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Operational Transformation Using GIS

A Technical Paper prepared for SCTE•ISBE by

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Introduction

Through digital transformation of legacy mapping to a more spatially intelligent option, new methodologies have been implemented across the enterprise around activities like plant maintenance, extensions, and troubleshooting. Midco continues to enhance its geospatial architecture by integrating with other systems and, depending upon the data within the system, to drive processes through the rest of the organization. Geographic Information Systems (GIS) are no longer just a system of record, but also becoming one of engagement and insight. Rather than simply reading data, it is the authoritative source for many datasets.

This paper focuses on how Midco is able to leverage GIS technology to help drive operational efficiencies and prioritize capital expenditures. We will discuss the path Midco took from using GIS to record network information with very specific use cases, to an enterprise level platform with over 80% of employees directly using web delivered services.

Content

1. Web-based GIS

Midco made a collection of apps, analyses, process changes, and data conversions to enable GIS to optimize operational efficiency. At Midco, GIS started out as a way to model the fiber optic network and expand business services. The potential was realized and plans to convert the coaxial network from Computer Aided Design (CAD) and Lode were developed. As the conversion was being planned, Midco continued to develop other use cases for GIS assisting with Sales, Marketing, and Construction Departments as well as rolling out web-based GIS. Operational transformation didn't occur at Midco from a single project, but rather several projects of varying scopes and complexities.

Web-based GIS started within Midco as only accessible via desktop computers and within the firewall. Eventually the system was upgraded to a portal environment that supported mobile devices and increased functionality through the use of widgets and app templates. This also gave end-users the ability to find meaningful content in a user-friendly manner.

Midco has seen significant usage of web-based GIS since implementing. The user base has grown to almost 80% of all employees within the company. Additionally, there are hundreds of views per day on GIS data and websites. This pattern of deployment has transformed GIS from a tool that a handful of employees use to a tool that is critical in daily operations at Midco.

Mobile access plays a large role in the uptick in GIS usage. Not only are web-browser based GIS apps supported, but also native iOS apps are used every day by Field Operations. One such example is Midco's Field Vision app which allows field staff to capture points on a map and record information about any issues going on in the plant that need to be addressed. Support for attaching pictures is included and any data captured is instantaneously transmitted back to the enterprise and can be assigned to the proper personnel to resolve the issue. A status on all work-orders is available and once the issue is resolved it's closed. Reports are available for managers to review and see what work is being done and by whom, giving further visibility into what tasks are being done. This simple app replaces the combination of paper and spreadsheets, which was prone to error.

Deploying GIS based web applications goes through a similar cycle as any application. First, a use case for the app must be identified and requirements defined. Then a beta version of the app is deployed to the

stakeholders and any feedback is applied back into the app. Finally, the app is deployed into production and then as enhancements are requested they can be applied to the app. Midco also implemented an app retirement process, which gives a workflow to delete apps that are no longer being used, or have been replaced by newer apps.

Having a way to clean up obsolete content is critical to maintaining a web GIS deployment. Data, code, and any other applicable information are all archived in case the app needs to be revived in the future. It's important to note that data may be used by multiple apps or content in a GIS environment, so only if that data is not being used by anything or anyone else should it be archived. Organization and metadata are important to ensuring that the correct steps are being taken during the retirement process.

2. Coax Data Conversion and Billing Integration

Midco's journey toward operational transformation with GIS was greatly and positively impacted by converting data from a CAD environment to GIS. This project involved taking design files, CAD maps, and billing data and combining them into GIS. The resulting product was a system that could design and draft simultaneously and integrate with a billing system. This single project opened up many more opportunities within the company to integrate with other systems as well as drive workflows via the enterprise GIS.

A project of this magnitude needed to have an internal Return on Investment (ROI) review created. The primary driver that could be identified was savings through bringing coax design in-house, rather than continuing to contract it out. Doing this meant that resources would have to be staffed and trained as well as a design software selected or developed. Midco chose to partner with a software development company to create a new design product, native to the existing enterprise GIS. Creating this product on the already implemented platform allowed Midco to avoid potentially troublesome Extract Transform Load (ETL) processes and also get data instantly into the production database.

The GIS conversion at Midco was the digital transformation that brought the rest of the network (the coaxial portion) up to date with the fiber optic portion. Having a single platform allowed all entities that interact with the GIS system to operate much more efficiently. It also gave visibility at the address scale and opened up possibilities to gather data from various systems and associate it to a spatial point within the GIS.

Three distinct systems (billing, design, and drafting) were combined during the conversion. Data discrepancies were found among the systems and rules were established about what to do in the most common scenarios. Often times, a hierarchy of the originating systems was used in order to determine which source would be migrated. Other times, data transformation would happen and the newly created information was written into GIS. The primary takeaway is that a plan must always be established during a migration for handling conflicting, missing, or data that doesn't fit into the target system. Establishing this upfront by utilizing data exploration tools is critical to the success of a migration.

The billing integration was a way for Midco to avoid the duplicate data entry of addresses from walk-out into GIS and then later again into the billing system. It also kept attributes that GIS maintains (serviceability, network information, etc.) automatically up to date among systems. In the past, these were maintained via spreadsheet. Midco averages hundreds of changes per day, so automating this process was identified as a way to greatly reduce time and errors associated to transferring this data.

3. Plant Analysis and Visualization

Midco has experienced a lot of success with plant analysis and visualization. Fiber and coax mileage data is compiled weekly and presented in a non-spatial dashboard. This is one example of taking spatial data and tools and compiling it in such a way that is useful to end-users who don't want it on a map. Midco has found that converting data from spatial to non-spatial is a simpler task than converting it from non-spatial to spatial. This type of analysis can be accomplished through a variety of spatial geoprocessing tools, structured query language (SQL) queries, and scripting languages to create high quality outputs on a regular, automated schedule. For example, the coax plant report used to be manual and took over 200 working hours to complete. Since it was so labor intensive, it could only be done once a year vs the once a week cadence it's calculated at now.

Proactive Network Maintenance (PNM) is another area of opportunity that Midco took advantage of to use GIS to operate more efficiently. The integration that Midco deployed flows in two directions. In the first direction PNM software consumes web-based map services so that plant can visually be displayed within the PNM application. In the second, the GIS consumes data from PNM and displays it at the node level for use by field and engineering staff to find spatial patterns. Node health and other statistics are also derived from other systems and displayed within the same spatially enabled web application. The application also allows users to jump back to a specific date and view the statistics for that day.

Within the same application, data usage by address is compiled and displayed for a number of time windows (1 month, 3 months, 6 months, and 12 months) and is displayed as proportional points on the map (Figure 1). The ranks of addresses' data usage for the top ten users within each node are also displayed. Having this data allows for the creation of heat maps of cities, showing which regions have the highest data usage. The data is also transformed into a space-time cube, where in-depth analytics and machine learning can be utilized to find spatial trends over time. Ultimately, this enables better predictions of where in the network usage will increase faster in the future. The goal of all these tools is to help make better decisions on where and when to augment the network to take care of current troublesome areas and anticipate where future issues may arise.

Figure 1 - Proportional Symbols of Data Usage by Address

Conclusion

In Midco's experience, operational transformation does not occur from a single project and can't be narrowed down to a single point in time. Operational transformation is a collection of projects and processes whose end-products continue to evolve. The transformation seen from GIS has brought Midco from a company where maps were referenced to a company where maps are still referenced, but the data contained within the GIS drives business processes downstream. It has gone from a nice to have tool to an enterprise level system that is part of larger processes and cannot simply be removed.

GIS adds a visual element to analyses and simply displaying data spatially helps detail out powerful stories. However, it goes far beyond that by being the engine through which phenomena can be examined through a spatial lense in ways not possible in standard reporting software. As more systems and workflows are integrated with GIS, the possibilities for the problems it can help to solve also increase. An effective strategy for growing a GIS within an organization is to first find a use case that is spatial in nature and then create the data, systems, and processes needed to solve that use case. Then, that new product can be utilized for something completely new, which leads to increased investment, use, and visibility of GIS. This snowball effect is one that was successful at Midco and can be replicated elsewhere.

Abbreviations

CAD	Computer Aided Drafting
ETL	Extract Transform Load
GIS	Geographic Information Systems
MSO	Multiple Systems Operator
PNM	Proactive Network Maintenance
ROI	Return on Investment
SQL	Structured Query Language