GIS

Next Generation E9-1-1 GIS

As E9-1-1 GIS systems are brought online, there has been a challenge in keeping the traditional MSAG and their GIS data sets individually current and synchronized with one another. To solve this dilemma, E9-1-1 agencies must look to a next generation MSAG/GIS data model.

Sam Bard, Contact One

MORE THAN 10 YEARS AGO, ELECtronic Geographic Information Systems (GISs) gained widespread use within governmental agencies across the country. Such use ranged from producing basic maps to complex data analysis. During the mid to late 1990s, GIS solutions began finding their way into an increasing number of E9-1-1 programs across the nation and around the world. The hallmark benefits of applying GIS to E9-1-1 are (1) graphic display of caller/incident location for E9-1-1 personnel, and (2) improved accuracy/quality of geographic data used by emergency responders in general. As with any solution applied to E9-1-1, the ultimate goal was to more quickly, accurately, and efficiently respond to emergency calls for service.

TODAY'S E9-1-1 DATA MODEL CONSISTS OF TWO DISTINCT **AND LARGELY SEGREGATED COMPONENTS: MSAG AND GIS.**

The past five years have seen an explosion of electronic computer aided dispatch (CAD) and GIS system deployments to E9-1-1 agencies of all sizes across the country. This movement has been fueled in part by the aggressive proliferation of wireless telephones and other alternative communication mediums. Charged with the task of ensuring a successful national wireless E9-1-1 system, the FCC not only recommended the use of electronic GIS for locating wireless E9-1-1 callers, they demanded it within their Phase I and II wireless E9-1-1 regulations.

As E9-1-1 GIS systems were brought online, administrators have quickly realized that they face a daily challenge in keeping the traditional Master Street Address Guide (MSAG) and their GIS data sets individually current and yet synchronized with one another. To solve this perpetual dilemma, E9-1-1 agencies must look to a next generation MSAG/GIS data model.

Traditional E9-1-1 MSAG/GIS Data Model

Today's E9-1-1 data model consists of two distinct and largely segregated components: MSAG and GIS. The MSAG provides the data framework for the traditional wireline and wireless E9-1-1 database, and includes road names, address ranges, community, and ESN/ESZs for a given E9-1-1 jurisdiction **(see Figure 1)**. Telephone companies use the MSAG to determine the validity of new service addresses, route E9-1-1 calls to the correct PSAPs, and provide recommendations for the correct emergency response agency.

MSAGs are traditionally maintained in-house by the local E9-1-1 agency, with updates being provided to the telco via Internet, fax, mail, or in some

cases, verbally. These data are housed and updated in a tabular fashion, which makes maintenance tedious, prone to errors, and lacking in one-to-one geographic reference when making changes and/or additions. The MSAG database maintenance methods, procedures, and tools are largely proprietary and entirely independent of any GIS data.

GIS programs across the nation vary greatly in size and complexity. In some agencies, the MSAG coordinator and GIS administrator are one in the same. However, it appears that in the majority of governments across the country, the GIS department is separate from E9-1-1. Though E9-1-1 ranks among the top uses of any given GIS program, this does not guarantee that the GIS data will be built and maintained with the exacting needs of E9-1-1 in mind. Even if everyone involved is committed to maintaining GIS data that meet the needs of the E9-1-1 system, the MSAG maintenance process remains entirely independent of the GIS data, and its respective maintenance cycle.

This situation begs the question: "Why are the GIS and MSAG independent of one another?" Because updates to both the MSAG and GIS data are needed on a daily basis in most jurisdictions; it is vital for the success of the E9-1-1 system that these two datasets be both initially and continually synchronized to one another. Unfortunately, this practice is not followed in the majority of jurisdictions across the country.

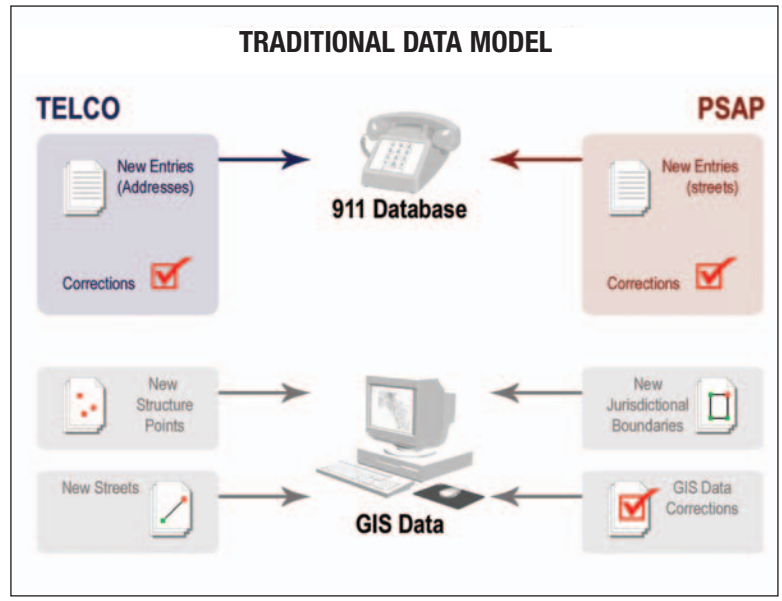
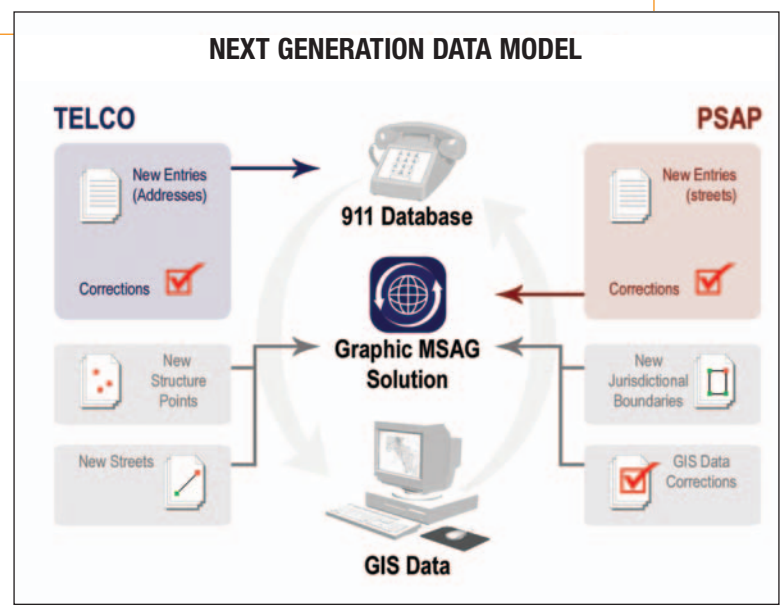


Figure 1

The traditional E9-1-1 data model illustrates the current disconnect that exists between the MSAG and GIS data.

IN ORDER TO MEET THE DEMANDS AND CHALLENGES OF TODAY'S E9-1-1 AND CAD SYSTEMS, **A NEW INNOVATIVE E9-1-1 MSAG/GIS DATA MODEL MUST BE EMBRACED BY THE NATION'S E9-1-1 PROGRAMS.**



Images courtesy of Contact One, Inc.

Figure 2

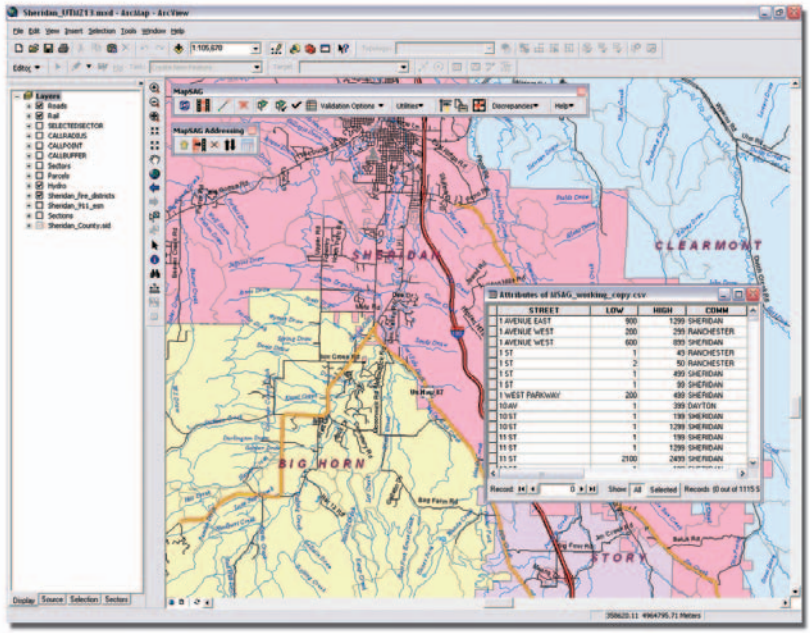
The Next Generation "Graphic MSAG" Data Model provides a comprehensive E9-1-1/MSAG integration lifecycle solution.

Lifeblood for the CAD Systems of Today and the Future

An MSAG database has long been a staple within electronic CAD systems. These critical data are most commonly found in the form of an independent database that must be manually maintained by the CAD system administrator. As changes are made to the telephone E9-1-1 MSAG, duplicate changes must also be made to the CAD database. Without automation of this process, as a result of manual entry, the probability for discrepancies between the CAD and E9-1-1 databases is substantial, and increases over time. CAD MSAG databases are used to validate caller/incident locations entered by dispatch personnel and to make unit/response recommendations, among other things. As CAD systems have increased in feature sets and sophistication, so has the need for an accurate CAD MSAG (commonly called a CAD Geo File.) A CAD's inability to validate the

caller/incident location entered can restrict the quality of the advanced feature sets throughout the duration of the incident.

Early inclusion of GIS/Mapping in CAD systems basically yielded an address spill from CAD that plotted a static location on a map display screen. This resulted in the GIS application plotting the best match it could find, based on the location entered into CAD and the GIS data. The CAD systems of today include complex bi-directional interfaces between the CAD and GIS dispatch mapping application, which require that the CAD MSAG and GIS data match precisely in order to properly function. Some CAD systems have evolved to the point of using the actual GIS data for call location validation and recommendation of response. This practice eliminates a redundant CAD MSAG tabular database, and relies solely on the GIS data to accomplish address validation and unit/response recommendation. However, the need for the continual MSAG and GIS reconciliation remains.



Graphic MSAG.

Image courtesy of Contact One and ESRI.

Recent trends in CAD system development illustrate a progression from a tabular database to a multi-layered spatial GIS database. Such a database model has the potential to elevate CAD system functionality to new heights, but will also require that the MSAG and GIS databases are completely seamless and perpetually kept current through synchronization.

BY AUTOMATING THE E9-1-1 MSAG AND GIS MAINTENANCE PROCESS, EXISTING ERRORS CAN BE IDENTIFIED, **NEW ERRORS PREVENTED, WHILE THE EFFICIENCY AND PRODUCTIVITY OF E9-1-1/GIS SYSTEMS INCREASE EXPONENTIALLY.**

Next Generation E9-1-1 MSAG/GIS Data Model

In order to meet the demands and challenges of today's E9-1-1 and CAD systems, a new innovative E9-1-1 MSAG/GIS data model must be embraced by the nation's E9-1-1 programs. One solution that is being successfully deployed by agencies across the country is a Graphic MSAG. The Graphic MSAG data model approach essentially uses GIS to maintain all aspects of the E9-1-1 database (**see Figure 2, page 23**). This is accomplished by placing GIS in the center of an automated E9-1-1 MSAG/GIS creation and maintenance life cycle that follows the logical flow of E9-1-1 addressing and GIS data creation. All database changes originate from GIS data via a graphical user interface application, and are then passed electronically to the E9-1-1 MSAG database, CAD MSAG database, and GIS dataset. Such an approach has been proven to reduce existing errors in an established E9-1-1 database, prevent new errors from being introduced into the system, and ensure that all of the databases needed for E9-1-1 are kept synchronized in real time.

This next generation E9-1-1 MSAG/GIS data model automates the entire process, from creation/change of an address or geographic feature to distributing the revised data into the respective MSAG, CAD, and GIS datasets. The proven results using this innovative approach are: reducing the time and resources needed to maintain the combined datasets; shorter turnaround time of updates; fewer errors and discrepancies, and real-time availability of the most current data. In sum, there is a measurable reduction in response times that can translate into less loss of life and property.

Enterprise Approach to Advanced E9-1-1 MSAG/GIS

There has been an increasing number of statewide, multi-county, large metro areas, and regional E9-1-1, CAD, and GIS deployments in recent years. Such initiatives are attractive because of the potential for interoperability and data-sharing among the many jurisdictions. Along with the substantial benefits of such programs comes the notable challenge of standardizing, combining, and maintaining seamless E9-1-1 MSAG and GIS datasets.

For example, let's say a state police department deploys a statewide CAD/GIS system to 10 state police posts/troops, cover-

ing 100 counties. Let's further assume that 75 of the 100 counties have existing E9-1-1 systems. Although the local governments with E9-1-1 may receive those calls and provide emergency response the majority of the time, the statewide CAD/GIS system still requires up-to-date E9-1-1 MSAG information to function properly, as they provide assistance to the local governments and conduct their own statewide operations. This information is also used if the state police needs to receive and dispatch calls for a given local agency during an emergency or failure of that local PSAP.

The logistics required to routinely obtain and update 75 local E9-1-1 MSAGs and GIS datasets into a seamless state police dataset is a tall order for any state in the country, even if done quarterly. An Enterprise Graphic MSAG solution can help make a task such as this manageable. Applying an Enterprise Graphic MSAG approach would allow the local E9-1-1 coordinators to make graphic changes to the MSAG/GIS data, which would in turn generate automatic updates to the statewide datasets. The result would be a synchronized local and statewide E9-1-1 MSAG/GIS database, without the need for redundant data creation or maintenance.

Voice Over IP (VoIP), Next Generation E9-1-1, and GIS

The certain necessities of validating the MSAG and GIS data described above are similar in nature to the Validation Database (VDB) and the Emergency service zone Routing DataBase (ERDB), which are used for VoIP. The VDB and ERDB solution includes necessary features to insure accurate data and gateways in order to perform the necessary validations and updates. It appears that accurate 9-1-1 GIS information will play an increasingly critical role in the location databases used to locate all 9-1-1 callers now and in the future. Also believed is that the GIS information will continue to be vital to the coordination of the emergency response and management of emergency service resources by PSAPs.

A solution to both the VDB and the ERDB are at this point in time, an I1 solution, as defined by NENA. This is not to state that the solutions would not be scalable and applicable to an I2 and even I3 solution. The fact of the matter is that there are many unknown variables on how I2 and I3 will eventually be implemented and there are no standards that have been fully developed and which have been fully adopted by the various 9-1-1 private enterprises. It is imperative to mention that the MSAG and related Emergency Service Number (ESN) databases must be compared, correlated, and reconciled with the street centerlines and Emergency Service Zone (ESZ) data layer. This is a preliminary step in ensuring that the database is accurate, that precise validations of database requests made from nomadic VoIP devices are made, and that other functionality specified in the I2 concepts is adhered to. The validation process can only be as good as the data behind it, similar to traditional 9-1-1. The GIS provides these necessary checks and balances to the 9-1-1 databases and can be applied in both a proactive data management approach as well as real-time, as needed for the VDB and the ERDB.

Graphic MSAG, an NG9-1-1 Solution

As public safety agencies look to both maximize the effectiveness of their current E9-1-1 systems and prepare for the next generation of infrastructure, it is assuring to see that an innovative GIS data model stands ready to meet the critical needs of 9-1-1. The application of a Graphic MSAG solution can help correct discrepancies that result from a generation of segregated E9-1-1 GIS data, while conditioning the data maintenance process to power the public safety systems of tomorrow. By automating the E9-1-1 MSAG and GIS maintenance process, existing errors can be identified and new errors prevented, while the efficiency and productivity of E9-1-1/GIS systems increase exponentially. Graphic MSAG is scalable, in that in can function within a single agency, or can serve as an enterprise approach to large-scale, multi-jurisdictional programs. **ENPM**

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