GIS Staffing for NextGen 911

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Introduction

Changes are currently underway that will significantly alter how 9-1-1 services are provided in the United States. The National Emergency Number Association (NENA) has been working for years developing a sweeping overhaul of 9-1-1 which, collectively, is called "Next Generation 9-1-1", or NextGen 9-1-1 for short. This paper analyzes one group of issues related to NextGen 9-1-1. In particular, the change from traditional spatial database systems to meet the needs of NextGen will be examined, primarily from the viewpoint of providing proper staffing. The implications of changing from the Master Street Address Guide (MSAG) in conjunction with Automatic Location Identification (ALI) to the use of a Geographic Information System (GIS) to serve 9-1-1 calls are the focus of this document.

Historical Background

9-1-1 services were first provided in the United States in the late 1960's, and into the 1970's. During this time, the concept of the MSAG was devised, as well as the ALI database. Both of these databases[1] are of a spatial nature, in the sense that they attempt to locate places on the earth. Given available technologies at the time of their invention, the MSAG and ALI were perfectly reasonable ways to represent this spatial information. Over time, however, GIS systems have been developed to efficiently and accurately deal with a broad range of spatial information problems. Because of this, it is now true that the spatial data issues that are addressed by the MSAG and ALI are much better suited to solution with a modern GIS system.

Maintenance of the MSAG and ALI databases has traditionally been done by someone known as the "MSAG Coordinator". In fact, the ALI database is generally not directly done by the MSAG Coordinator, but by the telephone companies (telcos). That is because the information being populated into the ALI database is, for all practical purposes, simply the customer data, and that is generated when the customer contacts the telco in order to initiate or modify service.

The MSAG, in the current system, is important because it defines the range of permissible addresses and street names that can be generated by the telcos. The MSAG is a check point that helps keep erroneous

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[1] Actually, the MSAG, from a database standpoint, is usually just a table in a database, though it is sometimes built as a database view, for normalization purposes. Also, the ALI is a table or view. The two tables are usually in separate database, but sometimes are included in the same database instance.

data from being entered into the ALI database[2]. Because of this, the skill and dedication of the MSAG Coordinator (or whatever title is held by whoever performs that function) has been critical to maintaining high-quality data.

Technical Directions

To a large degree, the processes and procedures for maintaining the quality and integrity of the MSAG and ALI data have not changed very much in the last 40 years. These are still tabular, non-spatial databases, and they are maintained using systems and processes that are appropriate for data of that nature. But, the types of suggestions being made at the national level are clearly intended to change this.

One of the big buzzwords that has been around now for a number of years is 'synchronization.' This is meant in the sense of synchronization of the MSAG with street centerline data from the GIS, or synchronization of the MSAG with address point or parcel polygon data, or synchronization of the ALI with the address points, or synchronization of the Computer-Aided Dispatch (CAD) system's 'geofile' with all of these things. Synchronization is, in fact, being pushed by NENA in its current planning documents for NextGen 9-1-1 planning.

Synchronization of the MSAG/ALI and GIS is clearly a laudable goal. If properly done, synchronization of these disparate data sources can not only ensure that all the different systems are working together to get people where they need to be when they need to be there, but the very process of synchronization inevitably uncovers issues that were overlooked when all of these different data sources were gathered and compiled. But, in practice, synchronization is a difficult trick to pull off. The key thing to note here is that, in order to accomplish synchronization, there has to be someone in place who has reasonable skills in the use of a GIS to do such work. Additionally, there has to be enough time devoted to do this job. And, for all practical purposes, there needs to be some type of software system available to the staff to help in accomplishing this goal. It is just too difficult to do with available manual methods. Regardless of the issues, however, we all have to recognize that this is a key step in making realistic progress toward implementing NextGen solutions in the PSAP, at least as long as the MSAG and ALI are going to be kept around.

The logical goal to be achieved under the various NENA proposals is to move away from the MSAG and ALI, and use three GIS layers instead. Those three layers are the Emergency Service Number (ESN) polygon layer, the street centerline layer, and the address point (or sometimes parcel) layer. In the interim, the MSAG and ALI might exist, though they could exist as nothing more than database views that merge the three GIS layers on the fly. We would suggest that this is where 9-1-1 is headed in the not-too-distant future. If for no other reason, the cost savings to be realized will drive the switch.

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[2] We say 'helps keep', because though the MSAG reduces the probability of bad addresses being inserted into the ALI, it does not stop them in many cases.

However, the fact that more accurate spatial information (and better emergency services) will also result, will frequently drive agencies in this direction.

Staffing Problem Scenarios

The transition to NextGen will, for many 9-1-1 agencies, raise a number of problems that, while technical in nature, will be manifested as human resource or staffing issues. This section describes a few of these in some detail, though this list is certainly not exhaustive.

Lateral Transfers

A common practice in many jurisdictions is to move people laterally to fill technical positions. Many MSAG Coordinators that we have seen, for instance, were at one time dispatchers or dispatch supervisors, or even officers. When the MSAG Coordinator position was created or later vacated, it made sense in these jurisdictions to move someone within the organization to this position. And when the job requirement was to maintain just the MSAG and check errant ALI records, this actually made a lot of sense. Dispatchers, because of the day-to-day workings of their jobs, have always been immediately aware of issues in the MSAG and ALI. After all, they're the ones who have to directly confront the problems created by errors in those databases when they occur. And, the technical complexity of maintaining these data tables is relatively low. Only minor retraining (if any) was usually needed to move someone into such a position. Plus, in smaller jurisdictions, this isn't a full-time job, so a dispatcher can sometimes even do it during slack time while on duty. Therefore, this type of lateral transfer has frequently worked out well for many 911 agencies around the country.

As agencies move forward into the world of managing GIS data for NextGen 9-1-1, it will often appear to make sense to move the MSAG Coordinator laterally into the role of managing the GIS. After all, as noted above, the GIS ESN, centerline, and address point layers are closely analogous to the MSAG and ALI database tables, so why shouldn't the MSAG Coordinator take them over?

Sometimes, this approach will work out well. Other times, this will not be the case. The reason is that the complexity of managing a GIS is much higher than that of managing the MSAG and ALI. GIS data management, at least at this time, is a more difficult task than managing the MSAG and ALI. This is not to suggest that some MSAG Coordinators cannot move into this role. Indeed, some will turn out to be very capable and qualified, and will to a great job. But, there is a significant possibility that this kind of a change in function for these people might fail. They might not receive enough training, or they might not be of the right mind-set to do this type of work. Or, they might simply not be of the sort of technical bent that is required to do this kind of work. Not everyone is great with data management and computers, after all.

Too Many Hats

Small 9-1-1 agencies, particularly those in remote rural locations around the US, have a tendency to use personnel in too many disparate roles. This tendency is usually an inevitable consequence of population

size and budgets, rather than some kind of short sightedness, but it's still a tendency. We've seen small-town police departments where the IT manager was a deputy who liked to set up computers and configure networks in his spare time in the evenings. We've frequently seen departments where the task of MSAG Coordinator was a part-time task for one of the dispatchers.

When one objectively looks at the situations in these places, it's pretty clear why such arrangements developed. Sometimes, they work out just fine. And, unfortunately, when they don't work out, there might not be good immediate solutions. But, at a minimum, there needs to be at least acknowledgement that there is a problem and that existing arrangements just aren't as good as they should be.

As we move toward NextGen solutions, it will be imperative that agencies avoid the tendency to add further requirements to existing job descriptions. This is somewhat related to the issue of lateral transfers mentioned above, and the two can certainly occur at the same time, which would likely make things even worse. But, in the future, to the best extent possible, agencies will need to make sure that they can staff positions with the right people, and make sure that those people can stay focused on the things they really need to do.

Underestimating Technical Requirements

As the technical complexity of 9-1-1 systems has gradually increased over time, some jurisdictions have been caught in situations where they thought they had a handle on the technical needs they were confronted with. If the technical needs assessments are entirely carried out in-house this can frequently be true. But, even with outside assistance, this can be a problem.

The most common case of underestimating technical requirements can come when an agency relies on a vendor to delineate what those requirements are. In this case, we're generally speaking of an outside vendor who has a vested interest in making the technical requirements seem as simple as possible, in order to secure the contract. Anyone who's been around 9-1-1 for a while has heard the stories of agencies purchasing Computer Aided Dispatch (CAD) systems where the complexity was so high that 75% of the functionality was kept turned off. In our work with small rural PSAPs, we frequently have seen this, where the incoming ALI doesn't automatically populate the CAD screen because keeping the cable hooked up was just too difficult, or the CAD vendor wouldn't or couldn't configure their system to handle the particular ALI format at the PSAP.

Then, there are technical requirements for software and database systems. GIS data management, in particular, is a place where this sometimes happens. The vendors of GIS systems, and software products that are meant to work on top of those systems, can sometimes make the mistake of conveying to an agency that their system or product is just about the greatest and simplest thing out there. And, that might actually be true, in relation to other similar products on the market. And, it is also true, sometimes, that the people listening to such pitches hear what they want to hear, or simply lack the background to adequately interpret the information they're being given.

Underestimating Maintenance Requirements

This problem is sometimes related to the problem of inadequately understanding technical requirements. Here, the issue, though, has to do more with data management. In GIS in particular, it is often believed (or hoped) that once the data is 'right', it won't need to be worked on much. Unfortunately, this just isn't true. In some places, where there is little constructions, and therefore not very much in the way of new addresses, police jurisdictions, etc., this can be true. But, in most places, where there is at least a modicum of new development activity, there is a constant flow of changes, such as moving ESN boundaries, adding addresses, and building new streets. If these changes are not kept current in the GIS data, especially as mapping of 9-1-1 calls becomes the norm, more and more often, call locations will be misinterpreted, or in some cases not found at all.

This problem can be particularly bad in locations where the GIS data for 9-1-1 is not maintained as a function of the 9-1-1 agency, but by some other, non-emergency department, such as the county assessor. There have been some agencies (and even states!) where resources for managing GIS data have been curtailed, or eliminated entirely. This is guaranteed to cause problems down the road, especially as the move toward NextGen 9-1-1 gets underway.

Jurisdiction Size

While it makes sense for a small county to have its own sheriff's department, with a small number of officers, this can be a problem when it comes to developing and maintaining GIS data. This problem actually can become worse, because it is not uncommon, particularly in the West, for jurisdictions with small populations to have large, complex geographic areas. So, trying to staff for GIS data management in a place like this is difficult in part because of limited budget and personnel resources, but also in part because there can be a lot of data to manage and maintain.

Silver Bullets

We've all seen the agency where management goes out and buys the latest and greatest hardware system or software package to solve their sticky data management or office communication problem. The idea is something like 'Well, maybe John could keep those address locations right if we just bought this flashy software." Vendors are all too happy to supply these 'silver bullets', because it's just too tempting to sell people what it is that they think they want to be sold. What's frequently being purchased is what is hoped to be a technical solution to what is really a human resources or training problem. Of course, when these systems fail to deliver the hoped-for benefit, they're loudly denounced, and the organization goes back out on the market to get the next Big Fix. This is not to say that these systems can't sometimes help make these situations better. But, in many cases they don't, leaving the client unhappy, and the vendor having a damaged reputation.

A great deal of caution will need to be exercised as we move toward NextGen 9-1-1. There will undoubtedly be a large number of potential silver bullets brought to market, and plenty of agencies unable or sometimes unwilling to be able to sift through these offerings to determine which ones really are going to help.

Suggested Solutions

This section will briefly lay out some potential solutions to the problems described above. Most likely, no single one will fully resolve an agency's issues. But, if appropriate, one or more of them might help with an agency's NextGen transition. Not all of them will be practical for every agency. But, considering these ideas as possible alternatives will at least help direct agency efforts toward alleviating some of the problems described above, along with other related issues that may be identified.

Director of Spatial Data

With the transition toward using GIS data instead of MSAG and ALI data in the PSAP, there is in fact an important opportunity emerging. We would suggest that agencies look toward moving from the concept of an MSAG Coordinator, and enhancing that position so that it becomes what we call either the Director of Spatial Data, or GIS Coordinator.

Most agencies are not going to move directly from using their existing MSAG and ALI databases to solely relying on the GIS to handle the routing of 9-1-1 calls. This fact will be driven by a few factors. One of these is simply that many agencies will not have the comfort level to abandon their traditional MSAG systems. So, there will be an interim transition (hopefully a short one) as they fully implement using the GIS for all call routing. Another factor that will keep some agencies from moving to GIS quickly will be that legacy systems in the PSAP will make it difficult to simply cut off use of the MSAG and ALI[3], until those systems are upgraded, or replaced with ones that can work entirely with GIS source data.

For agencies in this transitional situation, there will be the need to manage the MSAG and ALI, as well as the GIS data. In some cases, the physical management of the GIS may be elsewhere, such as with the county assessor. In other places, the 9-1-1 agency will have sole responsibility for both the GIS and tabular MSAG and ALI data. So, this person's job will be substantially more than that of just being the traditional MSAG Coordinator.

Though the roles and responsibilities of this position will vary, depending on local circumstance, it is important to realize that the person filling this role will be even more crucial to the operation of the PSAP than the MSAG Coordinator is now. Therefore, additional training will probably be required.

Though this appears to be a case where the operational costs in the PSAP are being driven up by external factors, this may not always be true. A single person who understands and can manage both the MSAG and ALI databases, as well as the GIS data, can conceivably fill two roles. This task can sometimes be simplified by existing off-the-shelf software systems designed for this purpose. Whether or not this is true in any individual case is a function of multiple factors, such as the nature of the GIS data, how the MSAG and ALI data are stored and served, and how address management is handled in the Agency. But, implementing this suggestion is certainly something that is worth careful consideration.

GIS Coordinator

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[3] See our paper on interim solutions for MSAG and ALI data for possible alternatives.

One end goal of an agency's transition to NextGen 9-1-1 should be to eliminate the MSAG and ALI databases, replacing them with equivalent functions that are handled strictly by GIS data. In some places, this might happen quickly. In others, it might take many years. But, once it does happen, the key data that 9-1-1 uses, which was formerly the MSAG and ALI databases, will become purely GIS data. So, in these cases, it would be wise to identify the person in charge of this information as a GIS Coordinator.

Even when considering that part of the coordinator's job will be to ensure proper maintenance of the i3 Emergency Call Routing Function (ECRF) and Location Validation Function (LVF), the information that drives those 'functions' is GIS data. So, identifying these databases, regardless of how they are stored or managed, as GIS data, is proper, and will ensure that all parties involved understand the nature of the data.

In many jurisdictions, this GIS Coordinator may not have a direct, hands-on relationship to the GIS data. In these cases, the former MSAG Coordinator should be able to transition quite smoothly into the role of managing how the data is maintained and utilized. And, again, with the right set of GIS software tools, the MSAG Coordinator can become the GIS Coordinator, and still do many of the day-to-day maintenance tasks, such as finding missing addresses, and making trivial edits to data, such as street addresses of address points.

Regional Data Management

Though local jurisdictions will still wish to control their emergency services in the NextGen world, for good reasons, in some cases, it might be best to try working out regional inter-agency arrangements for managing their GIS data. Some parts of Texas, for instance, have had good success with this model, through their Council of Governments (COG) model.

A variation on this that is worth considering for purposes of NextGen 9-1-1 is the possibility of having regional or even state GIS data management. The core data, in terms of geographical objects (lines, points, polygons) would be managed at the aggregated level. But, with remote access arrangements that allow MSAG Coordinators (or Directors of Spatial Data, or GIS Coordinators) to connect and either edit their own jurisdiction's data, which would primarily be street names and address ranges. Optionally, these users could be allowed to make 'red-line' edits when feature geometry needs to be added or updated. Those red-line edits would then be approved and inserted by the regional GIS staff.

Regardless of how such an arrangement is managed, it will have the advantage of removing the need for redundant staff across multiple jurisdictions, and also reduce or eliminate the need for expensive training of in-house staff. Existing MSAG Coordinator functions would not be radically changed, so existing staff could continue to fulfill very similar functions to what they currently do.

GIS as a Service

Much as the MSAG and ALI databases are usually maintained remotely from the 9-1-1 agency, such as by Intrado, the notion of GIS management as a service will probably become more prominent in the

near future. There are already moves afoot by MSAG / ALI database service providers to do just that. In this system, the jurisdiction's GIS data for 9-1-1 would be housed at the service provider's site, and they would do most or all of the actual editing.

In many cases, this would be similar to one of the scenarios described above under Regional Data Management. That scenario is the one where there is centralized management of the GIS data, with remote access allowed for attribute editing and red-lining. So, much as there are now remote web-based tools for updating a jurisdiction's MSAG, and reviewing ALI records, there would be remote tools for red-lining the centerline layer, both to add and delete actual features, and to update street names and address ranges. Options would also be available for adding, moving, and deleting actual address points, if such data is available and maintainable by the 9-1-1 agency. These providers will also need to accommodate management of ESN polygon boundaries, and may allow remote editing or red-lining of this data as well.

PSAP Consolidation

The additional complexities of data management that will be imposed by NextGen 9-1-1 will likely induce some jurisdictions to consolidate PSAPs. PSAP consolidation can in some cases allow the reduction of the number of people editing the MSAG, or the GIS. Of course, this option provides many of the same advantages that would be gained by regional data management, as described above.

Eliminating the MSAG and ALI

As pointed out, the logical and probably inevitable endpoint of the changes to spatial data that will be caused by NextGen 9-1-1 will be the actual elimination of the MSAG and ALI databases. There are many advantages to taking this step. One that is most relevant to this discussion is that, instead of managing five different database tables (or GIS layers) in two different formats, we are now reduced to 3 layers in 1 format. And, there are no logical inconsistencies among those three layers, as there usually are currently between the MSAG and centerline layers in the GIS.

The ability to completely eliminate the MSAG and ALI may not always be practical, at least in the short run. Reasons why this might be were discussed earlier in this paper. But, when these tabular data sources can be replaced with the GIS data that will eventually replace them, anyway, there should be significant savings in time and effort, as well as a reduction in error rates in location of 9-1-1 calls. Elimination of the MSAG and ALI, replacing them with GIS data layers, ought to be the goal of every 9-1-1 agency.

Conclusion

NextGen 9-1-1 will improve the ability to locate 9-1-1 callers by more completely integrating GIS into the system. But it will increase, especially in the short term, the complexity of managing spatial data. Additionally, in particular during transitional phases, implementation of NextGen 9-1-1 will increase the amount of time and effort used to maintain spatial data. Impacts on existing staff may be severe, which

could have substantial adverse impacts on 9-1-1 operations. Planning ahead for this transition, agencies may be able to use strategies that can reduce these impacts, or even eliminate them entirely.