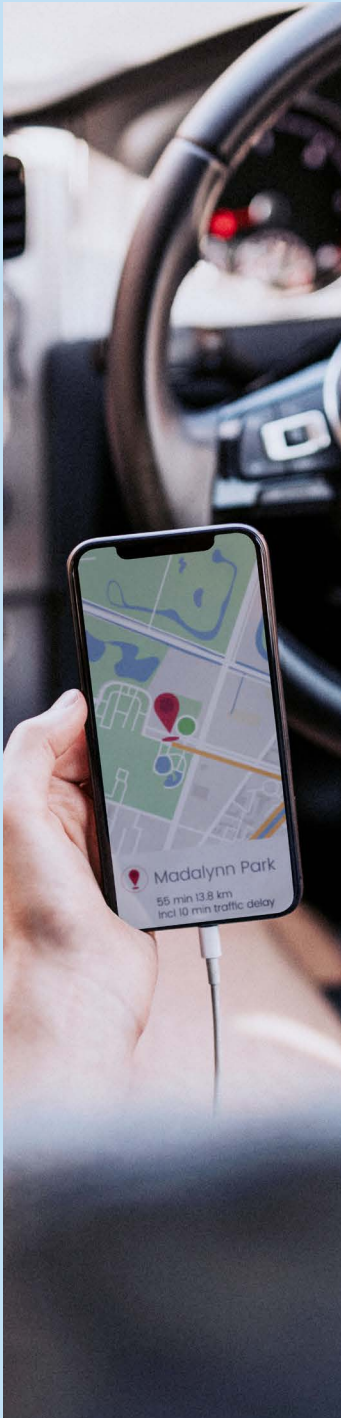




5G AND GIS: TWIN FORCES PROPELLING NEW EVOLUTIONS

Abstract

5G cellular networks are being rolled out in countries across the world. For 5G rollouts to be truly successful, the networks need to be well planned and accurate. This involves the exhaustive inventory data and precise location data; therefore, Geographic Information Systems (GIS) play an important role in the existence and performance of 5G cellular network for effective and real-time operation. It is therefore imperative that the two technologies that feed off each other are rolled out together. The twin technologies can offer governments and enterprises unprecedented new use cases in control and management of far-flung assets.



When the bard opined that “There are more things in heaven and earth...” he certainly did not dream of 5G in his list of ‘philosophies’. But the fifth generation of cellular networks (5G) is here, significantly faster than 4G and with much lower

latency. 5G comes with the promise of connecting massive numbers of embedded sensors, ushering in modern networks that can support a high density of control and monitoring equipment. Concepts like smart cities, safe driverless cars and MIoT

(Massive Internet of Things) can step out of books and plans into reality. 5G also promises radical evolutions in the way we work using augmented and virtual reality.

Data and more data

All of these hinge upon data - massive amounts of it, planetary size massive. This is where geospatial data comes into play. Geospatial data encompasses information about the earth - from the base location information (latitude and longitude) to characteristics and attributes such as geographic information and weather patterns. Overlaid on this comes human-created attributes such as mobility data,

satellite imagery, statistical information and other information of interest that brings the geospatial data alive in Geographic Information Systems (GIS) and makes it usable in multiple dimensions. To stretch a literary aphorism, 5G and geospatial are joined at the planetary hip! Let us start at the beginning. With over three quarters of the world’s population using mobile phones to transact their

daily lives, it is time to look beyond mere communication, work productivity and infotainment with cellular networks. With higher speeds and lower latency, governments can now provide city- state- and country-wide public services and engage with citizens, no matter where they are, with 5G.

Success of 5G depends on infrastructure and geospatial data

For 5G rollouts to be truly successful—that is, to provide degrees of efficiency and economy that are much higher than 4G—the networks need to be extremely well planned and truly expansive. The primary reason? 5G operates in higher frequencies and very short ranges - a requirement to carry large amounts of data. These frequencies have a very short range that can be impacted by even the tiniest of obstructions - think the size of a pea, or a raindrop or even the palm of one's hand!

That is why the infrastructure rollout for 5G has to be planned and executed down to the minutest detail: Geospatial data needs to be factored into important decision makings – order management, site selection, target profiling & network provisioning. Above factors leads into

the planning and placement of antennae to avoid local obstacles and hazards like foliage, buildings (2D or 3D) or even temporary weather patterns like rain. 5G installations need accurate location data: Effective 5G hinges on 'location awareness'. This translates into a significant fiber/cable rollout and massive number of telecom towers strategically seeded across the length and breadth of the planet providing location data along with information on not just weather conditions and vegetation, but street-level data such as buildings, furniture and objects. That is why authoritative geospatial data is essential for 5G rollouts.

With technology advancements, it is possible to acquire and process data from satellites in real time, enabling live

consumption of the geospatial data.

The converse of the '5G needs accurate geospatial for effective deployment' law is that 'geospatial needs 5G networks to handle massive data loads in real time'. Geospatial data-based technologies include GIS, GPS (Global Positioning Systems) and remote sensing technologies.

What else does it take to make 5G effective? To truly support effective 5G rollouts, with the kind of spatial data handling and processing, GIS requires cloud-native mapping solutions to visualize this data that will help [telecommunications](#) providers design effective 5G networks. Planners also need to make decisions about qualification of service, site selection of network components, and best methods to connect these components.



Here are some immediate benefits of the convergence of these technologies:

- **Land surveys:** Across countries, the proper measurement, categorization and mapping of land is an essential and legal requirement. 5G+GIS can transform this arduous process by enabling transmission of real-time land contour and terrain information from surveyors back to the servers. For Example, Technologies such as real-time kinematic (RTK) GPS can provide centimeter-level accuracy in land measurements. Surveyors can use autonomous remote sensing tools to access and measure remote or inaccessible areas as well.
- **Site Selection** - Analysis and Identification of Potential Cell Tower Sites: Additional to Survey, GIS will be basic planning tool to establish the proper sites or location to install the towers. Unlike 4G, 5G requires more towers with high frequency spectrum, so it requires multiple and small cell base stations to operate and function. And there are other factors determines the location of cell towers – i.e., sites must be near a major roadway and must be rural farmland etc., therefore, GIS plays a major role in building the maps & other datasets to determine the sites.
- **Internet of Things (IoT)-based decision making:** Telecom companies use GIS to convert raw data from tens of

thousands of IoT sensors into actionable insights. These insights can help city governments make crucial decisions with respect to water, power, internet connectivity, sanitation, traffic and more. The 5G can improve such systems by connecting a massive number of embedded sensors. This allows networks to support huge control and monitoring infrastructure. Smart Grids that rely on massive IoT finally can become reality. Think of mission control communication in the hands of the governments or private service provider of large urban metropolitan areas of 10 million+ populations that can effectively tackle traffic congestion and redirect traffic in real time. Autonomous vehicles can get a heads-up notification to remap to their destinations. The improvements in efficiency, as well as compliance with sustainability goals, can both be significant.

- **AR/VR-enabled maintenance:** Proactive and predictive maintenance in high-risk settings such as cell towers, oil rigs, factory lines or undersea cabling can be made far more efficient with 5G+GIS technologies. Workers in such situations can pull up detailed work instructions or manuals, even 3D animated how-to videos, on the spot, and perform repairs and maintenance work. Think of the crews of remote oil rigs and polar stations executing maintenance tasks using 3D animation videos - not sci-fi anymore! Augmented reality derived from GIS could also be employed to locate underground materials such as minerals and water aquifers.
- **Drone-powered surveys:** Drones are a very useful tool to conduct aerial surveys of high-power equipment and assets such as power lines, gas pipelines and water resources. While GIS information can be used to navigate the drones, 5G can be used to relay

video images in real time back to the controller reporting any damaged assets or assets that require maintenance. Such information is invaluable in case of natural events, accidents or any kind of incident management.

As we traverse these possible use cases, many possibilities open up. From intelligent street lighting in city streets to GIS- and mobile-enabled waste management and outage management systems at utility companies, corporations can look at varied deployments of 5G+GIS-enabled fleet management and inventory management systems. **Agri-businesses** may explore intelligent vegetation management, as well as inspections and repairs of their far-flung equipment using a combination of sensors, drones and 5G+GIS.

The two rollouts are vital for each other, and for new technology-enabled growth across world economies.



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- Spatial data management
- Application support and maintenance

- Spatial data analysis
- Project/Program management

Our team possesses highly skilled domain experts who are experienced in resolving major challenges across industries.

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