Unleash the power of location-based analytics with a comprehensive GIS

Introduction

They say a picture paints a thousand words. Why do they say it? Because it's true. We take in a vast amount more information from looking at an image than reading lines of text.

How much more? Well, a frequently quoted stat says the brain processes pictures <u>60,000-times faster</u> than it process words.

The stat has been disputed. But, whatever the exact number, common sense tells us that people think visually.

This is why maps and diagrams are so good at expressing complex information – information, especially in a commercial context. All over the world businesses regularly use maps to help them understand (quickly) what's happening on their networks.

However, a traditional geo-spatial map can only convey so much.

To be really powerful, it needs to reveal the relationship between multiple elements. It should reflect the changes happening in real time. What's more, users should be able to explore the information and create models of future outcomes.

Finally, a map shouldn't be siloed. Users should be able to share (securely) a map and any associated analyses with colleagues.

Esri is the world's leading geographic information system (GIS) software company.

Its <u>ArcGIS technology</u> helps 350,000 organisations to visualise their data. It lets them create maps that are effectively 3D digital twins. They can study these twins to see how their data is changing and then make informed decisions about what actions to take next.

The system is especially <u>applicable to telecommunications</u> companies and mobile carriers.

Why?

Because telcos are in the business of location. As such, they can use advanced GIS maps to see how their current infrastructure is working, know how their customers are feeling, and make better decisions about what and where to build.

In other words they can use GIS maps to:

- **Allocate resources**
  Network engineering and maintenance

- **Boost revenues**
  Customer acquisition, upsell, anti-churn

- **Improve customer experience**
  Reporting network outages, analysing customer sentiment

- **Transform network operations and maintenance**
  Making better decisions about cell site locations, 5G buildout

- **Introduce new digital services**
  Analysing data to identify the best places to launch new products

In this paper, we will dive deeper into the exciting possibilities offered by GIS, reveal the advantages of the Esri ArcGIS system and demonstrate how telcos are using GIS to save money and improve return on investment.

What is Geographic Information System (GIS) Mapping?

At its simplest, A GIS is a framework that provides the ability to capture and analyse spatial and geographic data.

For most users, this means integrating and connecting complementary data onto location-based geographical information.

This might include data about:

- Buildings
- Roads
- Public transport routes
- Wiring/cabling
- Population density
- Weather
- Traffic density
- Population income

Presentation matters too. How you visualise your data can make a huge difference to the speed of understanding it.

For this reason, GIS products offer many innovative ways to display information on a map. Colour coding, heat maps and so on make it easy to discern hidden clusters, relationships and patterns. You can zoom in and out to scrutinise these data points more closely.

Needless to say, all of the above features are welcome. But ultimately they are just features. The real point of a GIS is to provide business value and improve decision-making capabilities. We can summarise these as follows:

Identify problems
Use GIS to see where there is an outage or service failure

Monitor change
Get a historical picture of shifting patterns over time

Respond to events
GIS delivers real-time situational awareness. When there is an unexpected event, you can see the impact immediately

Make forecasts
Use GIS to predict consumption and traffic based on specific pre-conditions

Set priorities
By analysing today's patterns, you can allocate resources more astutely, saving money and time

Understand trends
The visual dimension of GIS helps you gain insight into data that you might miss in a spreadsheet

Finally, the best GIS products make it easy for users to share their maps, insights and models with others. Users don't need to be GIS specialists. They can use apps that work across mobile phones and tablets, on both the mobile and desktop web.
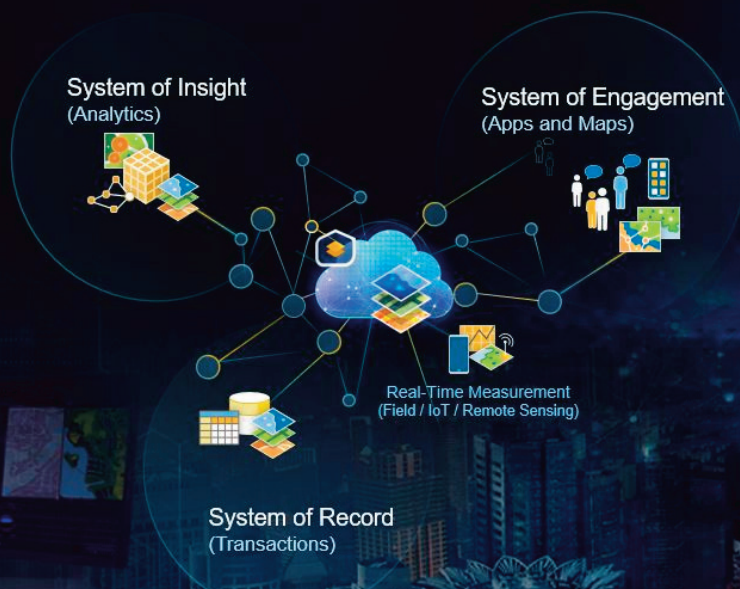
The real world on your desktop: GIS and the digital twin

In the last few years, GIS has ushered in a new concept the digital twin that has changed the way that engineering-based companies manage their present-day operations and plan for the future.

A digital twin is a virtual 3D representation of the real world. It can show physical objects, processes, relationships, and behaviours, and it can represent them as they are now, as they were in the past or will be in the years ahead.

The concept of the digital twin has existed for many years, but it's only in recent times that it has become viable. This is thanks to multiple factors such as advances in interactive 3D software and the free availability of third party data (via open APIs).

Then there's the Internet of Things (IoT). The proliferation of connected devices makes it easier than ever to record and analyse operational data across the network.

ArcGIS
Supports Three Fundamental Systems

System of Insight
(Analytics)

System of Engagement
(Apps and Maps)

Real-Time Measurement
(Field / IoT / Remote Sensing)

System of Record
(Transactions)

Introducing the ArcGIS system

At Esri, we like to describe our ArcGIS system as a comprehensive GIS.

What does this mean? In short, that it contains all the elements needed to solve business challenges, not just make conventional maps faster.

ArcGIS integrates and connects almost all forms of external data and uses the latest artificial intelligence (AI) tools to interpret and visualise them. The results can be viewed on any device, anywhere, at any time.

As such, ArcGIS is three things in one:

- **A system of record** that acts as an information source of truth through which to manage transactions
- **A system of engagement** that lets users share and collaborate
- **A system of insight** that makes it easy to visualise, analyse, model and explore data

Let's dive deeper into what you can do on the ArcGIS system.

1. Make your own interactive maps

The ArcGIS system includes an extensive collection of ready-to-use maps. You can use them as the basis for your own interactive models. Over time, you can add your own data. The system supports multiple file types including: spreadsheets, KML, GeoJSON, and common geospatial files.

And you can import from a variety of external sources such as IoT systems, message brokers, and third-party APIs.

Once you have built your custom maps you can:

- Get more details as you zoom in
- Click on the map to see region-specific information in text, tables, and images
- Search the world's locations and your custom locations
- Get more perspectives by filtering data and changing colours

2. Choose who sees your maps

Interactive maps tell stories and yield insights. You will want to share them with colleagues. But you need to be able to choose who sees what. The ArcGIS system provides pervasive and secure access through identity management, which gives you options. You can share with:

- Just you
- Selected users in your ArcGIS group
- Everyone in your ArcGIS Online organisation
- The world — allow anyone, anywhere to see your maps

You also have many options for how you share. For example, you can embed maps in your website, social media posts, and blog articles.

Or you can create interactive web apps in just a few clicks using preconfigured components (without writing any code).

3. Create maps with colleagues

The most useful maps are dynamic. They contain multiple data points that update in real time. Some of these data sources will arrive from third party sources. But others will come from your own organisation, in the office and out in the field.

This raises a number of questions.

- Which colleagues can edit, and which can just view?
- Who determines access and privileges?
- How do contributors safely authenticate?

The ArcGIS system meets the security, authentication, privacy, and user management needs of large organisations. Its precise settings allow creators to specify what can be edited and viewed.

4. Understand your data

Ultimately, what is an interactive map for? It's to help you make better business decisions. The ArcGIS system comprises user-friendly tools that let you tweak your analysis until you find the answers you need. In practice this means you can:

- **Identify the best location**
  For example, you could look for locations that have similar characteristics to other locations. Or maybe map the demographics of potential and existing customers

- **Find the best routes**
  The ArcGIS system lets you calculate travel costs by time and distance. You can make technician journeys efficient by planning routes according to vehicle limitations, traffic and more

- **Learn more about your existing locations**
  What do you know about the people, places of interest and businesses in your network. How are these groups impacted by an event? The ArcGIS system gives you the answers

- **Do real-time analysis**
  Thanks to the IoT, organisations now have a wealth of sensor data to look at. ArcGIS offers an add-on called ArcGIS Velocity. It can ingest this data, analyse it and visualise the results immediately on a web map. Just as important, it can then generate an output, recommending an action to be taken, which it can store to a feature layer, send as an email, write to a cloud store, or push to a third-party system for device actuation
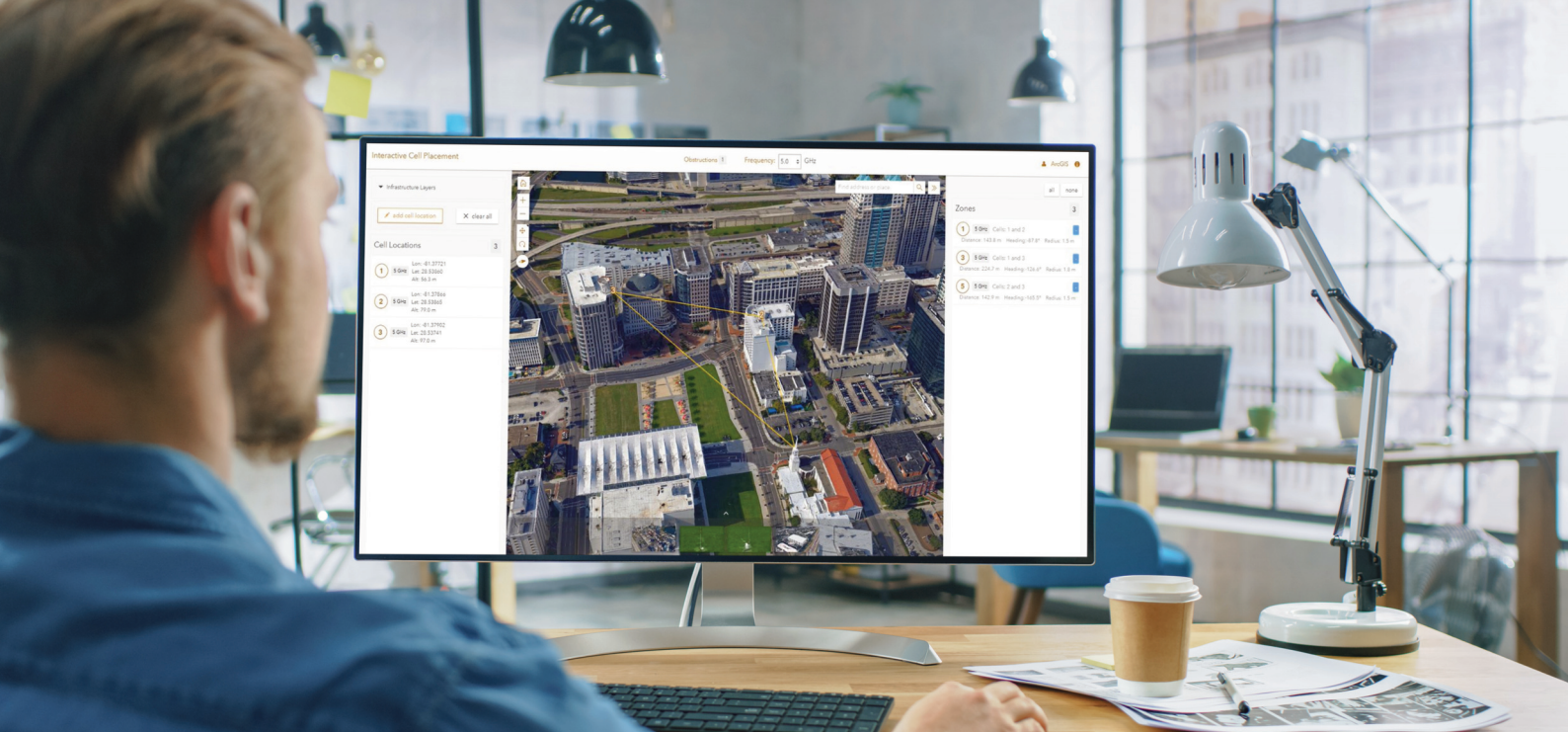
Unleashing the power of ArcGIS for telcos

All over the world, many diverse organisations use ArcGIS to create and use interactive geospatial maps from governments to farmers to foresters.

But as we have seen, the tech has many specific use cases in the telecoms and communications sectors. We can group these applications into five areas.

Planning and engineering

The more strategic you can be with your planning and engineering, the more you can reduce time to market and boost return on investment. In ArcGIS you can effectively bring the field to the engineer's desktop. You can remotely collect field data, develop designs, create final engineering documents, and submit permits with a minimum number of field visits.

Network operations and maintenance

ArcGIS gives you a real-time view of your network on a web-based dashboard. This way, your specialists can analyse the state of your network, dispatch engineers to trouble spots and provide restoration times to your customers through outage viewer maps.
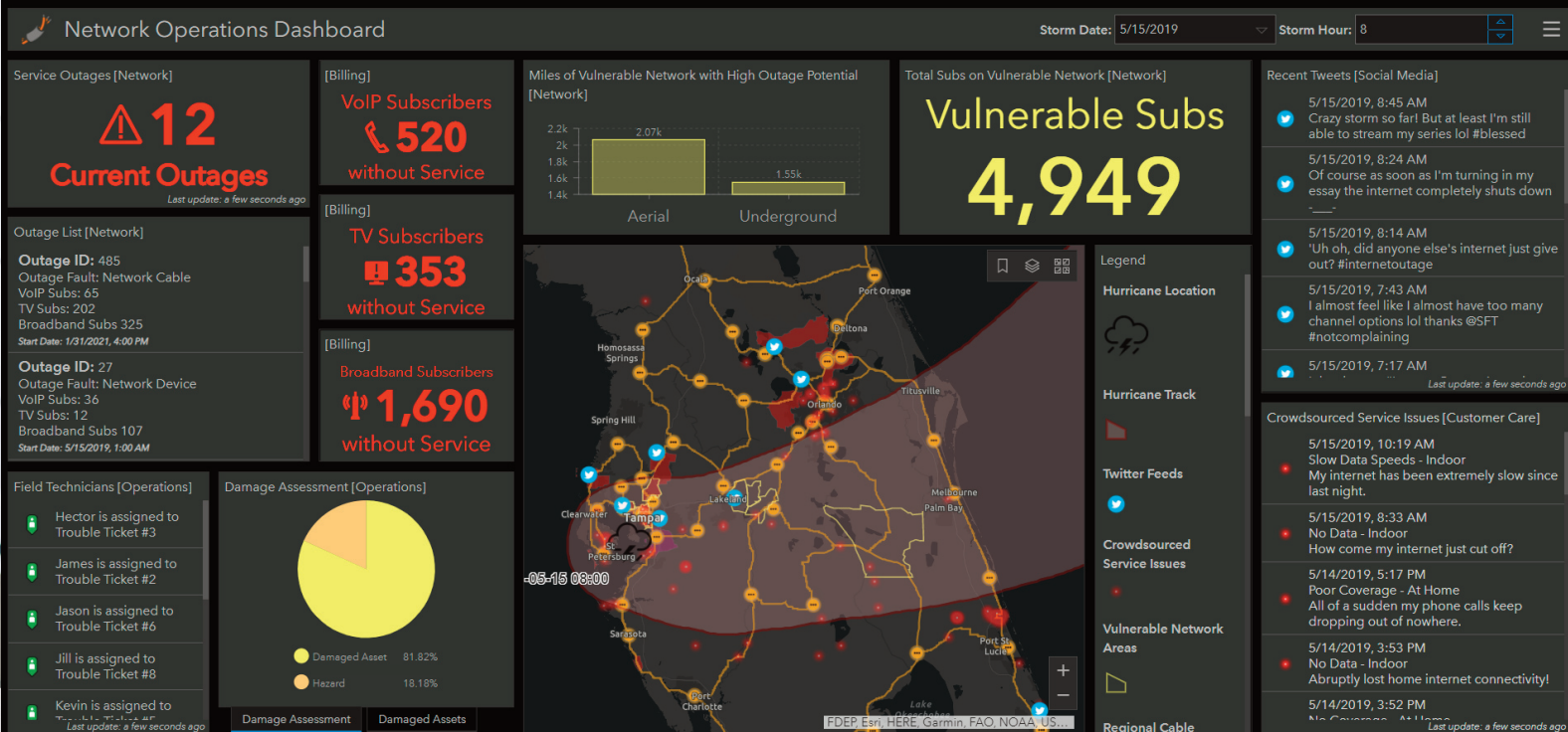
Customer experience

For most customers, user experience is just as important as download speeds. ArcGIS helps here. How? By giving you the ability to share service information, coverage availability, and outage time via easy-to-use maps. You can also make it possible for customers to report service issues.

Sales and marketing

Every business wants more business. But where are the opportunities? And what are the priorities? ArcGIS puts location information into the hands of the sales and marketing teams so they can make the best decisions possible. They can map customer sentiment by region and qualify business development opportunities faster.

Building new services

Big changes are coming to the telco world. Mobile carriers are moving to 5G and to software-defined networks. They are building out the infrastructure to support billions of Internet of Things (IoT) products and services. The challenge is to model the best future scenarios. ArcGIS brings business data together through an open web services architecture that is cloud ready.

ArcGIS in practice: three scenarios for telcos

We've seen how interactive GIS maps can help telcos to identify service problems, improve customer experience, aid business development and improve network maintenance.

But what does this look like in practice?

Let's walk through three scenarios.

1. Using GIS to locate and fix a network outage

In this scenario, a telco employee wants to know where any current network issues are and what might have caused them.

She opens up the ArcGIS Dashboard to see the real-time status of all its network assets. The maps displays **every current node outage.**

The user selects one of these outages, and zooms in to reveal

more detail. A side panel displays the number of subscribers who are without services thanks to this outage. It also shows all the customer care trouble tickets that have come in as a result. Each one is **represented by a red point.**

Another panel shows the **real-time damage reports** submitted by field technicians. The engineers were able to file these reports using ArcGIS mobile apps. When they identify a fault, they use these apps to scan a barcode on a network assets, take a photo and fill out a form to complete their submission.

Now, the ArcGIS user wants to know what might have caused the outage. She can see on the display that there are multiple events that could be the reason.

The map shows a **lightning strike** a mile away, and **roadworks** nearby. However, it is a **traffic accident** on

the next road that is the most likely culprit. Maybe a vehicle damaged a critical network asset. In each case, the system generates an output action to remedy the problem. This could be an alert to the nearest staff member to the source of the outage.

2. Using GIS to speed up a cable roll-out to new-build homes

Here is a real-life use case showing how a cable provider in Oregon US improved its planning and cut costs by **ingesting real-time data** into its GIS maps.

For years the company was frustrated by the process of laying cable to connect new residential homes. Often, it didn't know anything about these projects until they were under construction.

The problem was a delay in communication. Why? Because the company's engineers relied on power companies to say when they were creating the infrastructure for these homes.

> *We start with nothing more than a standard map, it gets enriched by adding how many customers we can reach, how many towers we need to build and connect, how much cable we need, and so forth— always keeping the 'where' dimension in the picture.*
>
> **Milind Deshpande, Senior Vice President, Jio**

Regrettably, the power companies were often slow to pass on the information. The telco would find that, by the time the reports arrived, the trenches had already been covered over. Obviously, this increased the cost of laying the cable or forced the telco to abandon the project.

However, the telco then realised that it could **import deed-transfer records** relating to permits and land use into its GIS maps. These records contain information that shows when a new build is coming: parcel sizes, a change of land use (farm to residential for example) and so on.

Because these deed records are submitted many months before the start of a new construction project, the telco suddenly had the ability to make much better decisions. It **overlaid the deed data** onto its maps, and quickly saw a plan for 10,000 new homes to be built on a wheat field. It didn't have the fibre to support it, and would need $600,000 to extend its network. However, with its advance notice, the company was able to budget and plan, and ensure that when the construction started it was first in the ground and first to connect.

3. Using a GIS digital twin to perform a network trace

As we have seen, a GIS-based digital twin gives a telco a complete 3D representation of its network. However, its real value is its ability to let users run models.

> *Esri's mapping capabilities allow us to take the wealth of data and combine it and connect it with the mapping capabilities to really paint the full picture of everything that needs to be considered. This lets us to make more informed decisions, take a more strategic approach, and ultimately define what's going to be the best route.*
>
> **Jessica Strickland, Senior Marketing Coordinator, HTC**

Let's say a network wants to know how it is **serving a specific cell tower** via a specific microwave receiver. On the GIS map, the user runs an **upstream network trace** to see how the tower is connected in the network. This trace highlights the assets and shows all the inventory.

The user can now identify the upstream tower serving the specified cell site. By panning out, he can see the **fibre backhaul plotted on the map** and follow it all way back, traversing through wireless and fibre outside plant assets and finally to the inside of the plant itself.

Here, the visualisation goes deeper. The map can even show the data centre floor-by-floor, and reveal the rack based on the original network trace in 3D. Finally, it can **pull up a rack view** to show which ports/switch the fibres terminate at.

Armed with this insight, the ArcGIS user can run a downstream network trace in order run a **dark fibre report,** and filter it based on the trace results to see a full breakdown of the strand availability.

Your next step

Mobile and communications companies are in the business of location. They run networks. These networks need to be maintained, improved and fixed. Converging all the relevant data into interactive GIS-based maps gives telcos the best possible tool for doing so efficiently.

The ArcGIS system offers a system of record, engagement and insight to telcos. In this paper, we have shown how it leverages the power of location intelligence to support:

- planning and engineering
- network operations and maintenance
- customer service
- sales and marketing
- new service development

To find out more about how ArcGIS can help your organization, please visit www.esri.com/telecommunications

THE SCIENCE OF WHERE®

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