

## **Introduction**

Since 2008, the E-911 Services Board has provided funding to several Next Generation 9-1-1 (NG9-1-1) pilots. These pilots represent the first realistic applications of NG9-1-1 technologies in the commonwealth and will provide the necessary real-world experiences to enable the E-911 Services Board to transition the current planning efforts into a sustained deployment strategy. The overall goal of the trials was to evaluate different technical and operational solutions for NG9-1-1 and to utilize the knowledge gained from this process when determining next steps in strategic NG9-1-1 planning activities. A brief description of the scope of each pilot is provided below:

- **Pittsylvania County** installed the first stand-alone IP-based 9-1-1 network in the commonwealth to deliver wireline, wireless, and VoIP 9-1-1 calls to the locality's Public Safety Answering Point (PSAP). This network is maintained by a Competitive Local Exchange Carrier (CLEC).
- The **Southside Project**, which includes the counties of Franklin and Patrick, installed the first regional IP-based 9-1-1 network in the commonwealth with completely redundant IP-enabled telephony equipment. This network is maintained by the same provider serving Pittsylvania County.
- The **Southwest Project**, which includes the counties of Dickenson, Lee, and Wise and the city of Norton, established a multi-node geo-diverse and redundant Customer Premise Equipment (CPE) solution.
- The **New River Valley Project**, which includes the towns of Blacksburg and Christiansburg and Montgomery County, invested in the deployment of a regional broadband IP network that can support several public safety communication applications through an integrated interoperability governance structure.
- The **Bland/Twin/ Wythe Project**, which includes the town of Wytheville, the city of Galax, and the counties of Bland, Carroll, Grayson, and Wythe, brought together two stand-alone PSAPs and a recently consolidated PSAP into a multi-jurisdiction geo-diverse CPE solution to overcome the issue of regional redundancy.

This white paper summarizes both the positive and negative outcomes of the pilots. Virginia Information Technologies Agency (VITA) Integrated Services Program (ISP) staff collected data and information through in-person interviews with local project managers. The standardized questions posed during these interviews were related to these four focus areas:

- Governance/Project Oversight
- Project Costs
- Operational and Technical Impacts
- VITA-ISP Support

A complete transcript of these interviews is available from the following link: <http://www.vita.virginia.gov/isp/default.aspx?id=8488>. A summary of key findings from the local project manager interviews is provided in the next section.

## **Findings**

1. The pilots highlighted the need for statewide and local governance models for NG9-1-1 projects. Statewide governance should include a path forward to interconnect the regional pilots with a statewide IP backbone. Localities will need a standardized planning approach that includes a best practice for a formalized local governance structure.
2. Pilot participants identified two potential governance requirements. One, whether or not grant funding should be used to support NG9-1-1 projects prior to the completion of more robust governance models. And two, whether or not grant funding should be contingent upon an interconnection requirement with a statewide IP backbone.

3. The NG91-1- pilots required a great deal of local resources and specialized knowledge. Two specific areas identified by pilot participants for follow-up were local IT support and procurement. The suggestion was made to secure 24/7 tech support on all equipment.
4. Localities identified the need for greater project management support and clarity. The suggestion was made to create a project checklist. Project scopes need to be better defined and must contain clear end points. Resources should be developed to help PSAPs concurrently manage multiple vendors working on a single project.
5. Pilot projects contain many unknowns, but one area identified by pilot participants where they needed greater insight was in estimating all types of recurring costs. This knowledge is vital for the localities that participated in the pilots to be able to sustain the project once the grant funding has ended. Sustainability strategies will need to be identified to help support, and to the extent possible, reduce recurring costs.
6. An anticipated outcome from the NG9-1-1 trials was a determination as to whether a regional or a standalone approach was the most cost effective solution. It was assumed that the regional approach would cost less, but when comparing the two, there were no identified cost savings associated with a regional pilot as compared to a single deployment. The reason for this may be that the economies of scale necessary to generate cost savings were not present. In addition, all of the benefits associated with the regional pilots may not have been considered when evaluating cost. NG9-1-1 may cost more, but localities are deriving greater benefits with this technology, as compared to legacy 9-1-1. More analysis may need to be conducted to determine if localities are completely aware of the added value of NG9-1-1.
7. All participants reported redundancy within their systems. However, this was not evaluated against pre-determined criteria and the results were subject to interpretation.
8. T1 and fiber were the common connectivity choices, but issues related to redundancy and reliance on third party providers were identified by the pilot participants who used fiber as their means of connectivity. Microwave also proved to be problematic because of mountainous terrain.
9. Pilot participants were open and supportive to expanding the projects to other locations, but expressed concern about proceeding in this manner until they felt more secure in sustaining the status quo. Concerns related to sustainability would need to be addressed first. Since scalability was not addressed at the inception of the pilots, additional costs related to equipment, connectivity, and bandwidth requirements would need to be considered before any expansion decisions are made. The suggestion was made to require periodic review for growth of the system.
10. Pilot participants reported improvements in call processing in regards to functionality, connectivity, and coordination.

## **1. Governance**

Initially, the governance structure of the pilots was informal. Pittsylvania and the Southside and Southwest pilots did not have a formal project plan prior to applying for grant funding. The Bland/Twin/Wythe pilot began with a milestone plan. The New River Valley pilot was the exception, with a formalized and integrated governance structure from the beginning. However, as the pilots progressed, the localities recognized that more formal governance structures, such as Memorandums of Understanding (MOUs) and by-laws, were needed to provide structure and safeguards.

The Southside, Southwest and New River Valley pilots began as a partnership between VITA and participating local governments to evaluate the potential for hosted PSAP services. Unfortunately, VITA, and its contractor Northrop Grumman, were unable to provide a hosted PSAP services solution. As a result, adjustments had to be made to the project plans for the Southside, Southwest, and New River Valley pilots. Pittsylvania, in contrast, was a stand-

alone project conceived to help that locality's Deaf and Hard of Hearing community with IP-capable CPE. The Southside, Southwest, and Pittsylvania pilots relied heavily on VITA for project management guidance, in lieu of a formal project plan. In the case of the New River Valley pilot, there was a greater concentration of local resources to provide project management support. Local project management support was also an initial component of the Bland/Twin/Wythe project.

Aging equipment was the predominant reason for participation in the pilots by Pittsylvania and the localities involved in the Southside and Southwest projects. Equipment was also a factor for the New River Valley localities; but these localities were evaluating equipment replacement as part of a larger project, a regional broadband IP network that could support several public safety communication applications. Similar to the New River Valley pilot, the Bland/Twin/Wythe project shared a broader focus. And since this was the last pilot to begin, it appears that an evolution towards more strategic outcomes was occurring. Equipment replacement in the Bland/Twin/Wythe pilot was a strategy towards developing regional redundancy to share people and resources. The procurement of equipment for these pilot projects was accomplished through a combination of sole source and RFP approaches. However, there was some acknowledgement on the benefit of cost efficiencies. The procurement decision within the Bland/Twin/Wythe pilot was whether or not to bundle the project components into a single procurement or to procure equipment and connectivity separately.

The majority of the pilot participants were satisfied with the governance oversight of their respective projects, but several recommendations were made for future projects of a similar nature. These recommendations included the following:

- Establish a governance structure much earlier in the implementation process
- Develop a governance model (e.g. regional jail authority) for localities to emulate
- Maintain clear and consistent communication with local government officials
- Provide guidance on necessary skill sets for local project managers
- Discourage stand-alone efforts and encourage greater statewide coordination

On the other hand, sustainability was an area in which participating localities had a great deal of concern. Pittsylvania is struggling with recurring costs. Participants in the Southwest pilot are trying to determine the Total Cost of Ownership (TCO) for their project and decide whether or not a regional approach will be truly cost effective. And, participants in the New River Valley pilot may be faced with additional costs related to a future consolidation with Virginia Tech.

## **2. Financial**

Given the complexity of the pilots, a significant portion of employee time within the participating jurisdictions was required to be spent managing the projects. And although the E-911 Services Board did not require localities to document the amount of local time assigned to the pilot, it was the consensus of the pilot participants that similar future projects should track the amount of time that is dedicated to the project.

Local and PSAP IT departments are essential to the implementation and future budgeting process. As a result, these groups should be included early on in the project design and implementation. Many local Information Technology (IT) departments are not accustomed to the 24/7/365 requirements of a 9-1-1 center, which may lead to the implementation of shortcuts, resulting in increased project costs. To help reduce costs, each of the pilot projects utilized five-year maintenance agreements to take advantage of substantial discounts over single year reoccurring agreements. While this has a positive effect for the locality in the implementation and subsequent

years, it does require the education of local budget committees on the sustainment and maintenance costs required in year six.

The Total Cost of Ownership (TCO), as identified by the local project managers of the five NG 9-1-1 pilots, totaled \$3.24 million. This ranged from a cost of \$300,000 for the Pittsylvania project, which was for a single PSAP, to implement a NG network and moving away from the traditional Local Exchange Carrier (LEC) to a multi-node redundant system in the Southwest project, which connected four PSAPS, at a cost of \$1.1 million. These TOC figures represent NG9-1-1 costs, but it is not clear whether or not they reflect all of the cost elements associated with the total provisioning of 9-1-1 services. Additional analysis will be conducted to make this determination to gain a greater understanding of the financial aspects of the pilots.

Furthermore, each solution came with its own set of unknown costs that led to surprises. Initially it was thought that the current LEC costs would go away and would transition to the NG9-1-1 service provider charges. Unfortunately there are still charges associated with the LECs that remain and this is proving to be particularly problematic for Pittsylvania County. With the Southwest pilot the cost of maintaining the network is just over \$100K annually. This price would have been even higher; however, the localities implemented a microwave connection between the two systems that saved additional recurring network costs. The connectivity costs are being split equally by the participating localities.

The cost differential between a stand-alone vs. a multi-jurisdictional system implementation varied but for the most part was close to the same cost. Through year five of the current project lifecycle for the NG9-1-1 pilots, the costs are divided between the CPE and the network. In year six, the network connectivity costs and the maintenance costs become a local responsibility, which is causing concern. It appears that these costs will exceed what the locality would have previously paid on a legacy stand-alone system; however, the locality has gained functionality and reliability that was not previously present.

It is difficult to determine what the cost difference would be due to jurisdictions having difficulty obtaining pricing for their future maintenance costs after their prepaid maintenance has expired. Another unique option is on the horizon and that is with service-based solutions. This would be accomplished by localities paying for a service of 9-1-1 call delivery rather than purchasing their equipment and related services. Funding for this type of solution would need to be borne by the locality, as the PSAP Grant Program does not currently fund this solution. Instead, this grant program supports the purchase of equipment, but the appropriateness of funding service-based solutions may be a issue for the PSAP Grant Committee to explore in the future.

Each of the project teams was asked if they had identified any other funding sources other than VITA. None of the teams were able to identify any other state or federal funding sources. Local funds would have been the only other funding sources available and it is not believed that acquiring funds for such a project would be possible. However, one locality, Dickenson County, has been successful in obtaining additional funds for their PSAP via a local foundation.

### **Operational and Technical Impacts**

The CPE solution chosen by the localities participating in the pilot projects resulted in the procurement of equipment manufactured by two different vendors. The Pittsylvania, Southside, and Southwest pilots chose Viper systems and the New River Valley and Bland/Twin/Wythe pilots chose Patriot systems. All participants reported redundancy within their systems. Some localities have each other as their backup while others have duplicate equipment, and still others make use of generators or UPS. There were some unexpected obstacles such as needing a second circuit, additional T1 lines, and regular testing of a command post.

T1 and fiber are the common connectivity choices with the pilot projects. Microwave is being used to connect some of the localities in the Southwest project, but if connectivity via microwave was expanded to Lee County, it would require multiple hops because of the terrain in the region. Additional towers are being considered for this project. The connectivity using fiber also has issues. In the Bland/Twin/Wythe pilot redundant fiber is running concurrently for five miles. This is a problem because it represents a single point of failure since both fiber paths are co-located. A single incident could disable both fiber paths. Finally, the New River Valley pilot identified the need to have local personnel trained or on contract for fiber repairs and maintenance in order to avoid dependency on third party providers.

Most of the pilot participants favored expansion of the project to other localities. However, additional costs related to upgrades, expanded connectivity, bandwidth requirement re-provisioning, and remote locations would need to be considered first. There is also concern among the pilot participants regarding the sustainability of the current systems beyond the pilot period. This concern would need to be overcome before the localities would consider expansion. And finally, all of the pilots reported improvements in call processing in regards to functionality, connectivity, and coordination. Specific improvements cited by the localities include the following:

- Increase in the number of provisioned lines
- Greater system reliability during weather-related events
- Faster call set-up time
- Enhanced ability to transfer calls
- Decrease in the number of dropped wireless calls
- More back-up capability
- An established infrastructure and network design that will enable future growth

### **VITA Support**

A majority of the pilot participants spoke positively about VITA's support during the implementation of their projects. It was acknowledged that none of the NG9-1-1 projects could have been implemented without funding from the E-911 Services Board. However, some of the pilot participants felt overwhelmed with the process and would have benefited enormously from the support of a full-time project manager. Another gap in support was the need for an on-site engineer to coordinate the efforts between the equipment and service providers and local vendors during the install and go live phases of the pilots.

Since these pilots represent the first applications of NG9-1-1 in the commonwealth, it was acknowledged among the pilot participants that VITA could not realistically foresee the full scope of problems or concerns experienced by the localities. However, there is an expectation that VITA will compile the data and experiences related to the implementation problems with the pilots and use this information to inform participants in future projects.

### **Conclusion**

The evaluation of the technical and operational solutions included in the NG9-1-1 pilots has generated some very useful results. These results will aid the E-911 Services Board and ISP staff in their efforts to complete currently identified planning milestones and deliverables. The two immediate planning milestones are the next edition of the 9-1-1 Comprehensive Plan and a NG9-1-1 technical feasibility study. The Comprehensive Plan will provide the continued vision and path forward for 9-1-1 in the commonwealth and the feasibility study will identify the process for establishing a statewide ESInet.

The first and most critical deliverable is the identification of the legislative and regulatory needs and the legislative agenda items to support NG9-1-1. The analysis of the NG9-1-1 pilots brings us one step closer to completing this task. The pilots presented a learning opportunity for NG9-1-1 technology that ranged from a proof of concept to a soft launch. Although several of the pilots started out as forward-thinking CPE replacement solutions, all provided insight into the deployment of a shared-services consolidated approach. The emerging policy question is whether or not to encourage and/or require this type of approach in the future, and if so, how should it be accomplished? To this end, ISP staff will be seeking policy direction from the Legislative Agenda Subcommittee.

The second deliverable is the creation of the following informational resources for 9-1-1 stakeholders:

- Provide useful standardized planning information for NG9-1-1
- Offer feedback on network approaches and equipment selection
- Measure the outcomes of critical success criteria for NG9-1-1: call transfer and set-up time
- Estimate recurring NG9-1-1 costs
- Identify the level of support these types of projects will require moving forward
- Evaluate products and services used by the PSAPs

And third, is the establishment of NG9-1-1 best practices for the E-911 Services Board and ISP staff to use in shaping the commonwealth's 9-1-1 policy for the transitional role between legacy 9-1-1 and NG9-1-1 technologies.