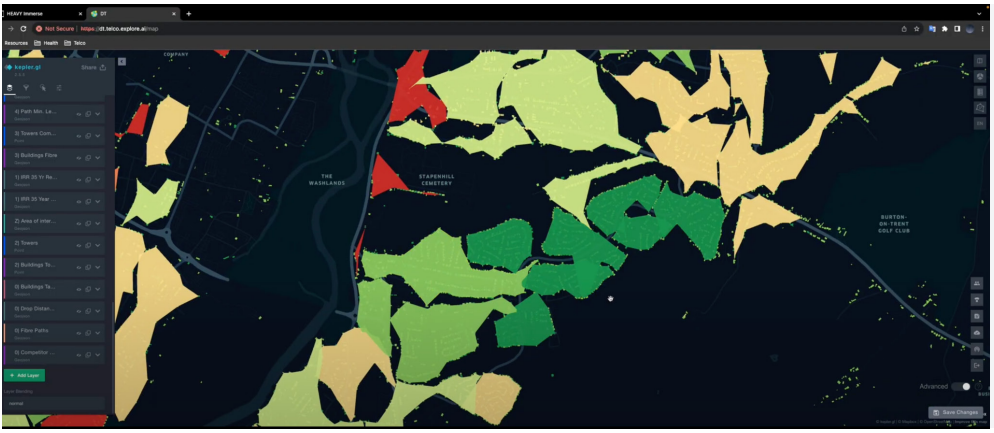
Determining Profitable Areas for Fiber Rollout



In the first step, the model identifies profitable areas to roll out fiber by predicting take-up by building. The first image shows a detailed view of a specific area and the potential take-up. The dark green buildings have the highest predicted profitability.



The next step is to overlay the fiber needed to reach every building, indicated by the blue lines, and the drop lines (white lines) to each building.

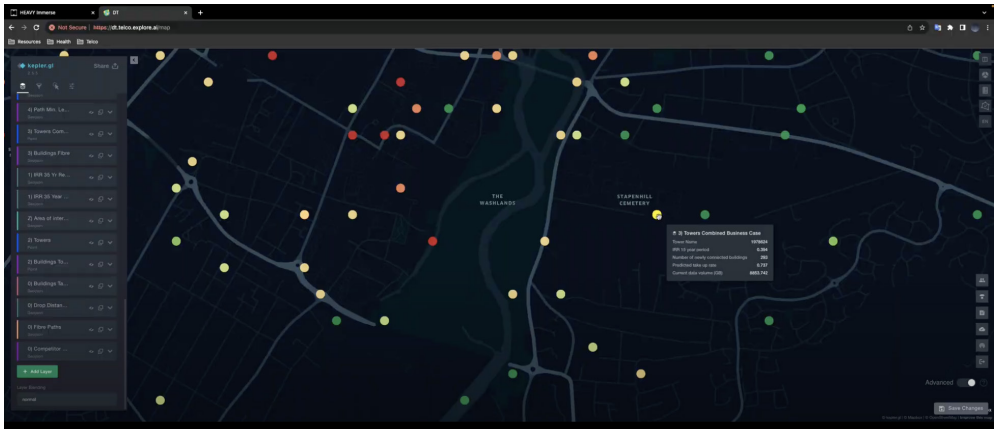


Aggregating all the data shows the different rollout plans by profitability — the dark green zones are the most profitable, and the red are the least profitable. The results show operators the most profitable areas to expand their networks.

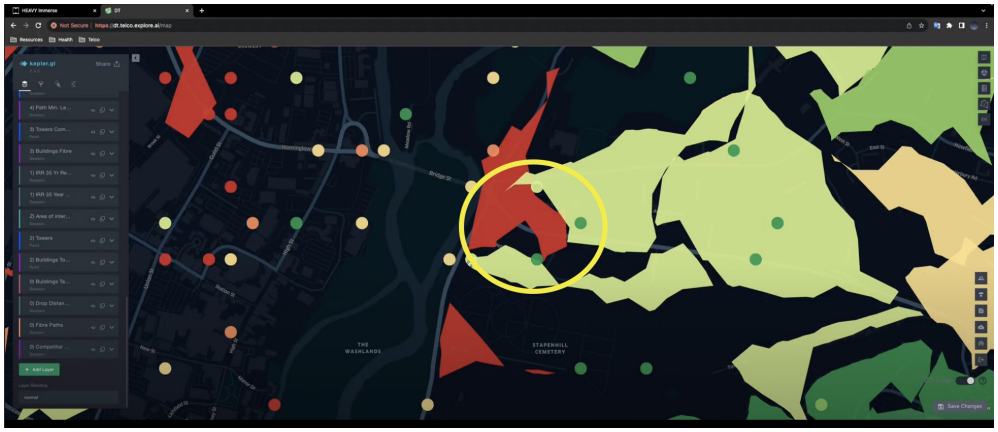
EXAMPLE

Tower Optimization

In this example, the model identifies profitable uptake areas by towers. The image shows all existing towers. The colors represent the level of profitability for each tower. Red indicates low profit, and green indicates high-profit towers.



Next, in the image below, the operator overlayed tower profitability with the predefined fiber rollout plans. Operators can see cost-effective expansion opportunities with two highly profitable towers alongside a low-profit fiber rollout plan generated by the model.



The operators can optimize these two towers to increase profit without investing in an expensive fiber rollout in an unprofitable area.

The Evolution of Network Planning

The telecommunications industry operates under a state of continuous change. In fact, the sector is widely considered one of the most rapidly changing industries, and it is under constant disruption.

New technologies will continue to emerge, placing increased pressure on network operators to optimize, expand and push the boundaries of their networks to keep up with technological and market demands.

In many ways, network planning has not kept up. But AI is leaving its mark, integrating into the network-planning process to help telecommunications companies find the most cost-effective strategies to expand their networks.

With the next-generation network on the not-so-distant horizon, fast and efficient AI network planning will quickly become indispensable.

Sand Technologies' teams of experts have particular expertise in the telecom sector and serve clients around the world through training as well as direct support.

Contact us today to see how your business can capitalize on data intelligence.

telecom@sandtech.com

sandtech.com/telecom