



# Leveraging Digital Twins for Improved Network Design

The Transformational Effects of Digital Twin Technology on Radio Access Networks

One of the most interesting and transformative technologies of our generation is the concept of digital twins. While the name might conjure images of video game avatars, a digital twin is essentially a digital representation of a real-world entity or system. A driver using their vehicle's navigation system is a good example of a digital twin at work, with a digital representation of real life traffic conditions and roadways. Remember what life was like before this technology existed? We wasted a lot of time getting lost.



# Digital Twins Go Beyond Simple Models

Sticking with the navigation analogy, digital twins are more than just a static map of roads and highways. Value grows exponentially when new layers of information are added, like traffic alerts, accidents, detour options, construction zones, speed traps, or available parking spaces. The more layers of data you add, the more value the digital twin provides.

Now, imagine a world where this concept expands across the business world. Yes, there will be a day when airports, warehouses, factories, hospitals, automotive plants, electrical grids, telecommunications networks and even human bodies will all have a digital twin at their side to help navigate daily decisions. The business benefits will be transformative.



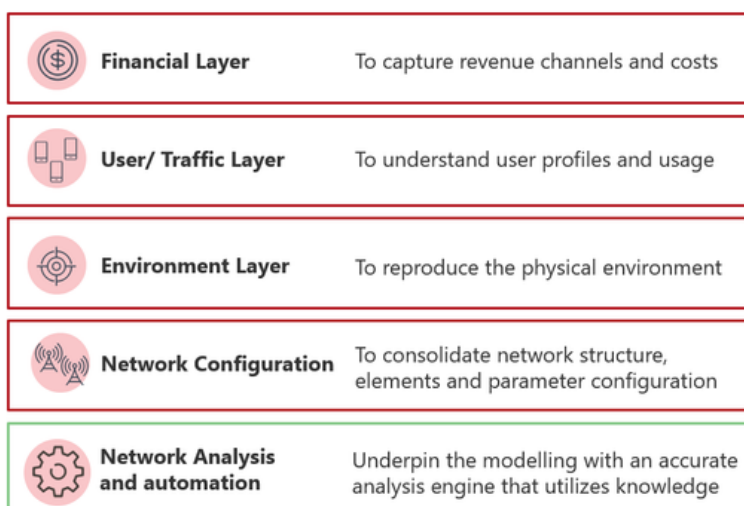
# The Mobile Telecom Sector is a Prime Candidate for Digital Twin Technology

**Gartner estimates that over 80% of network problems are due to improper configuration and change management. Digital twins can help solve this challenge.**

Mobile operators have used network planning and optimization tools for years to create digital models of their networks to help design and manage complex systems.

Now, with advancements in machine learning, AI, and real-time processing capabilities, these tools enter the digital twin realm by going beyond just a static view of a service provider's network to include additional layers of information that provide a more real-time view of its broader surroundings, such as GIS maps of terrain, buildings, and vegetation, along with real time information on network traffic, subscribers, devices, and even costs and revenue.

This is critical because cellular networks don't exist in isolation.



By adding these additional streams of data within a digital twin, CSPs can precisely replicate live network environments to create a truly accurate view that continues to evolve just as the real network evolves.

A service provider's digital twin enables network engineers to quickly and cost-effectively simulate different scenarios to see what the outcome would be under different circumstances – without investing capital resources or risk damaging the live network.

# Network Complexity Drives Demand for Digital Twins

Modern networks have grown immensely complex, resulting in an environment where a simple change in one part of the network may have an unforeseen ripple effect somewhere else. Even minor errors can trigger unforeseen and significant impacts across different sectors, resulting in costly network failures, SLA infractions, service delays, and upset subscribers.

The ability to design and test different network scenarios and knowing exactly what that impact would look like has huge advantages, allowing CSPs to:

**Improve processes and speed up innovation**

**Speed up network expansions and upgrades**

**Gain more control over security and operations**

**Optimize signal coverage and strength**

**Reduce the risk of changes to the network**

**Make smarter OPEX and CAPEX decisions**

**Troubleshoot network issues before they occur**

Leveraging digital twin technology to maintain an accurate model of the network allows operators to achieve ambitious site integration targets. With this technology, operators can efficiently and cost-effectively test an extensive range of new parameters and capabilities, enabling them to make well-informed decisions regarding network design in a fraction of the time.

# Why Digital Twins are Needed Now

5G radio networks have become so complex that it's become nearly impossible to design and optimize them using yesterday's tools and processes. Designing and deploying 5G networks present unique and unprecedented challenges:

## 1 - Scale

The first major challenge is the sheer enormity and complexity of 5G radio networks. Each new cell site added to the network introduces hundreds of parameters. When multiplied by the thousands of new cell sites needed for 5G, the enormity of the task becomes apparent.

## 2 - Spectrum Challenges

The frequency band at which 5G operates is especially finicky, requiring an increased number of cells to provide adequate coverage and capacity, making the scale even more demanding.

## 3 - A Mix of Equipment and Systems

Integrating equipment and systems from various vendors with differing technological configurations can be challenging. This complexity is especially pronounced in the context of 5G. Each cell site requires meticulous planning to optimize its performance to its specific environment, and for operators with thousands of cell sites to design with a mix-up of legacy equipment and systems to account for, this quickly becomes overwhelming.

## 4 - Workforce Limitations

Given the sheer volume of new 5G sites required, the number of available network designers, no matter their experience, are inadequate to meet this challenge. Moreover, network engineering teams spend far too much of their time on repetitive tasks. A digital twin can reduce network design tasks from hours to minutes.

To build a digital twin, the right tools are essential; ones that can automate 5G network design and allow these experts to focus on higher-value tasks that demand their extensive expertise. Fortunately, advancements in AI, GIS, and network planning tools are progressing at just the right time.

# Digital Twin Consistency Requires Automation



For those involved in RAN network planning and design, a digital twin will certainly become an invaluable resource, but creating one should be viewed as an evolutionary journey. One of the most critical first steps is to create an accurate view of the live network, otherwise it will only lead to poor decision making.

For any digital twin to be useful it needs to constantly evolve to reflect real-world network conditions. When engineers need to introduce changes to the network, altering the properties of a cell or a group of cells can potentially compromise network operations and degrade service quality.

To prevent this, consistency checks are automated within the digital twin application, emphasizing speed of execution and adherence to the 'right first time' principle. This is one of the primary benefits of digital twins – their ability to mirror real-world systems and maintain this accuracy indefinitely is their 'superpower'. But it doesn't happen instantly.

# Digital Twin Consistency Requires Automation

Creating a digital twin for automating network design requires:

**Focusing on incremental accuracy**

**Adopting an evolutionary mindset**

**Building a robust feedback mechanism**

Building a digital twin isn't a one-and-done project. It's an evolutionary journey that requires layers of AI-powered cloud-based software solutions paired with automation: automated updates, automated outputs, and automated processes, all working in synch. APIs are also critical to supporting the robust feedback loop necessary to automatically maintain an accurate digital twin.



As mobile networks continue to evolve, the integration of digital twin technology underpinned by automated network modeling becomes paramount for operators. These advancements are pivotal in not only facilitating efficient network planning and design but also in delivering an elevated quality of service while curtailing operational costs.



# How TEOCO Can Help

Here's how TEOCO can help:

## **ASSET**

A suite of solutions for designing and delivering cost-effective high performance networks. It helps users understand traffic demand by leveraging crowdsourced data, geolocated traffic data and performance and configuration management network data. The ASSET suite addresses all aspects of network design: macro, small cell, backhaul, multi-height coverage and capacity and automated design optimization.

## **Mentor**

A suite of applications that utilize advanced subscriber geolocation analytics for radio access network optimization and troubleshooting. It provides valuable insights across devices, subscribers, and locations.

## **SmartCM**

A configuration management and site integration tool that maintains network integrity by automating the monitoring, auditing, updating, and reporting on cell site configurations. It's able to synchronize thousands of network parameters with OSS data daily.

TEOCO provides what mobile operators need to address today's constantly evolving network design challenges with a path towards supporting tomorrow's digital twins.



**Contact us  
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