Professional Consulting Services

PSAP Consolidation and Shared Services Report

Allegany, Schuyler and Steuben Counties, New York
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1. Executive Summary

This study examines public safety answering point (PSAP) consolidation from two perspectives:

- Functional Consolidation
- Shared Services Consolidation

At the request of the client, both aspects of consolidation were analyzed. Functional consolidate is the physical relocation of PSAP operations to a single facility. The shared services consolidation examines what services and technologies could be shared by the participating counties while keeping their individual PSAP operations.

1.1 Elements of Consolidation

The consolidation of communications services has been a part of the evolution of public safety communications. The technology of public safety communications has evolved. The cost of delivering services has increased, and the role of public safety has changed. As a result, the concept of consolidating public safety answering points, communications dispatch centers and communications systems has garnered increased interest.

To successfully consolidate a PSAP and communications system is much more than simply relocating existing dispatch systems into a new location. It is much more than the sharing of technology systems. The successful consolidation begins with governance and addressing the potential operational impacts from the dispatch and responder aspects to the public.

The complexity of a consolidation must take into account the cost of initial investment to initiate the consolidation, the differing operational and technology requirements of the partners, the expectations and opinions of responders and dissimilar land mobile radio systems.

The goals of consolidation include seeking cost savings, improving the sharing of information, and the opportunity to improve technology systems for the delivery of law enforcement, fire and EMS services. Focusing on a single goal is likely to result in failure. Indeed experience demonstrates if cost savings are the sole objective, success will be elusive.

In this analysis Blue Wing has reviewed two consolidation options. The first is an analysis of functionally consolidating the PSAPs of Allegany, Schuyler, and Steuben Counties. The second option is for the counties to share technology systems within their existing PSAPs.

Given the diverse operational needs of the responders in the counties, the technology requirements are not equal. The cost to procure and maintain systems will be significant. This could be offset because Steuben has already procured computer aided dispatch (CAD) and E-911 telephone systems, which are an integral part of a consolidated center. The cost sharing arrangement between the counties would dictate the recurring operating costs of CAD. Nevertheless other costs would be incurred.
The opportunity to improve the sharing of information is enhanced with consolidation. Clearly improving information sharing provides a benefit to the public. The question for public safety officials is whether there is a need to improve information sharing between the counties and what the benefit is for the cost.

There are numerous technology and cost impacts to providing public safety communications. Next generation (NG) 911 is still in the development phase but will be deployed within the next several years. While costs of NG911 to an individual county have yet to be identified, it is anticipated that the costs of equipment, networking and maintenance are more than current costs. Planners need to consider the future of public safety communications. Within that context, what is the best public safety communications configuration for the public and responders?

Short term goals should be the clarification of needs, requirements, and expectations; developing a governance model; and a phased approach to improve PSAP-to-PSAP communications and radio interoperability.

1.2 Functional Consolidation

A functional consolidation is when the partner PSAP is located in a common facility. For this study, the Steuben County PSAP was used as a model because it already contains much of the infrastructure necessary. Counties would continue to use their existing land mobile radio (LMR) systems. The organizational structure could be either that Steuben County provides PSAP services to the partners for a fee or an independent consolidated PSAP authority could be established. Both alternatives have strengths and weaknesses.

Governance – for either model there would need to be a clearly articulated governance document. The governance would articulate tasks, responsibilities, and services provided. An executive committee and operational committee would be necessary.

Currently there are 56 full time equivalent (FTE) communications employees in the three counties. The consolidated model estimates that 53 FTEs would be needed.

Currently $4,031,892 is spent on communications services within the counties. The consolidated model estimates that the annual cost increase of $470.608. The cost increase is from higher salaries. This number does not include other elements from additional cost to create positions to do work that is currently done by local dispatchers to the reoccurring networking cost of radio and backup dispatch capabilities. Saving could be realized with reduced staffing.

The Allegany and Steuben PSAPs are dedicated to public safety communications. The Schuyler County PSAP staff also attends to the Sheriff's service window and comprises sworn jailers. Schuyler County would need consideration of those positions. The estimated cost to hire five full time staff for 24 x 7 coverage is estimated to cost $325,500.

The functional consolidation explores the possibility of some or all of the counties developing a single region-wide PSAP. The shared services model explores the possibilities of some or all of the counties sharing resources but maintaining their PSAPs.

Blue Wing has provided three models for apportioning the cost to each county. These models are based on E-911 calls, population, and assessment. As seen in the analysis each model has advantages and disadvantages.

1.3 Shared Services Consolidation

A shared services consolidation is when the partners share certain technical platforms such as CAD or E-911 telephone systems. A shared services consolidation is dependent on connectivity between the partner PSAPs. The Chemung-Schuyler-Steuben and ION fiber networks would facilitate the shared services consolidation.

Potential partners need to consider what the best shared systems are and what features and functions those systems need to support. One county may need more capacity than another. Individual county needs must be clearly identified early in the process. Finding partners with like needs appears to be an important element to consider.

While this shared services model was based on Allegany-Schuyler-Steuben, the concepts could be applied to other potential partner counties.

Blue Wing has identified possible shared services technologies. An overview of the complexity and capabilities of each technology is provided. To provide cost and savings estimates will require the development of a conceptual design along with each agency's needs and requirements.

Possible shared services include:

- CAD
- E-911
- Land mobile radio
- Mobile data radio
- Recorders

1.4 Summary

Both functional consolidation and shared services can offer individual counties greater capabilities and functionality. The fundamental question is what capabilities and functionality is needed by the individual counties and at what cost.

Neither the functional consolidation nor shared services model offer immediate cost savings. This can be attributed to Allegany and Schuyler Counties modest current PSAP operations expenditures. In both models, there are large initial costs.

While significant cost savings are not foreseeable it is Blue Wing's experience that consolidations can result in improved exchange of information and the efficient use of public safety resources.

Future discussions should use the information provided in this report as a foundation. As goals and system specifics are developed, operational, technical, and cost models can be further refined.

2. Overview

Allegany, Schuyler, and Steuben Counties in New York State are seeking ways to reduce costs and improve public safety services within their counties.

Recognizing that there may be inefficiencies in maintaining multiple emergency dispatch centers, the three counties commissioned this study to determine the feasibility of establishing a centralized dispatch operation or shared services that could handle service calls from multiple municipalities and agencies.

2.1 Background and Process

There are currently three PSAPs operated by the counties. Although this configuration has worked well, with the development of shared computing capabilities and improved regional connectivity, the concept of exploring either a regional communications center or shared services has gathered greater interest.

In 2010, the counties, with Steuben County as the project sponsor, submitted an application for funding through the New York State Shared Municipal Services Incentive Program to study the feasibility of consolidated dispatch. The effort was successful and through funds obtained, counties engaged Blue Wing Services to conduct this consolidation dispatch feasibility and implementation study. The study not only examines the functional consolidation of PSAPs but also looks at the operational and technical opportunities available by sharing resources.

Because there is no single model for a consolidated dispatch center, the counties directed Blue Wing to thoroughly investigate the opportunities and base consolidation recommendations on meeting local requirements. This was done within a “best practices” framework. Blue Wing conducted site visits and gathered information in an effort to obtain inputs from the participating agencies.

2.2 Key Findings

A number of call answering and central dispatch service models were researched and explored. Through the community process, a consensus emerged for creation of both a functionally consolidated center and shared services models. The functional consolidation explores the possibility of some or all of the counties developing a single regionwide PSAP. The shared services model explores the possibilities of some or all of the counties sharing resources but maintaining their PSAPs.

The functional consolidation option considers the following:

- Mission statement
- Impact on the public
- Impact on responders
- Governance
- Policy development
- Technologies
- Cost sharing of technology products
- Improved sharing of incident information
- Staffing
- Staffing costs
- Use of existing legacy land mobile radio (LMR) systems
- Training and standards
- Backup configurations
- Redundancy
- Initial startup costs
- Reoccurring operational costs
- Cost sharing

The shared services model explored these issues:

- Mission statement
- Impact on the public
- Impact on responders
- Governance
- Policy development
- Technologies
- Cost sharing of technology products
- Improved sharing of incident information
- Use of existing legacy land LMR systems
- Training and standards
- Initial startup costs
- Reoccurring operational costs
- Cost sharing

Both models examine the impact on staffing and operations. Both models examine technical applications including using fiber connectivity. A comparison of current costs and projected costs is also analyzed. These models provide a high-level framework for additional study.

2.3 Existing PSAP Findings

	Allegany	Schuyler	Steuben
County Population	49,927	19,225	98,726
Households	18,009	7,374	39,071
Total 911 Calls, 7 Digit, and Other Calls	54,130	80,619	109,127
Wire line 911	47,436	5,444	20,311
Wireless and VoIP 911	6,694		26,613
Abandoned	1,580	256	4,985
911 Trunks	8	6	12
7 Digit			
Inbound	12,113	55,698	58,218
Outbound	26,364	19,477	52,449
Non-communications Tasks	Answering after hours phone for select departments	Sheriff's service window/monitor jail operations	Answering after hours phone for select departments
911 Equipment	Plant/CML Vesta	Moducom 911	Positron Power 911
7 Digit Telephone System			
CAD	J2 Software Solutions	J2 Software Solutions	Positron (Tiburon in 2012)
Communications Consoles	Zetron	Moducom	Motorola - Centercom Gold Elite
Staffing			
Per shift			
0800-1600	3	2	7
1600-2400	3	2	7
0000-0800	2	2	4
Full Time	9	9	27
Part Time	7	7	10
Bargaining Unit	ASME	Schuyler County Correction Officers Benevolent Assn, Inc.	Dispatchers – CSEA Local 851
Seniority	Yes	Yes	No
Pay range – Dispatcher	No data	$16.78	$15.49 – $18.97
Pay range – Shift Supervisor	No data	No data	$16.51 – $20.33
Training	APCO, OJT	APCO, NYS Fire Academy, OJT	APCO, OJT
Dispatch Protocols	ProQA		Medical Priorities
NYS Compliant	Yes	Yes	Yes
Governance	Sheriff's Department	Sheriff's Department and OEM	Independent Department

- The total 2000 population of the three counties was 167,878.

- In 2010, there were an estimated total of 243,876 E-911, seven-digit, and other inbound calls annually.
- There were an estimated total of 224,314 inbound and outbound seven-digit calls annually.
- There are a total of 45 full-time and 24 part-time call takers and dispatchers.[1]
- Based on current staffing, there is an equivalent of 32 positions staffed per day resulting in 93,440 hours of staffing annually.
- There are a total of 37 law enforcement, 89 fire, and 51 EMS agencies dispatched within or adjacent to the three counties.

[1] Directors, assistant directors, and other administrators are not included as some have other non-communications responsibilities.

3. Consolidated PSAP Model - Overview

Consolidations can occur in several ways, including functionally consolidating PSAP operations, virtually consolidating, or sharing services among the PSAP partners. This section examines the requirements, tasks, and issues necessary to develop and support a three-county or regional functional consolidated PSAP.

It is Blue Wing's observation that few PSAP consolidations result in large savings. As will be shown in this analysis, small communications centers often rely on the management services of officials who include communications with other tasks. The systems are typically smaller and provide fewer features. The radio communications systems are often conventional analog and do not require periodic software upgrades. The cost of maintenance is less than that of a technologically enhanced trunked radio system. While the total number of PSAP positions may be reduced in a consolidation, there are non-communication tasks done by communications staff that would need to be filled.

A new consolidated PSAP will require initial expenditures to get started. These may include: engineering, procurement of equipment and systems, and professional services such as human resources, legal, and consulting. If an existing facility is not generally ready, there is the need to procure a facility and ancillary services.

Where a consolidated PSAP excels is in sharing information. The gathering of information in a single location provides the opportunity to view events regionally and deploy resources more effectively. It could be argued that sharing information among municipalities can enhance law enforcement, promote police officer safety, and provide for better and timelier mutual aid between communities.

3.1 Governance

Governance is the process of establishing a framework for conducting business. This extends to identifying a purpose, developing policy, exercising authority, and deploying the resources necessary to achieve the goals. Governance structure needs to be crafted to meet the requirements of the proposed partners. Nevertheless, the key areas that must be addressed are:

- Oversight – Both an Executive Committee and an Operational Committee are recommended. The Executive Committee would be comprised of executive and elected officials from the partner counties. The Executive Committee would be charged with PSAP goals, executive policy, budget, human resources, regulatory, and accountability. The Operational Committee would be tasked with developing operational policies, addressing operational problems,

liaison with agencies and mutual aid partners, and meeting the Executive Committee's directives. The Operational Committee would be comprised of law enforcement, fire, EMS, and emergency management representatives of the partner counties.

- Policy development – Both the Executive and Operational Committees would be required to develop and maintain policy documentation for their areas of responsibility. Clear and concise policy defines the tasks and responsibilities that provide guidelines on how the consolidated PSAP will perform. Policy directives need to remain relevant. Assessments of policy need to be done at regular intervals.

3.2 Organization

PSAP consolidation organization can use the following options:

- One partner county provides consolidated services to other counties, creating a provider and customer relationship.
- A multi-county regional PSAP authority is created.

Both options have merits and constraints. When one county provides services to others, agreements need to be in place to ensure that a specified level of service is provided, costs are managed, and that there are sufficient methods to address changing requirements and resolving issues. Both the provider and customer counties need to know their responsibilities when joining and being a participant and the conditions and obligations if the relationship is terminated. Prior to purchasing systems and equipment, the provider county needs assurances that the fees charged to the customers are sufficient. This includes the necessary length of time to cover the added cost to support a larger multi-county system. Likewise customer counties would want to be sure that they are obtaining quality service and that the systems are using current technologies. The governance model would be that of a seller and buyer relationship. It would not be unrealistic given the costs to support a multi-county PSAP to require multi-year commitments. The strength of this concept is that no additional level of government is developed. Agreements are either contractual or through the use of memoranda of understanding (MOU). Additionally the host county will need to be in the position of meeting the needs of its clients to keep their participation. The weakness of this concept is that partner counties may not feel their needs are being addressed as adequately as they might be if they had maintained their own PSAP.

A multi-county regional PSAP authority could be created for the purpose of providing PSAP services to the member counties. Each member county would have representation along with fiscal responsibilities. The creation of a local authority would require appropri-

ate legislative action. Once created, the authority would adopt a governance model, hire staff, secure facilities, and develop plans to provide PSAP services for the member counties. One complaint of a local authority is that it creates another level of government that is removed from elected officials of each county. Given the cost of running a regional PSAP authority, multiyear commitments from partner counties would be anticipated.

Each organization model can work. To be successful, each model requires all participants to know what services they will obtain verses the cost.

A provision of the governance document needs to address how a new partner county is incorporated. What are the entry procedures that must be addressed by both the applicant and consolidated PSAP?

Likewise there need to be provisions on how an existing partner county ends its relationship with the consolidated PSAP group. If long-term expenditures and obligations have been incurred on behalf of the members, the exiting process must be clearly defined.

3.3 Management and Operational Staff

The organization is typically divided into a management staff and operational staff. This structure is similar to that currently found at the partner PSAPs.

Management Structure:

- Director – reports to legislative, executive, or head of regional authority. Responsible for PSAP operations, performance, budget, and staffing.
- Assistant Director – supports director, responsible for training, regulatory compliance, scheduling, and operational compliance with standard operating policies.
- Administrative support – Clerical, book keeping, and HR.

Operational Structure:

- Technical Support – responsible for E-911 databases and systems, computer-aided dispatch, loggers, and other systems.
- Shift Supervisors – responsible for shift performance in compliance with policies and guidelines.
- Communications Staff – call takers and dispatchers who take 911 and seven-digit calls and alert responders.

3.4 Location

The location of a consolidated PSAP needs to consider the following:

- Sufficient space for the facility that would include building and parking.
- Secure surroundings.
- Clear of hazards such as flood zones, industrial areas that use hazardous materials, and unstable and contaminated soils.
- Access to diverse sources of telephone and broadband services.
- Access to utilities such as electrical, potable water, and sanitary sewer.
- Access to public roads and public transportation services.
- Ability to host a communications tower.

With sufficient connectivity, a PSAP communications center can be located anywhere. However, in the Allegany-Schuyler-Steuben model, the existing Steuben County communications center supports many of the systems and features that would be needed.

3.5 Required Infrastructure

In New York State, the State Wireless Board has established equipment minimums for PSAPs that take wireless 911 calls. While not a requirement, the National Fire Protective Association's section 1221 includes good recommendations for PSAP systems.

In addition, a modern PSAP will need to have the following:

- Seven-digit telephone
- E911 telephone
- Computer-aided dispatch
- Logging and instant recall recorders
- Power systems including both primary and backup power
- Console positions
- Grounding and bonding systems
- Utilities such as water, sewer, natural gas, telephone, and broadband
- Heating and air conditioning systems
- Security systems for building, parking lots, and surrounding areas
- Administrative space
- Training space

- Storage space
- Loading dock
- Staff space – kitchen, lockers, break room
- Emergency provisions – Sleeping/rest areas, emergency food and water, personnel hygiene supplies.

If the existing Steuben County communications center is used, a majority of the infrastructure issues will be addressed including:

1. 911 equipment
2. CAD system
3. RMS system
4. Use of databases
5. Mapping systems
6. Use of the existing consoles with the addition of four more.
7. Backup PSAP, however, other configurations are possible
8. Connectivity with LMR sites
9. Interoperability with adjacent municipalities
10. Paging and alerting system
11. Seven-digit telephone system

3.6 Land Mobile Radio and Connectivity

The three-county region consists of nearly 2,780 square miles. Each county has developed public safety radio systems for fire, EMS, and law enforcement. In the initial phase of PSAP consolidation, the existing land mobile radio systems would be used. During later phases, the development of a regional land mobile radio system or other alternatives could be assessed.

The current county land mobile radio systems would need to be connected with the regional PSAP. The recommended method would be to use redundant microwave or fiber-optic cable. Alternatively the use of redundant telephone circuits could be used. There would be costs associated with the design and construction of systems necessary to connect adjoining county radio systems to the regional PSAP. For Schuyler and Steuben Counties, the regional fiber project could be used for connectivity from the Steuben County PSAP to the Schuyler County radio sites. A microwave or radio-telephone connection

between the Steuben County radio system to the Allegany County radio system would be required.

Maintaining each county's existing LMR system is inefficient from a dispatch perspective. It is more efficient for dispatch purposes to consolidate the radio systems of the various services. The inefficiency occurs when a dispatcher has to monitor several separate radio frequencies and when there is insufficient radio traffic on any one frequency that would require a sole dispatcher for that frequency. Because users on separate radio systems cannot hear radio traffic on the other systems, the result is the lack of communications awareness at the dispatch level. Land mobile radio systems consolidation would improve dispatch operations efficiency.

Regional LMR systems are being developed in NYS. A regional LMR system can be a single system configured for each County or it can be individual systems that are networked together. Both configurations have merit and constraints. A regional radio system would enhance interoperability, promote communications center dispatch efficiencies, and could cost in excess of $50 million for the three-county area. A comprehensive study would be required to determine user needs, system requirements, spectrum availability, tower site connectivity requirements, and costs.

3.7 PSAP Operations

The function of the regional PSAP would be to answer and dispatch 911 calls. This will require call taking and radio dispatch functions. The existing three county PSAPs also support the answering of seven-digit non-emergency telephones and related tasks such as emergency medical dispatch (EMD) procedures. Associated with PSAP operations is the necessity to support field operations by making outbound calls, sending notification messages, and supporting database services. Typically these calls are to notify police, fire, and EMS officials, county and local highway departments, towing services, and similar entities. The consolidated PSAP's priorities would include:

- 911 call taking
- Dispatching emergency calls for service
- Seven-digit call taking
- Making non-emergency notifications
- Monitoring systems

Within the governance document, the PSAP's purpose and priorities need to be clearly stated. For example, does the consolidated PSAP take non-emergency seven-digit calls for agencies? Are there services of other governmental operations and not-for-profit agencies?

Non-Communications Tasks

Some PSAPs support non-communications tasks associated with public safety operations. These may include attending a public information service window, non-communications administrative tasks, and taking calls for other county or publicly supported agencies. Allegany and Steuben Counties have communications centers that focus nearly solely on 911 and related communications. Schuyler County's PSAP is also the public information service window for the sheriff's department. The call takers/dispatchers are classified as jailers with associated jail responsibilities.

911 Call Taking Standards

When estimating the need for staffing, it is beneficial to know the average number of calls anticipated and the busy hour estimate. The busy hour is a theoretical estimate that assumes that 10% of the daily call volume will occur within a given hour. Additionally it is necessary to determine the amount of "wait" time that is acceptable before a call taker answers the ringing 911 line.

The New York State Wireless 911 standards, section 5202, require that 90% of the incoming 911 calls are answered within 10 seconds.

Human Factors

The impact of consolidations often has signification impact on communications staff, the department that currently hosts the communications center, and responders. Human issues that will need to be monitored and addresses include:

- The existing communications employees often become concerned that their jobs will be eliminated. As an unintended result, staff may find other employment opportunities before the consolidation occurs, resulting in a staffing crisis.
- Current dispatchers may not want to be part of the consolidated center because of loss of familiarity with surroundings and responders.
- Current dispatchers may not work well with the pace of a consolidated center that may be greater than that of a smaller center.
- Current dispatchers will need to learn new systems, processes, and policies.
- Current dispatchers may lose seniority, status, or preferred schedule positions.
- Current dispatchers may feel less represented by a new or different bargaining unit.

- Responders may feel that the dispatchers from a consolidated center will not have local knowledge.
- Response agencies may feel that they have little input on communications procedures and policy development.
- The loss of local dispatch staff may create a lack of staff to perform administrative tasks.

Managers who have led communications center consolidation efforts have reported that dealing with the people issues are far more complex than those of technology. To manage the people issues requires leadership, personnel communications skills, establishing goals, and having effective governance. While these constraints can be overcome, the impact of emotions, rumors, and disinformation should not be understated.

The retention of communications staff can be challenging. The nature of the job is stressful. Call takers can be the recipient of calls where terrible events have occurred. Communications staff pay is typically modest. In small to midsized centers, the opportunity for promotion or advancement is often limited. Some individuals use becoming a dispatcher as a pathway to becoming a professional law enforcement officer or firefighter.

APCO has initiated Project RETAINS in an effort to identify reasons why communications staff leave and methods to improve retention. Project RETAINS data suggest that retention is better in small to midsized centers, and employees who feel appreciated are less likely to leave.

3.8 Staffing

Administration and Management

Director - The size and complexity of a consolidated center would require a full-time director who is tasked with the overall management and responsibility of PSAP operations. The director would be responsible for fiscal operations, liaison with user groups, liaison with legislative and executives, and being the official spokesperson of the PSAP.

Assistant Director – The assistant director would support the director and would be responsible for scheduling, training, regulatory compliance, and technology systems.

Administrative Aid – An administrative aid would assist the director and assistant director by performing clerical tasks.

Book keeper – The book keeper would keep fiscal and time sheet records, submit payrolls, track employee time off, and be a liaison with human services.

Support Staff

Technical Services – A technician is necessary to support and maintain the various technical systems. These systems would include:

- Console systems
- E-911 telephone
- Seven-digit telephone
- Logging recorders
- Computer aided dispatch
- Power systems
- Mapping systems
- Security systems
- Database
- IP networks

While the technician would not be expected to provide total support for each system, they would need to have an understanding of each system, be capable of performing emergency and routine repairs, and monitoring system conditions. The technician would also need to monitor the activities of contractors who would provide more in-depth technical support.

911 Database Technician – The 911 database technician would be responsible for ensuring that address changes are provided to 911 database service providers. The 911 database technician would be the liaison with local governments in reviewing street/road names and addressing formats. The database technician would also resolve 911 discrepancies and errors. As PSAPs increasingly use geographic information systems (GIS) and mapping products, the 911 database technician would need to be able to support these areas of technology.

Outside Services

PSAP operations would require the services of other departments or for a standalone authority to contract for these services. These would include:

- Human resources
- Legal
- Purchasing
- Pay roll
- Facility maintenance

- Engineering

Communications Staff Workload Analysis – The communications staff is comprised of watch supervisors and call taker/dispatchers. Watch supervisors are the leaders of each shift. Their job is to ensure the policy and procedures are followed, that quality service is provided, and that problems that need immediate attention are addressed. The watch supervisor may take calls or perform radio dispatch operations to address a surge in activity.

Call taker/dispatchers take 911 and seven-digit calls, perform radio dispatch functions, and do other support operations such as CAD entry and monitoring notification systems such as Amber Alert and E-justice.

For the Counties of Allegany, Schuyler, and Steuben, the PSAP will need to be able to process a minimum of 250,000 in-bound and out-bound calls annually. For planning purposes, a consolidated center would need to be able to handle 175,000 911 calls. There is currently close to 110,000 calls annually, however allowances for call surges need to be considered.

The average hour analysis indicates that each 911 call is estimated to be 90 seconds in duration, 30 seconds for call wrap-up, and that the call answering criteria meets NYS Wireless 911 standards. The standard states that 90% of the calls are answered within 10 seconds. For a typical average hour, three call takers would be required.

The busy hour analysis indicates that if 10% of the estimated 480 calls per day arrive in one hour to meet that demand, five call takers would be required.

Call volumes for public safety are greater during the day and evening hours. Staffing needs to reflect this characteristic. Therefore more call takers are required on the day and evening shifts than on the overnight shift. The following call taker shifts would be needed: day – five call takers; evening – five call takers; and overnight – three calls takers.

Support for land mobile radio dispatching is more complex. For law enforcement positions, the workload is a function of the number of units deployed. Each county would have a dedicated law enforcement radio dispatcher, while if the radio communications system was consolidated, additional efficiency could be obtained. The existing fire and EMS LMR systems would be used. Fire and EMS positions would work as a unit, thus sharing work as necessary. For fire service dispatch, there would be a single position. For EMS dispatch there would also be a single position. The fire and EMS dispatchers would share work as necessary. Again, consolidating the fire and the EMS LMR systems would provide operational efficiencies.

Proposed Staffing

Position	Day Shift	Evening Shift	Overnight Shift
Call Takers	5	5	3
Police Dispatch-ers	3	3	3
Fire Dispatcher	1	1	1
EMS Dispatcher	1	1	1
Supervisor	1	1	1
TOTAL	11	11	9

Table: Proposed Staffing

Current Staffing

Allegany

Position	Day Shift	Evening Shift	Mid Shift
TOTAL	3	3	2

Table: Allegany Current Staffing

Schuyler

Position	Day Shift	Evening Shift	Mid Shift
TOTAL	2	2	2

Table: Schuyler Current Staffing

Steuben

Position	Day Shift	Evening Shift	Mid Shift
Call Takers	3	3	1
Dispatchers	3	3	2
Supervisor	1	1	1
TOTAL	7	7	4

Table: Steuben Current Staffing

Total Current Staffing for Allegany, Schuyler, Steuben

	Day Shift	Evening Shift	Mid Shift
Allegany	3	3	2
Schuyler	2	2	2
Steuben	7	7	4
TOTAL	12	12	8

Table: Total Current Staffing for Allegany, Schuyler, Steuben

Staffing Analysis – The differences between the existing and consolidated plans need to be noted.

- Given the increased call volume, the consolidated dispatch operation would be a two-stage center. There will be dedicated call takers and dedicated dispatchers.
- The consolidated staffing plan results in requiring 31 person-shifts, which compares to 32 person-shifts positions currently. Expressed differently, the consolidated plan would require 64,480 communications staff hours while the current need is for 66,560 communications staff hours. Alternatively it currently requires approximately 56 FTE communications while the proposed consolidation plan would require 53 FTE.
- Using three police dispatchers should be evaluated once experience is gathered. Using less than the estimated 5 call takers should be evaluated after the consolidation has been established. Typically there would be time available for radio dispatchers to take 911 calls. However it is important to provide and ensure quality of service.
- Only in Steuben County are the management and administrative staff dedicated to the PSAP operation. In Allegany and Schuyler Counties, the PSAP is managed by individuals who have other duties. In Allegany County the PSAP is managed by a sheriff's department lieutenant and in Schuyler County by the director of emergency management and sheriff's department staff. The consolidated PSAP would allow those management staff to focus on their other responsibilities.
- In Steuben and Allegany Counties, the communications staff takes only 911 and seven-digit calls for service, dispatch, and related tasks. In Schuyler County, the communications staff are sheriff department sworn jailers. As such they monitor jail operations and perform other jail-

related tasks. The elimination of the Schuyler County communications staff would require replacing at least one of the positions to work the service window and support jail operations tasks. Schuyler and Allegany Counties could recoup the services of administrative and management staff that are currently required. Because these positions are not solely dedicated to 911 operations, the amount of time to be recovered is unknown.

3.9 Staffing Budget

To develop a staffing budget, Blue Wing used rates that are adjusted to reflect the increased responsibility and workload of working in a larger facility. Where there would be multiple employees with a range of seniority, an average rate was calculated.

Proposed Staffing Budget

Position	Total	Number	Annual Rate of Pay	Annual Salary	Benefits
Director	$112,500	1	$75,000	$75,000	50%
Assistant Director	$78,750	1	$52,500	$52,500	50%
Administrative Aid	$52,500	1	$35,000	$35,000	50%
Bookkeeper	$57,000	1	$38,000	$38,000	50%
911 Database Technician	$67,500	1	$45,000	$45,000	50%
Technical Services Technician	$67,500	1	$45,000	$45,000	50%
Shift Supervisors	$315,000	5	$42,000	$210,000	50%
Call Takers/Dispatchers	$2,901,750	53	$36,500	$1,934,500	50%
Overtime	$150,000	1			
Total	**$3,802,500**				

Table: Staffing Budget

The total cost of staffing is estimated to be $3,802,500 as compared to the currently estimated cost of $3,261,196. If one of the three law enforcement radio positions is eliminated the talk labor cost could be reduced to $3,527,750.

The increased cost under consolidation can be attributed to increases in salaries

3.10 Contractual - Equipment, Maintenance, and Services Budget

The current equipment, maintenance, and services budget for Steuben County was used as a base. A budget estimate of $700,000 seems reasonable. The estimate includes $600,000 for equipment, maintenance, and services. A lease cost of $100,000 is estimated.

3.11 Initial Costs

A onetime cost of $1,120,000 is for additional console positions, new logging recorder, and existing radio system terminations. A budget of $50,000 is estimated for administrative, legal and governance development, and $100,000 is budgeted for engineering and consulting services.

One-Time Costs

Start Up	Total
Additional Consoles, CPE - 13 New Consoles	$750,000
New Logger	$200,000
Terminations	$20,000
911 Terminations	TBD
Admin, Governance, etc	$50,000
Engineering, Consulting	$100,000
Total	**$1,120,000**

Table: One-Time Costs

3.12 Migration Budget

Using the Steuben County communications center would minimize infrastructure costs. Migration costs would include:

- Hiring and staff selection – Advertise, interview, conduct background checks and process employee applications.
- Governance committees support – Provide support to governance committees. Administrative support, legal, HR, policy development, and finance.
- Bargaining unit negotiations – Legal and administrative support.
- Training – Training of communications staff on systems and policy.
- Connectivity with Schuyler and Allegany County radio systems – Establishing connectivity into the Schuyler and Allegany law enforcement, fire, and EMS radio systems. Use County fiber to Schuyler and microwave or leased lines to Allegany.
- Radio console modifications to accommodate Schuyler and Allegany Counties – Install the necessary equipment into consoles for Schuyler and Allegany County access.
- Mapping software to cover Schuyler and Allegany Counties – Provide additional mapping software to cover the service area.

- Install additional call taking console positions to accommodate the anticipated additional workload.
- Engineering Services – Miscellaneous engineering tasks such as structural evaluations, renovations, and electrical modifications.
- IT Services – Costs associated with modifying IT systems.

3.13 Budget Analysis

Currently the cost of PSAP and communications operations in Allegany, Schuyler, and Steuben Counties is $4,031,892.

Existing PSAP Costs

Current Costs	
Allegany	$631,828
Schuyler	$697,617
Steuben	$2,702,447
Total	**$4,031,892**

Table: Existing PSAP Costs

The reoccurring cost of the consolidated PSAP labor and contractual cost is estimated to be $4,502,500. The consolidated model costs $470,608 more than the current costs. However, the costs and potential savings are not shared equally as will be examined.

This budget does not include any costs for connectivity or maintenance of existing LMR systems. The estimate does not include costs of hiring staff in individual counties to perform non-communications tasks. If counties desired to use remote computer-aided dispatch terminals and other ancillary equipment, those costs would need to be added.

Factors as to why the consolidated costs are greater than the total individual costs include:

- Higher base salaries for employees
- Inefficiencies created by using existing LMR systems
- Current administrative and management costs are covered within an existing department's budget.

3.14 Cost Apportionment

A method of assessing participating partners needs to be identified. The following methods or variations are options that could be used.

- 911 Call Volume – Each partner would be assessed based on the number of 911 calls. The rate or cost of each 911 call would be recalculated annually. The cost of capital projects including debt service, if any, would need to be added. The disadvantage with this methodology is that it does not take into account variations in the dispatch side of operations. This method makes the assumption that there is an equal amount of work for all 911 calls. This method does not include answering seven-digit telephone calls.
- Population – In this method each county would be assessed based on its population. In general the greater the population, the greater the demand for public safety communications services.
- Assessed Value – In this method the cost to each county is based on the assessed value of the county. An issue with this method is that assessed value rates may not correlate well with public safety communications service requirements.

The following analysis shows the following:

- Existing PSAP operating cost by county
- 911 volumes by county
- Population by county
- County real property assessment

3.15 Existing Data

Current Costs

Current Costs		
Allegany		$631,828
Schuyler		$697,617
Steuben		$2,702,447
Total		$4,031,892

Table: Current Costs

County Data – Population, 911 Calls, Property Valuation

Geopolitical Data	911 Calls	Population	Valuation
Allegany	47,436	49,927	$1,829,482,096
Schuyler	9,140	19,225	$1,253,600,989
Steuben	98,063	98,726	$5,201,857,781
Total	**154,639**	**167,878**	**$8,284,940,866**

Table: County Data – Population, 911 Calls, Property Valuation

Consolidated Reoccurring Cost Apportionment

Cost Apportionment	911 Calls	Population	Valuation per $1,000
Current Allegany Cost	$13.32	$12.66	$0.3453589
Current Schuyler Cost	$76.33	$36.29	$0.5564905
Current Steuben Cost	$27.56	$27.37	$0.5195157
Consolidated Cost	$29.12	$26.82	$0.5434559
Annual Consolidate Cost	911 Calls Based	Population Based	Valuation Based
Consolidated Allegany Portion	$1,381,156.05	$1,339,045.72	$994,242.84
Consolidated Schuyler Portion	$266,122.06	$515,615.88	$681,276.85
Consolidated Steuben Portion	$2,855,221.89	$2,647,838.40	$2,826,980.31
Total	**$4,502,500.00**	**$4,502,500.00**	**$4,502,500.00**

Table: Consolidated Reoccurring Cost Apportionment

3.16 Cost and Savings Analysis

The following matrix shows the costs/savings for each county for each of the apportionment models: population, 911 calls, and real property valuation. It will be noted that there are significant variations between the three models regarding Allegany and Schuyler Counties.

While the overall cost of the consolidated center is greater than what the three counties are currently paying, the savings are not equally distributed.

Using population as a base for apportionment, Allegany County would pay $707,218 more than it currently pays for PSAP operations while Schuyler and Steuben would save.

3.17 Schuyler Replacement Labor

Schuyler County is in the unique position of using county jail staff to run the PSAP/communications center/sheriff's service window.

If the communications function was eliminated, the jail and service window tasks would remain. Therefore, there would be a cost to maintain those positions.

Schuyler Replacement Labor

Schuyler Replacement Labor	
Annual Average Rate	$42,000
Fringe Rate	55%
No. Staff	5
Total	**$325,500**

Table: Schuyler Replacement Labor

Current Operating Costs verses Consolidation and Potential Cost/Savings

Current Operating Costs verses Consolidated - Population	Current	Consolidated - Population Based	Replacement Labor	Difference from Current
Allegany	$631,828	$1,339,046		$707,218
Schuyler	$697,617	$515,616	$325,500	$143,499
Steuben	$2,702,447	$2,647,838		-$54,609
Total	$4,031,892	$4,502,500		$796,108
Current Operating Costs verses Consolidated - 911	Current	Consolidated - 911 Based	Replacement Labor	Difference from Current
Allegany	$631,828	$1,381,156		$749,328
Schuyler	$697,617	$266,122	$325,500	-$105,995
Steuben	$2,702,447	$2,855,222		$152,775
Total	$4,031,892	$4,502,500		$796,108
Current Operating Costs verses Consolidated - Valuation	Current	Consolidated - Valuation Based	Replacement Labor	Difference from Current
Allegany	$631,828	$994,243		$362,415
Schuyler	$697,617	$681,277	$325,500	$309,160
Steuben	$2,702,447	$2,826,980		$124,533
Total	$4,031,892	$4,502,500		$796,108

Table: Current Operating Costs verses Consolidation and Potential Cost/Savings

3.18 Unidentified Cost

Unidentified costs include:

- Expanded backup PSAP configuration
- Connectivity with county LMR systems
- Extraordinary legal or legislative expenses to achieve either consolidated model.

These costs should be anticipated but cannot be quantified at this time.

3.19 Backup PSAP

Planning for a backup PSAP becomes more significant in a consolidated environment. Currently Steuben and Allegany each have backup locations. Allegany has an old communications center, while Steuben can operate from the Civil Defense bunker and in a very limited way from the communications shelter atop Mount Washington. Schuyler has

an arrangement with Chemung County to take overflow 911 calls. The Schuyler County communications van is the county's backup PSAP/communications center.

The trend is to develop plans with neighboring counties for mutual backup services. This concept's goal is to have no breaks in 911 services. Therefore, the partner PSAPs would need to have LMR connectivity with each other.

An in-region backup facility could be developed for longer term outages. As the PSAP increases in size, the likelihood of finding a single adjacent county PSAP capable of handling its own calls for service and the overflow from a regional PSAP becomes problematic. One alternative would be a distributed backup plan where 911 calls are routed to two or more adjacent county PSAPs/communications centers. While the work load would be dispersed, a common CAD system would be required so that each PSAP/communications center has situational awareness of what the other PSAPs/communications centers are doing. Another alternative would be to use an out-of-region PSAP that has the size and capacity.

A key decision for policy makers is what level of backup service needs to be provided.

No provisions for a backup PSAP or diverse connectivity for backup purposes has been provided in this study's budget estimates.

3.20 Transition Methodology

Transition
A transition plan must be developed that allows:

• The hiring and on-boarding of new staff, testing of all modified systems, adopting a communications plan with municipal stakeholders and creating a redundancy plan in the event of a system failure.

Tasks would include:

• Memoranda of understanding (MOU) – Participating governments execute MOUs defining responsibilities, participation, governance, cost sharing agreements, and other understandings.

• Establish advisory committees – As established in the MOU, policy and operational advisory committees are established and begin functioning.

• Standard operating procedures – As soon as the decision is made to move forward with consolidation, the director and operational advisory committee must begin developing

standard operating procedures and policies. Decisions regarding policy could affect equipment installation.

• Equipment and systems installation – Close coordination among vendors is required. Some of the technical systems rely on several vendors to coordinate activities. Equipment and systems must be identified and procured early, space and infrastructure required to support the equipment must be in place, and secure storage of staged equipment must be maintained. Connectivity between the consolidated center and public safety radio systems must be arranged and tested.

• Systems testing and acceptance – All systems must be thoroughly tested through an acceptance test plan that defines operability, parameters, and related functionality.

• Develop call taker/dispatcher/management/administrative staff hiring criteria – The director, working with appropriate personnel and advisory staff, will need to develop job descriptions for call-takers, dispatchers, supervisors, and management/administrative staff.

• Hire staff –The PSAPs in the three counties have a sufficient number of public safety communicators to staff the consolidated center. Working in the consolidated center will be very busy. Potential staff will need to be informed about mission and expectations. A thorough review and interview process will need to be developed and implemented.

• Train staff – Trained staff is key to the success of the consolidated center. While most of the current public safety communicators have some training, all supervisors and communicators will need to be re-trained on procedures, policy, equipment, and systems. Sufficient time and funding must be allocated for staff training.

On-boarding and Switchover
The final implementation phase is a continuation of transition but allows for the actual operation of the consolidated center to begin. Skeleton crews of the new call-takers and dispatchers will operate a shadow operation in sync with the existing dispatch operations. Following evaluation and quality control, the skeleton crew will begin to actually dispatch. Tasks would include:

• Notification of agencies for cut over. Client agencies need to be kept apprised of schedules and timetables. The current PSAPs will need sufficient time to brief law enforcement staff on policy and procedures. Local provisions for service windows will need to be finalized.

• Conduct quarterly evaluations to determine compliance and resolve issues. Even with careful planning, unexpected issues will need to be addressed. Some issues can be re-

solved by the director and client agencies; others will need a policy review. A formal feedback process needs to be in place both in the near and long term.

3.21 Functional Consolidation Summary

Often in PSAP consolidation studies, the potential cost savings vary between the participants, the methodology of apportioning costs, restructuring to fill positions once the county communications staff has left, and costs of LMR systems.

The greatest benefit to consolidated PSAP services is the sharing of data and information. In the following section a review of shared PSAP services will be examined.

A shared service implies that the physical existing PSAPs remain but there is an enhanced sharing of information. In addition, the use of commercial communications platforms will be evaluated to assess their reliability and ability to provide public safety communications.

4. Non-Consolidated - Shared Services Options

The concept of shared technology options is based on the concept that each county PSAP will remain at its present location, but the PSAPs will share technologies. The following section outlines the opportunities, constraints, and methodologies.

4.1 Overview

A functional consolidation of PSAP facilities is easy to understand, but not always practical to facilitate and has many more facets to plan for than sharing at a network level. Best practices dictate that every PSAP maintain diverse and redundant paths to its center, as well as redundancy in equipment and power design. It is also highly recommended that each PSAP has a backup mechanism, for both equipment breakdown and the physical unavailability of the primary facility. To maintain a full backup facility without losing many of the tools used for call taking and dispatch is an expensive proposition, and unaffordable for most agencies.

If all agencies require the same level of technologies, the sharing of resources with adjacent geographic entities or other agencies can help reduce the cost by reuse and sharing of common equipment and networks. This can be accomplished most simply by a point-to-point connection between PSAPs, and can be as complex as a shared network accessible by multiple agencies or government entities. Although shared networks have a capital cost for building, if implemented properly, they can reduce the normal monthly costs associated with leased lines and other capital assets by eliminating the duplicity of interconnects needed to each county.

An example of this is northern Florida, where initially three counties formed an independent network that provided interoperability and sharing among PSAPs. This has now been expanded to over a dozen counties. Maryland is implementing a statewide CAD /RMS (records management system) system that allows access and interoperability across county borders and agencies.

The other potential savings may be realized by sharing assets or facilities with commercial organizations. In Nevada, the Nevada Shared Radio System is a partnership covering major utilities, DOT, and Washoe County, with each partner responsible for different parts of the system.

In the 1980s, there was a move to consolidate at the county level. It was realized at the time that there was not enough money available for each local jurisdiction to have its own PSAP and dispatch and afford advanced technology systems. With the advent of NG911, the same budgetary constraints are applying, and now the move is toward multi-county regional systems, and in some cases, statewide networks.

Emergency communications planners must consider both near term and long term issues when considering shared services. In Allegany, Schuyler, and Steuben, the partner counties have a wide degree of needs and demographics. Additionally to increase the technical capabilities to equal levels in the three counties will require a significant commitment to fiscal resources.

The cost estimates provided by Blue Wing are modeled on conceptual systems that provide an order of magnitude.

4.2 Networking / Connectivity

Networks can be comprised of many different transport types, both physical connections and radio frequency (RF)-based connections. Copper is still widely used in both the transport of analog radio as well as telephone lines. Because a typical Plain Old Telephone Service (POTS) or Centralized Automatic Message Accounting (CAMA) line can carry only one conversation, it is not useful to networking functions short of connecting to a remote resource. Telephone T1 lines are the building blocks of most networks and are widely used as main data and audio pipes. Over the last several years, agencies have had increasing access to fiber networks. Although widely used commercially, the costs have typically prevented wide usage in public safety, with the main reliance being on microwave point to point (PTP) and RF links.

Internet Protocol (IP) technology has the ability to be transported over virtually any media, and has found wide usage over T1s, microwave, and certainly fiber. With packet technology, the path does not need to be direct, as it can be routed over any potential link available.

Like microwave, fiber is typically run in a ring topology for network transport. This allows data to run in either direction if there is a break in the transport, effectively providing redundant paths to the endpoint. Because by default, fiber needs a physical connection, many access points will have to be spokes off of the main ring. Obviously these paths would be more greatly affected by a break in the line or other hardware failure.

Currently there are not any known connections between the counties considered in this study. Both Steuben and Schuyler have signed onto the Southern Tier Network, a fiber ring encompassing both counties as well as Chemung. Allegany may be connecting into the ION Network. It is expected that the Southern Tier Network will be interconnecting with the ION Network at a future date.

The Southern Tier Network will be connected to the different PSAPs, as well as attempt to access most tower sites in Steuben and Schuyler. The ION Network's path through Allegany has not been fully determined yet. Steuben and Schuyler certainly have the greatest opportunity to take advantage of the potential of this network, with the possibility of

Allegany connecting through the ION/STN bridge or possibly through an extension of the Southern Tier Network.

Microwave paths and or T1s may be used for connectivity between counties, and may be evaluated independently. The fiber networks present the best opportunity for consolidation and interoperability. Fiber will offer the greatest bandwidth, with the most security. As the Southern Tier Network is dark fiber, connectivity and security is under control of the counties. The ION network is services based, and may present some other concerns with use for different applications. Both networks will need to be examined in more detail for interconnection and suitable equipment.

4.3 Resource Sharing

There are multiple architectures for sharing resources on a network. The most common architecture is for one agency to allow another agency access to its local resources. Each sharing agency has full control over access to its resources, and is responsible for its local system. This may be access to a few radio channels or certain partitioned records in an RMS system.

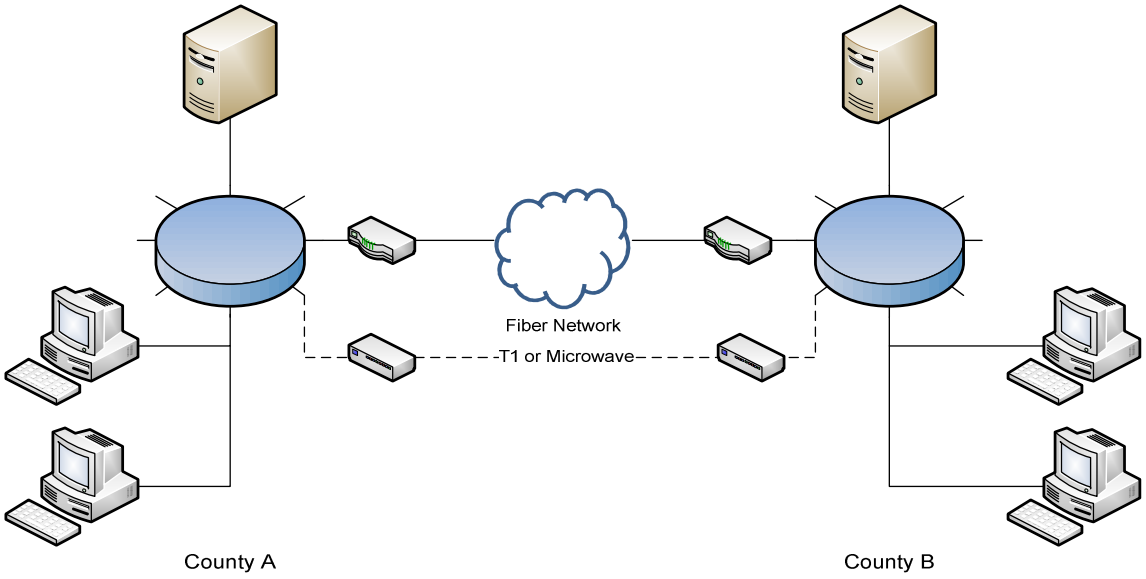

Figure 1 Simple Resource Sharing

The above architecture may be used by any service that has the capability of being network connected. Although primarily data driven and most suited to CAD/RMS, it may also

apply to radio systems, either digital (by converting audio to IP packets), or simply by a T1 connection. For data applications, it would be ideal to use the fiber network connectivity.

The second type of architecture is where one agency owns a system and allows other agencies to use certain resources. This is common in CAD/RMS systems, where one agency purchases and maintains the equipment and allows another agency to operate on its servers or over its network.

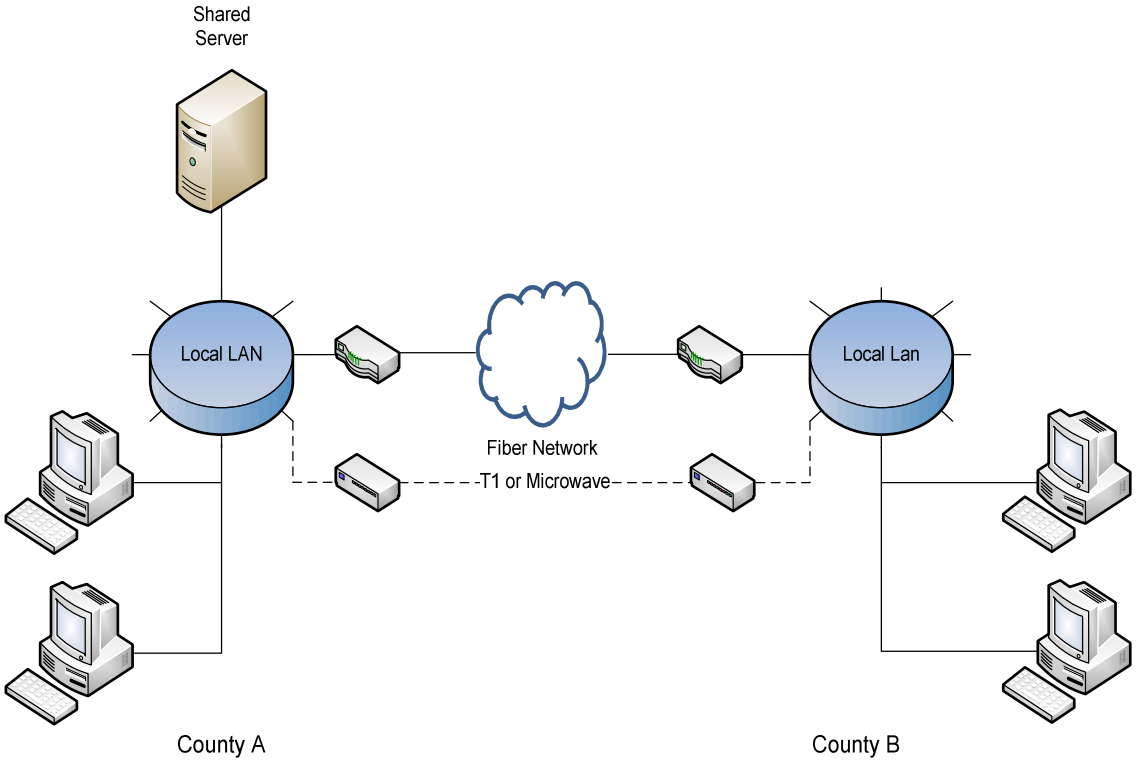

Figure 2 Remote User

In this type of architecture, County B becomes a remote user, or a client on County A's network. With the fiber network, there would be sufficient bandwidth for the remote client to share a system without any noticeable difference in speed.

The third type of architecture is where another authority owns the network or equipment, and rents or leases time on the system. This could be one agency allowing others to use its network, such as a trunked radio system, or could even be a commercial entity such as a business or utility that owns the system and allows use by a public safety agency or vice versa. This is similar to when PSAPs consolidated to county systems from individual towns, and then charged the towns for usage. The ION Network is an example of this, as it sells services on its commercial network.

Currently, most of the commercial world is switching to or planning on cloud-based systems, or hosted solutions. This is gradually gaining acceptance in the public safety and government arenas. Early systems were for email and faxing, but now cloud-based configurations are available for almost any application. Although initially this was utilized in the data world, it is now being looked at for digital voice applications. A simple example of this is conference calls. Few companies or agencies presently own their own voice conferencing equipment, but now use third-party vendors to host their conference calls, and pay per usage instead of having costs for capital equipment and maintenance. Cloud-based faxing is also commonly used, where the only access needed is a computer, and the client pays for a usage plan instead of having multiple fax machines.

There are pros and cons to a cloud-based system. The main feature is usually in cost savings if comparing the purchase or sharing of equal systems. Cloud systems are sometimes talked about as a capital expenditure (capex) versus operational expenditure (opex), although there are definitely some upfront capital expenses to be considered. In a hosted system, a private party owns all of the equipment and maintains it. Besides the capital equipment costs, this also minimizes the need for large staffing of IT departments. The only local equipment comprises workstations, the local network, and some small servers. The main servers are remote. Typically, large data centers have higher reliability as they are running large server centers, with full redundancy, full backup, and a secured location. They can usually upgrade the equipment and software for cheaper than a local IT department, and the agency does not face the large capital expenditures every few years. The other advantage is that most centers can run virtual servers. Because the server size is virtual, this helps to prevent peak overloading and allows easy expansion without upgrades.

There are several disadvantages to cloud-based systems, some real, some perceived. Probably the hardest feature to overcome is the fact that data is stored out of the local control of the agency, and “transported” out of the local jurisdiction. This is hard for many public safety agencies and government agencies to accept. Most remote data is more secured than the agency itself, and many mechanisms are provided to encrypt and secure the data. Also, the client themselves “own” the data, and it is encrypted and stored under full control of the data owner, and partitioned from other users’ data accordingly. In evaluating any applications being considered for remote hosting, one should make a detailed evaluation of the data center being used, the security of the data center, and the track record of the company running it.

The biggest disadvantage is remote connection. If the connection is broken, then the data is inaccessible, as well as whatever part of the application is hosted. Any connections should be reliable, and alternate connections should be provided for. This may be as simple as using a T1 for the main connection, and using a virtual private network (VPN) through a public network as a secondary connection. Any remote application that is being considered needs to be analyzed by what operability is lost during a connection failure,

and one should always look at a redundant or secondary data connection if considering a cloud-based solution. The access point of the data center provider also needs to be analyzed for bandwidth, to ensure that there is sufficient bandwidth to prevent overloading during a large incident.

Large centers can still fail. Amazon, one of the largest operators of hosted servers, had a failure that caused several companies to lose access for a couple of days. Virginia also had several agencies shut down for several days because of a server farm failure. Both Microsoft and Google have had large-scale outages with their hosted services. In all cases, this could be looked at as a learning curve, or more pessimistically, a foresight into the norm of future computing.

One of the other variables is that hackers are increasingly looking at bigger targets. Some of the most secure government agencies and companies have been hacked. Certainly, 911 and medical data will increasingly become a larger target for hackers, and large, hosted facilities will be looked at as prime targets. This is not to say that local networks cannot be hacked, but the payload of a larger center may make it a more inviting target. Most large data and network centers have an arsenal of IT tools and staff to handle such incidents, but in today's world, no system is foolproof.

Even with the potential disadvantages, a good company with a good data center may be more reliable than an internal local network.

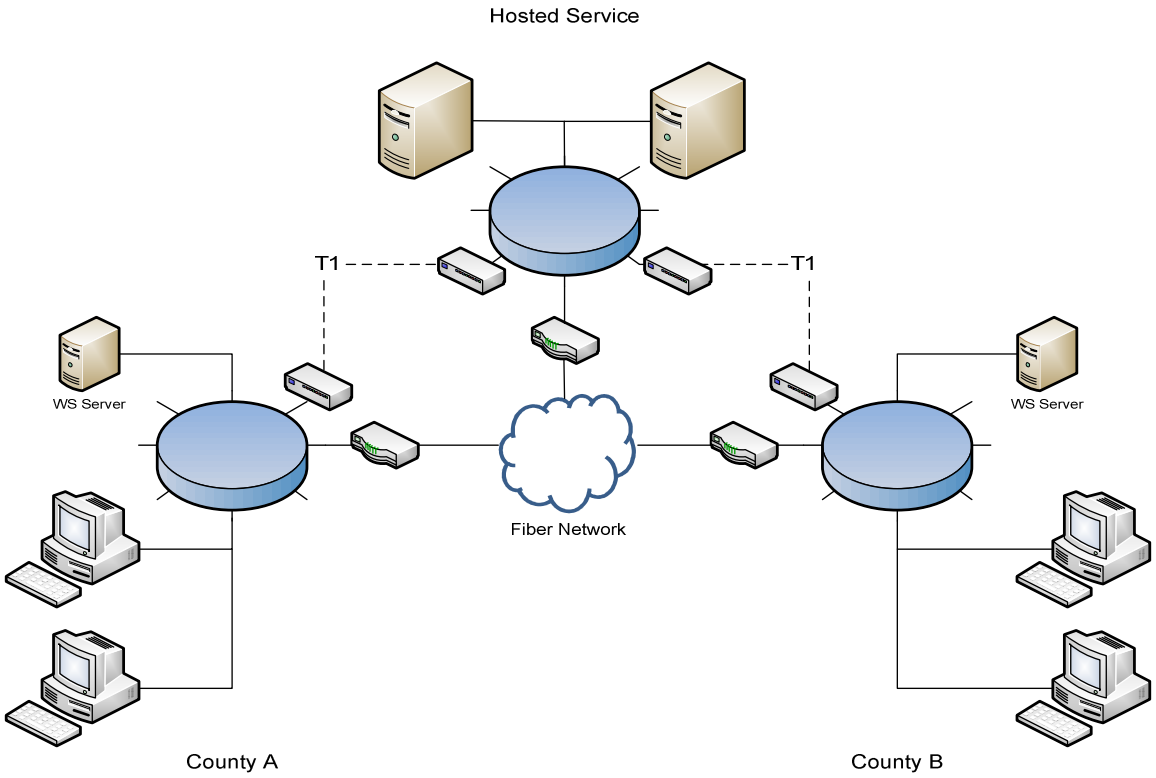

Figure 3 Hosted Service

In the above figure, counties could each have a connection directly to the hosted application, or shared through one county. As future applications are considered for cloud or hosted solutions, it may be desirable to share a connection directly through the cloud under control of multiple county governance.

Steuben County has already made a move into the cloud for certain applications such as its choice of a hosted CAD vendor and a 911 provider that has the capability and experience to run over a large shared network. Assuming that the counties will eventually be tied together by fiber, many choices can be made for sharing by any of the methods that have been described. Even without the network, the counties can also look at sharing at the cloud level if they choose some common platforms. This will be further discussed under each application.

4.4 911 Systems

911 systems have evolved from simple routing of 911, to displaying automatic number identification (ANI) to displaying automatic location identification (ALI), locating landline

and wireless callers. CAD and geographic information system (GIS) systems work integrally and automatically with 911 data. Many counties have the ability to transfer calls and several have roll-over agreements, but mostly this does not include CAD records. This does allow a certain level of redundancy, increased call-taking capability, and back-up considerations. Besides CAMA or similar routed trunks, each PSAP still needs individual access to both landline and mobile location databases.

With the advent of NG911, the different types of information coming into the dispatch center greatly increases the complexity of the networks needed to service a PSAP. Audio, text, video, Internet, automatic collision notification (ACN), advanced automatic collision notification (AACN) and other telematics will increasingly become part of the norm for PSAPs. Each different technology requires an increasing amount of additional customer premises equipment (CPE).

NG911 is often referred to as a "network of networks." Having a common fiber system among counties would allow for many types of consolidated implementations that could reduce the costs to each PSAP, as well as prepare for the future of NG911.

The National Emergency Number Association (NENA) is responsible for writing standards and recommendations for NG911. NENA has long been responsible for writing technical and operational recommendations. The standards for NG911 are still in process, but basic frameworks have been published starting in 2006. NENA documents can be found at: http://www.nena.org/technical-standards for review. The research division of USDOT also completed a set of architectural documents providing for the operation of an NG911 network and setting up some operational pilot programs. This work was finished in 2009 but the documents are still available here: http://www.its.dot.gov/NG911/.

By consolidating multiple counties into an area-wide Emergency Service IP network (ESInet), cost savings may be realized over the years while having full interoperability between agencies. Several states are in planning stages of statewide ESInets. Vermont has already implemented its network: http://e911.vermont.gov/vermont_911/system_information. Just recently, nine counties in western Pennsylvania joined forces in implementing an IP-based NG911 solution that is estimated to save more than 30% over individual systems.

There is much discussion about i3 standards. I3 standards are the long-term architecture for NG911. Currently, as i3 standards are still being written, there are no i3 standard systems in the country. However, there are enough standards for different vendors to be "future" compatible. PSAP equipment provider Cassidian Communications has provided a check list on its website that shows the type of questions that need to be asked of vendors. Any new equipment being evaluated for purchase should look for a commitment from the vendors about compliance to future NG911 standards.

The current 911 configuration is very phone company-concentric. Each PSAP receives its own CAMA lines, and each PSAP has one or more feeds to one or more ALI data-bases.

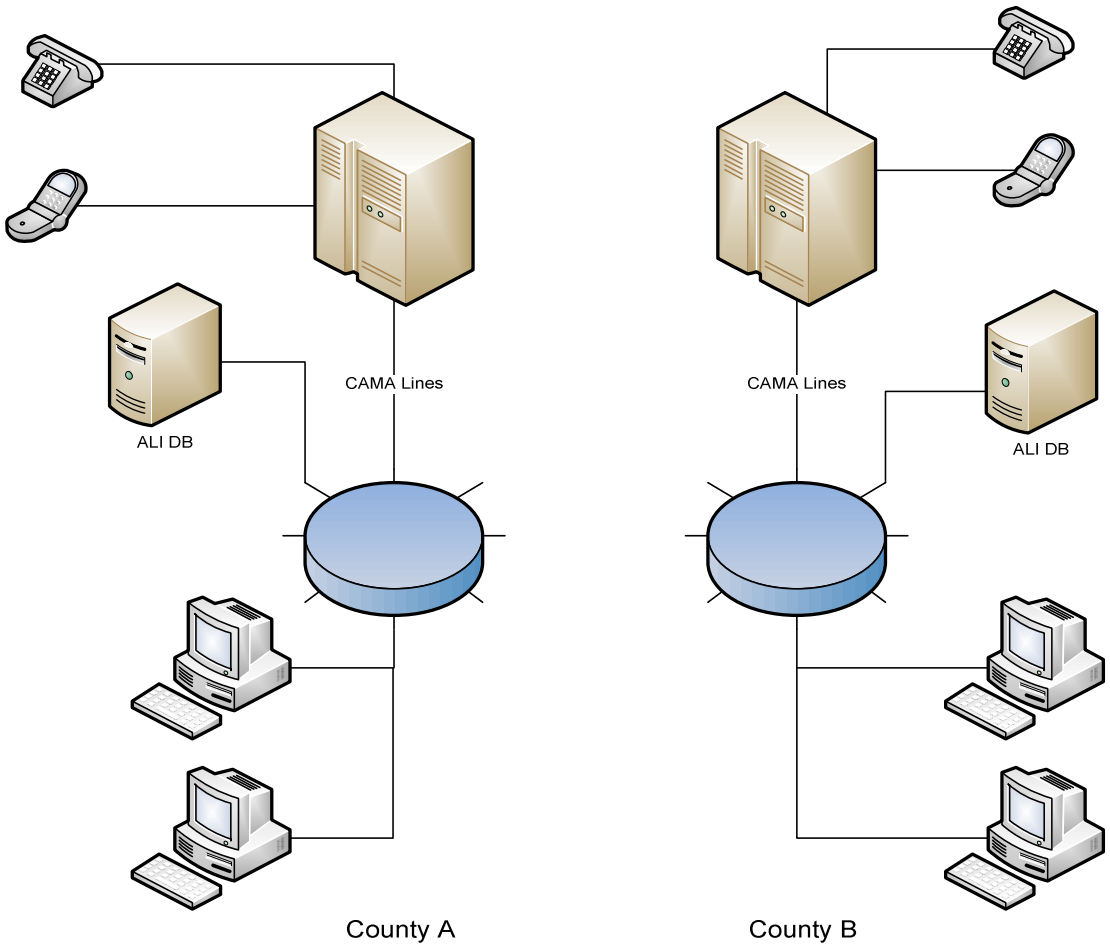

Figure 4 Typical Separate 911 Systems

For cost savings, the first area that should be looked at is the location database server. Usually, one server covers a large area. Mobile data may or may not be combined with landline, but almost always requires a separate line to one of the major providers. By combining the PSAPs through the same network, savings may be realized by the reduced number of lines. Ideally, this could be a centralized function of a regionalized ESInet. As the PSAPs move to incorporate future features of the NG911 system, this would also set the framework for future savings from consolidation.

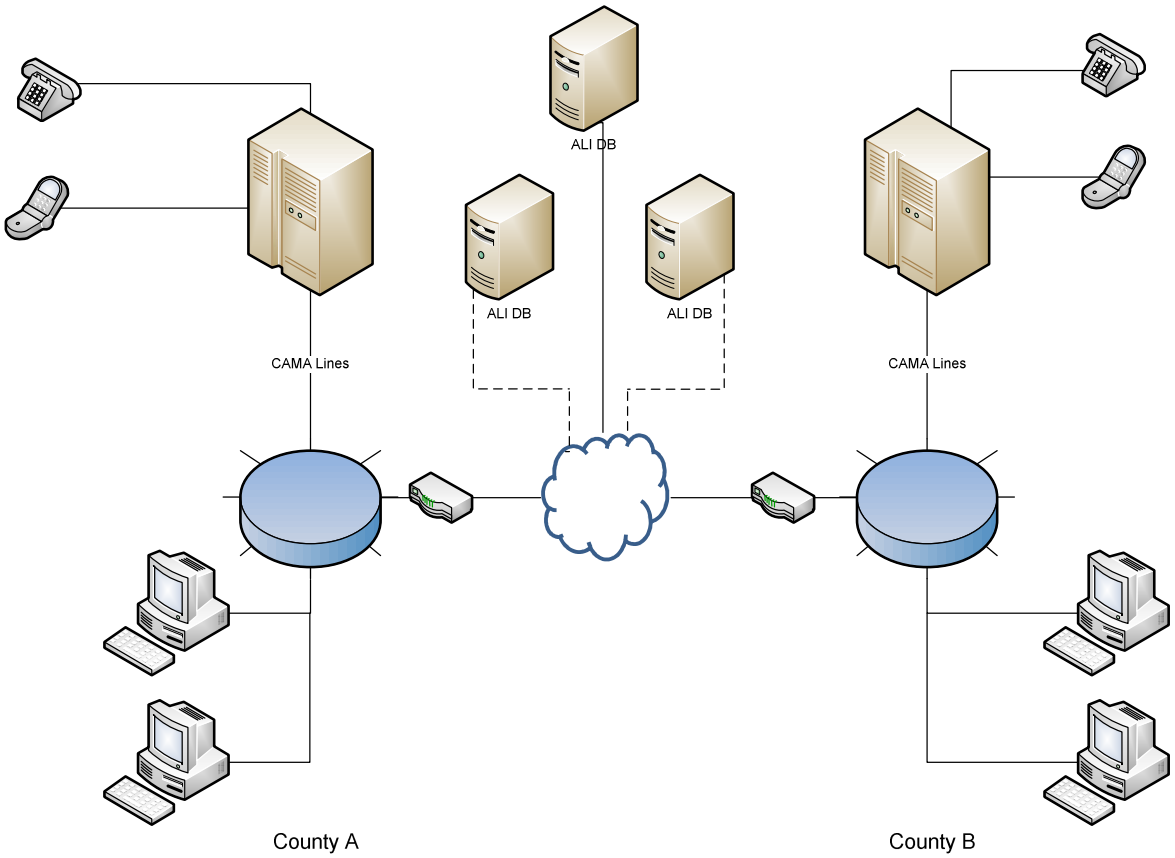

Figure 5 Shared ALI Database

The second area to look at is moving the incoming 911 lines to the network. With a regional ESInet, routing can be done within the shared network closer to the call origin. Rather than have each county have individual CAMA trunks, it can be brought into the IP network, potentially reducing the total number of trunks needed. The main benefit would be that all lines within the consolidated area would now be available to each county, thereby increasing interoperability and providing simple mechanisms for failover and backup. Routing could be configured to allow rollover to an adjacent county.

Although it may make the process simpler, each county would not have to choose the same vendor for 911 equipment, as the network would route and adapt all calls to counties using legacy equipment. The key is converting all lines to IP as close to the call origin as possible. This way, routing rules can be programmed to direct calls to anywhere within the network. Once routed, they can be converted back to analog for a PSAP with legacy equipment. It is assumed that in the future, all manufacturers will adopt NG911

standards as they are approved, which would allow the counties to easily migrate their systems. By setting up a regional ESInet, planning for future features and further consolidation becomes simpler.

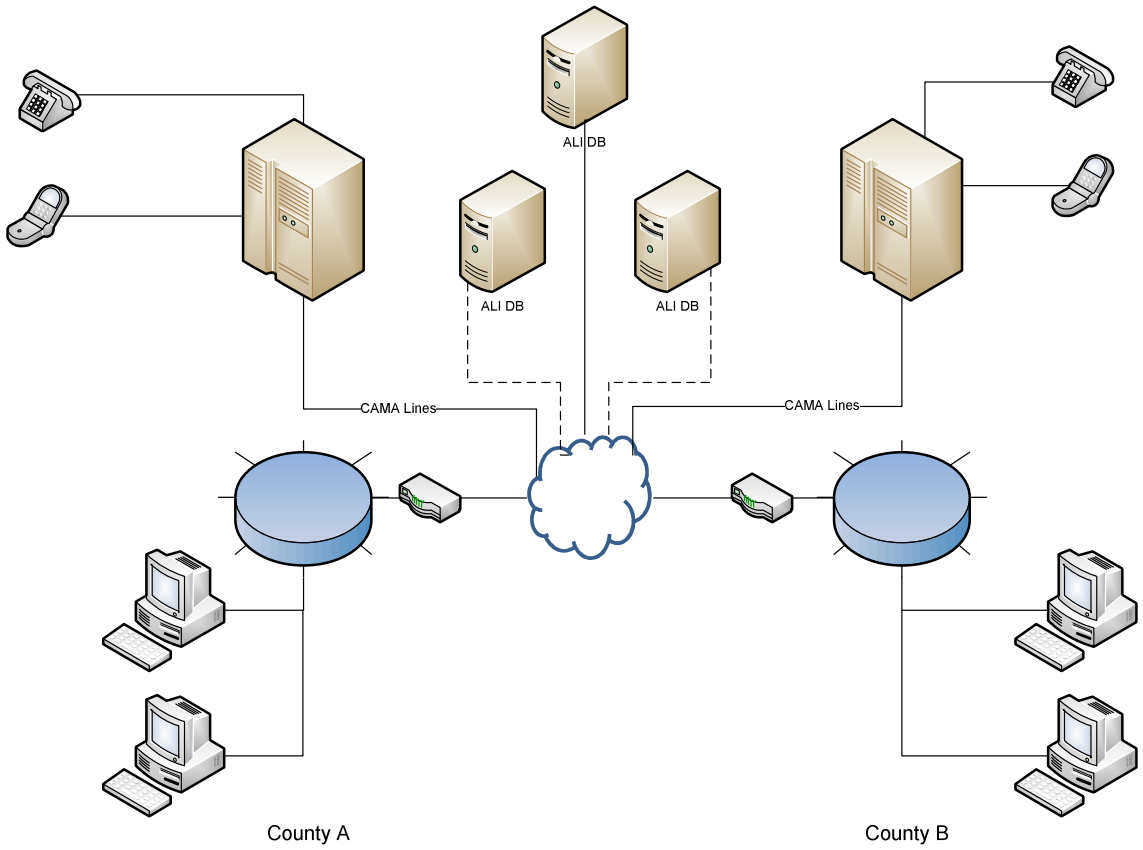

Figure 6 Regional 911 Network

As NG911 evolves, the number of individual feeds from data sources can be shared, as well as the burden of the IT overhead that normally each center would be responsible for. With expected sources of data such as text messaging, video from smartphones, and Web-based 911 calls, the financial impact to small agencies can be formidable. By centralizing these functions into an ESInet, the transport of such services will already be in place, thereby minimizing the costs.

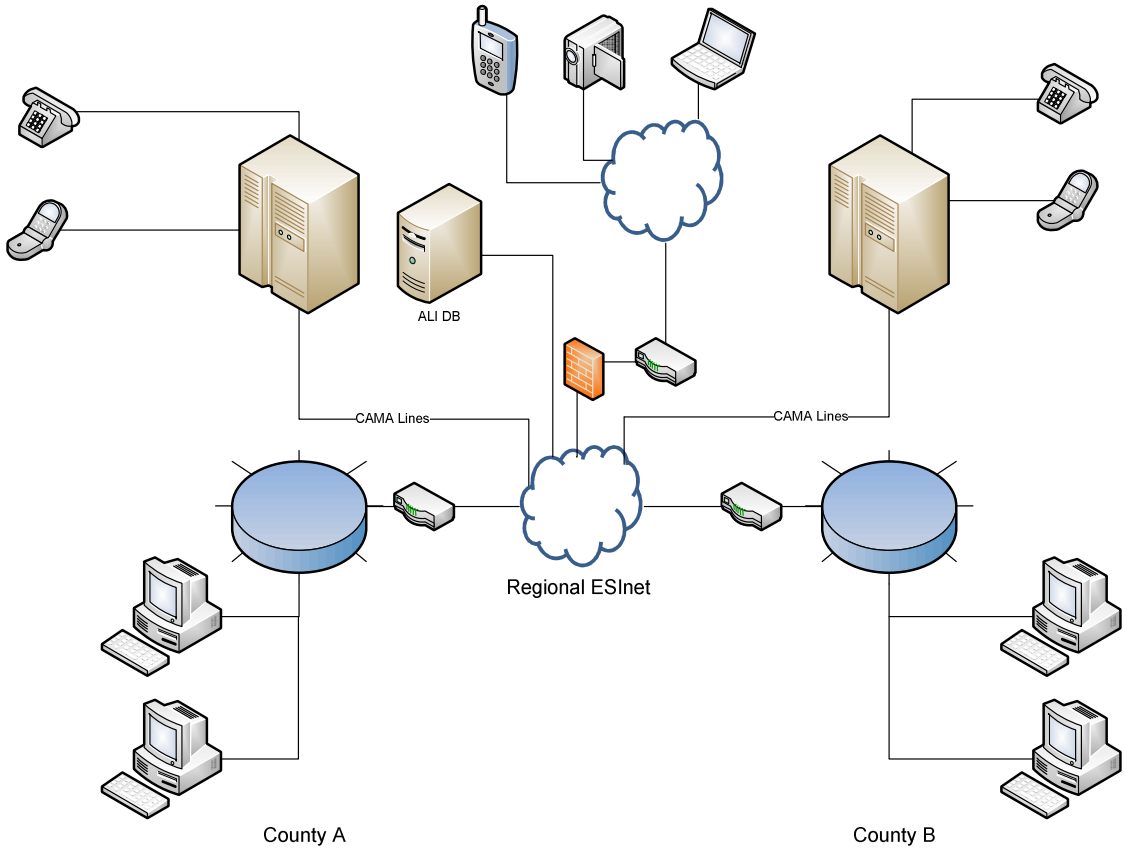

Figure 7 Regional ESInet

Major issues such as setting up a governing board, assigning responsibilities, funding, and cost sharing would need to be planned and implemented.

Installation of the Southern Tier Fiber Network would provide an opportunity for the counties to evaluate the possibility of using the network as a basis for an ESInet. This could be a longer term solution that does not immediately impact any of the counties' legacy equipment.

As existing CAMA trunks and ALI database connections are moved onto the network, the monthly cost savings could be calculated by the number of duplicate connections to each county that would not be needed in a shared environment. This cost could be compared with the cost of a county owning and maintaining its own systems. Future savings would be realized as agencies adapt to NG911 resources. The envisioned 911 data processing for individual PSAPs will be expensive. By regionalizing, each type of feed would be shared among the counties.

Summary:

911 systems must be evaluated in conjunction with CAD and radio. Although an adjacent county could certainly receive a 911 call, without CAD and the ability to dispatch, the options for the call-taker are limited. Short-term, the counties need to evaluate their current needs as the ability to transfer or provide backup are available with current capabilities for 911 only.

Another interim method would be to have the main 911 system hosted in Steuben County. 911 call-taker positions in Allegany and Schuyler would then be connected to the main system in Steuben by the fiber network. This makes the assumption that all incoming trunks and phone lines are capable of being routed to Steuben.

Over the long term, each county needs to address its response to the expanding event inputs that its call-takers will be responsible for with NG911. This is the area where moving forward would provide the greatest benefit, for both interoperability and cost savings.

Next Steps:

- Evaluate current 911 needs of each county for overflow, backup, and transfer capabilities.
- Evaluate short-term solutions to address the above needs using current legacy equipment and providers.
- Discuss future path plans of each county for NG911.
- Evaluate Southern Tier Network for use as a Regional ESInet.
- Evaluate local governance of the network.
- Evaluate cost impact of centralizing ALI database connections.
- Discuss moving CAMA trunks out to the network and converting to IP.
- Discuss interoperability and backup of centralized 911 trunks.
- Discuss future impact of NG911 devices.
- Work together to share costs.

4.5 CAD/RMS/GIS

A shared CAD/RMS package could be configured to improved information sharing and back up capabilities. A shared CAD/RMS package would be beneficial if the CAD/RMS requirements of the three counties are the same. From user data gathered that appears to not be the case.

Allegany and Schuyler have legacy CAD systems from J2 Software Solutions. Recent budget estimate for CAD for Schuyler County was discounted to $85,000 for

CAD/RMS/Mobile Data. The annual maintenance fee was quoted at $32,171. Based on the PSAP size of the Allegany and Schuyler County PSAPs CAD systems could be procured between $85,000 - $150,000 depending on needs, requirements, and number of positions.

As with any system procurement a thorough needs analysis and conceptual system design would be required of each PSAP before a final decision was made.

CAD/RMS packages tend to be proprietary among manufacturers. With NG911, CAD/RMS/GIS become even more of an integral part of the process, as many different record types need to be organized and stored. NENA NG911 standards are addressing the protocols needed to share data among different users, but the complexity of the data has made standardizing a slow process. With the interest and backing of the federal government, priorities are being placed on the standards.

Sometime in the future, each agency could choose different vendors that have fully implemented NG911 and CAD standards, as the market currently operates in proprietary mode. Most CAD/RMS vendors are implementing standards as they evolve. There has been a lot of work over the years in standardizing data exchange, especially since the standardization of Extensible Markup Language (XML), which is now used in virtually all commercial data exchanges. One of the latest standards is National Information Exchange Model) (NIEM). This has been used extensively by federal and local governments. New Jersey has implemented this model on a statewide basis, improving interoperability between agencies and reducing costs in the process. This has allowed RMS interoperability between various agencies in the state, even among various vendors. Defining the data models is a long process but, once done, ensures interoperability between agencies.

There are three ways that the counties could share data: one county could provide access to its own CAD and resources, the counties could look at a combined system using the fiber network, or the counties could join a hosted system. Maryland is using its network to implement a statewide CAD system.

As Steuben is already making a move toward a hosted solution, potential models of interconnect will be based on the assumption of using this CAD system. Hosted systems provide the benefit of a common data center, with the ability to easily share data without having separate connections to each of the individual counties' servers. Each county would own its own CAD and RMS data, while coding the records to be available on a pre-agreed basis.

Each county could have their own separate connections to a hosted solution, but cost savings may be realized through the sharing of the interconnection to the host. There are a few different ways of doing this.

The first method would share the Steuben County connection to the CAD/RMS package. Other counties would gain access through the fiber network. Bandwidth and loading need to be evaluated under any condition. Optionally, and recommended, the other counties should have their own VPN connection through a different network in case of failure in any part of the fiber or Steuben's connection.

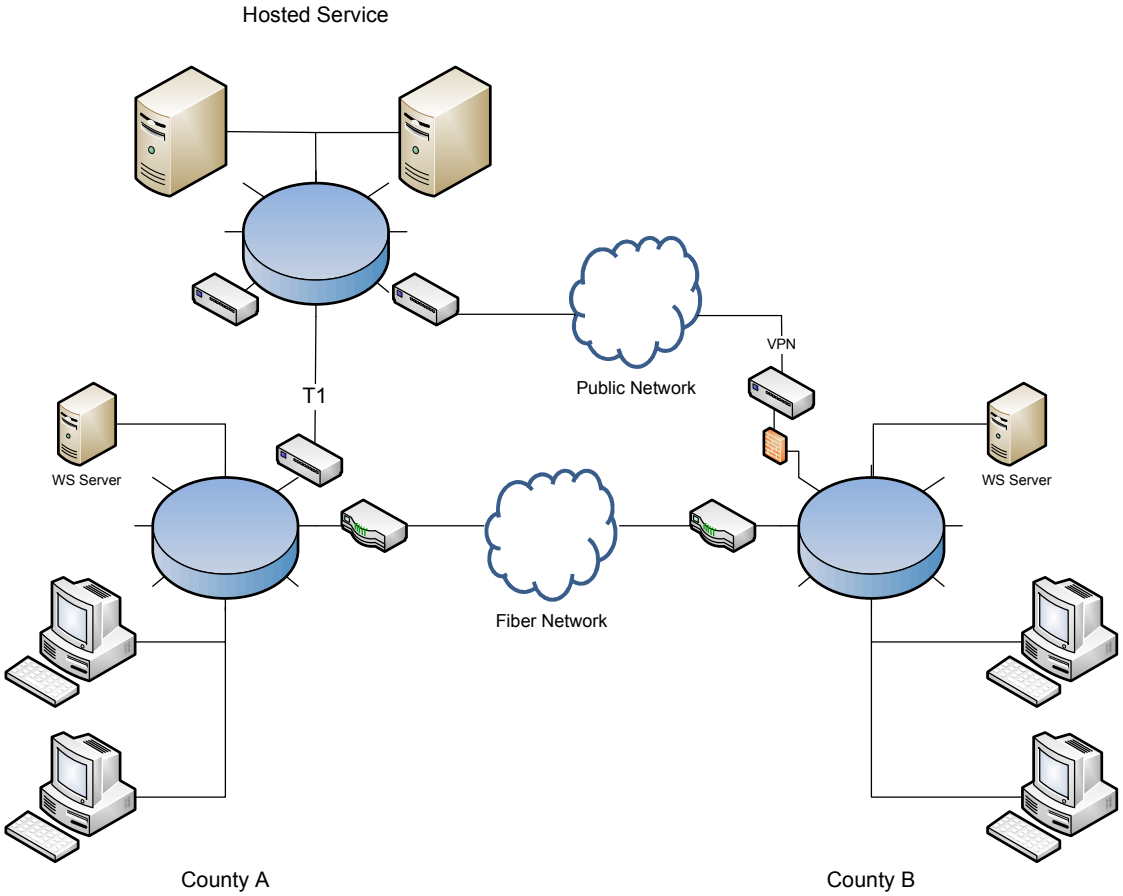

Figure 8 Hosted Single Entity CAD

If the counties decide to form a separate entity to manage the data network, or ESInet, the connection to the service could be centralized and maintained independently. It is always recommended that each county have a diverse path back to the host.

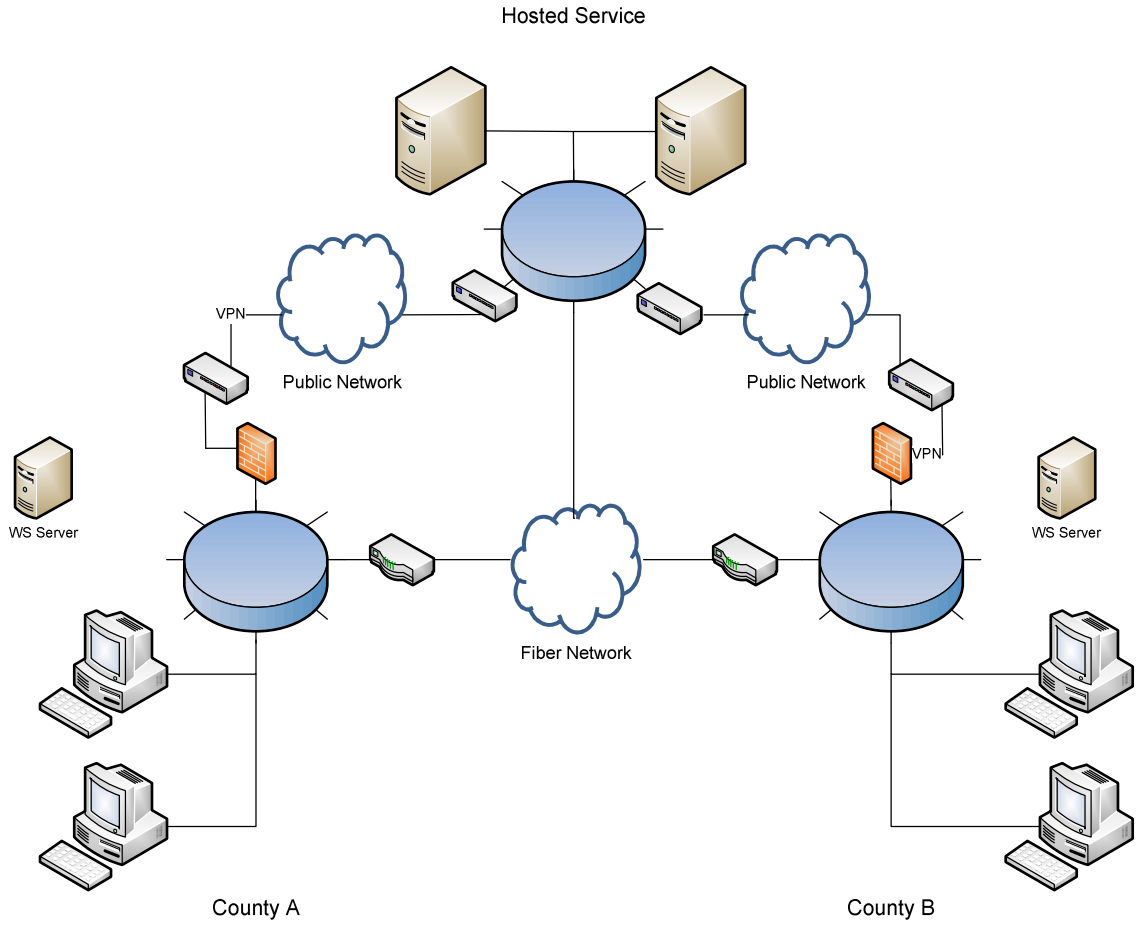

Figure 9 Hosted Regional CAD

Data would be shared at the server level, with each county responsible for its own data, and setting sharing access rights for its data. For reliability, each county should have small local servers to provide functionality in case of network outage.

RMS packages are used by more than just the PSAP. Other agencies within the counties need access to the records as well, to maintain their own data. This could allow the cost of the package to be spread out over other agencies, since many more clients would be needed than the communications centers alone.

GIS packages tend to be local. Although technically possible to share, they can be bandwidth-intensive, especially as with maps. Cost savings could possibly still be realized if bought through a multi-county agency, and all agencies could benefit by using the same platform. By centralizing mapping, maps can be synchronized across multiple

counties, ensuring increased accuracy. This would allow for less cross-training, especially if one county had to take over for another county, or share in a multi-county incident.

To assess the viability of shared CAD/RMS, individual counties would need to determine if they need all of the features available in a cloud solution. Once a comprehensive needs analysis has been done, a comparison of functions versus costs could be undertaken.

When comparing costs of running CAD/RMS locally or cloud-based, several factors need to be examined.

The local client workstation and local network would be the same for both. A local solution typically requires a large server, usually with Redundant Array of Independent Disks (RAID) discs, and typically with a redundant backup. With a cloud-based solution, a small server is needed as a backup in case of loss of connection. Depending on the configuration, GIS may be on the same server, or have a separate server. This would be the same for either configuration, as GIS is usually too data-intensive for real-time cloud operation. When figuring the costs of a local CAD server, additional maintenance needed by the in-house IT department versus the automatic maintenance provided by the vendor at his facility needs to be compared. Although a small factor, the local CAD server would require additional usage of the UPS.

Cloud-based solutions typically pay monthly for a client license, with all other costs factored in. With a local solution, there is the cost for the complete package, and then a yearly maintenance cost. This may or may not include automatic upgrades. Be careful with a cloud-based solution to make sure that automatic upgrades are included as part of the monthly license.

The other factor to consider is backups: With a local server, your IT department must maintain scheduled backups of the data; with a cloud-based solution, it is included as part of the package, with continuous backups made at the vendor's facility.

As part of this study, a quote was provided by Tiburon to allow Schuyler and Allegany to share access through Steuben for their hosted system. Costing was based on a five-year hosting agreement for software only. Hardware and interconnect are to be provided by the counties. Estimated costs for hardware are included here.

Tiburon Monthly Cost Matrix

Feature – Monthly Costing	Schuyler (3 positions)	Allegany (6 positions)
CAD Seat Licenses (Dispatch NOW) - $695 Monthly Per Seat	$1995	$3990
CAD RMS XML Interface	$200	$200
NCIC Interface (through Steuben)	Included	Included

Feature – Monthly Costing	Schuyler (3 positions)	Allegany (6 positions)
Deployment, Help Desk, Upgrades	Included	Included
Total Monthly Costs	$2,195	$4,195
Options		
Mobile Client License	$30	$30
WebCAD Concurrent Client License	$40	$40
Direct NCIC Access	$258	$258

Table: Tiburon Monthly Cost Matrix

Tiburon Capital Expense Matrix

Equipment – Capital Expenses	Schuyler (3 positions)	Allegany (6 positions)
Workstation with Two 19" LCD Monitors – Assume $2K Each	$6000	$12,000
Communications Server	$10,000	$10,000
Router	$5,000	$7,000
UPS/Rack Space Assumed	$0	$0
Total Capital Costs	$21,000	$29,000
Options		
Direct NCIC Interface Server	$3,000	$3,000
Tiburon Setup Fee	$10,000	$10,000

Table: Tiburon Capital Expense Matrix

The following is a comparative analysis of Allegany and Schuyler each procuring new CAD/RMS systems with sharing the Steuben County Tiburon system.

4.6 Tiburon verses Stand alone CAD Analysis

One-time Costs Comparison

Item	Allegany	Schuyler
CAD/RMS/GIS		
Local hardware - Tiburon Solution	$ 29,000.00	$ 21,000.00
Local hardware - Stand along solution	$ 150,000.00	$ 85,000.00

Table: One-time Costs Comparison

Annual Reoccurring Costs Comparison

Item	Allegany	Schuyler
CAD/RMS/GIS	$ 50,340.00	$ 26,340.00
Mobile Data - Tiburon Solution		
CAD License per unit @ $360/year	$ 7,200.00	$ 5,400.00
Total - Tiburon Solution	$ 57,540.00	$ 31,740.00
Local Solution @ $32,000	$ 32,000.00	$ 32,000.00

Table: Annual Reoccurring Costs Comparison

Five year comparison – Tiburon verses Local Solution Projection

5 Year Projection	Allegany	Schuyler
CAD/RMS		
Tiburon Solution – see note	$ 316,700	$ 179,700
Local Solution	$ 310,000	$ 245,000

Note - Does not include connectivity costs w/Allegany

Table: Five year comparison – Tiburon verses Local Solution Projection

Summary:

CAD is a critical element for both call-taking and dispatching. For any level of interoperability, access to event information and records is critical. The needs of the individual counties in conjunction with 911 and radio need to be evaluated in detail, from sharing of records to mutual access to databases. The easiest approach is for counties to share a CAD system. This provides the greatest level of interoperability and allows other features such as shared mobile data systems to be implemented in an easier and economic way. The counties should also evaluate their individual databases and determine if record types could be shared as a NIEM-compliant interface.

Over the longer term, it is necessary to align evaluations with NG911, ensuring that vendors are compliant. Besides 911 and CAD, this will also impact logging systems, as they will become another interface on any type of future ESInet.

Next Steps:

- Evaluate CAD/RMS needs of each county.
- Discuss areas of interoperability that would provide areas of benefit.
- Evaluate costing of Tiburon-hosted CAD/RMS.
- Evaluate interoperability needs for CAD/RMS.
- Evaluate interoperability needs for mobile data.
- Align evaluations with future path plan for NG911.

4.7 Mobile Data

Mobile data may be another area of sharing. Simple text messaging and other devices may be supported by a common server or by hosted device.

There may be some cost savings in expanding over a larger group by consolidated purchasing. Other data connections coming into the mobile data system may be shareable over the fiber network, thereby saving costs on having separate connections to each county. Other data depends primarily on decisions made about the sharing of CAD and RMS packages.

At this time, this is an area that needs to be deferred until decisions are made at the CAD/RMS level.

Summary:

In most cases, mobile data is an extension of CAD/RMS, and most features are dependent on the host. Features such as Web access and email may be stand-alone features, and with Web-based applications, could provide some tools that may be shared. Other-

wise, any evaluation of mobile data must be done in conjunction with the CAD/RMS system for both interoperability and economic considerations. As with any other purchased item, there may be some cost savings by combining purchases between counties.

Next Steps:

- Evaluate mobile data usage and future needs.
- Determine current and future features that may be shared.
- Evaluate features that will be more useable on higher speed LTE systems.
- Evaluate consolidation of CAD/RMS.
- Discuss common needs within counties.
- Evaluate combining of services.
- Contact wireless providers for combined county quantity pricing.

4.8 Long Term Evolution (LTE)

The national broadband initiative has been a hot topic for the past couple of years. LTE has become the standard planned for use by public safety. Many arguments can be made whether or not additional spectrum is needed for standard LMR, but politics seem to have decided that LTE is the catch-all for everything that public safety needs.

Without talking about voice capability, LTE does in fact offer the potential for the highest data speeds over a wireless network. LTE is a worldwide standard, so by default it becomes interoperable. The commercial world, due to its large multi-billion dollar markets, has been much more capable of setting standards in a timely fashion. Wireless Fidelity (Wi-Fi), as an earlier standard, has shown to be unsuitable due to security concerns and lack of coverage. Worldwide Interoperability for Microwave Access (WiMAX) was available before LTE, but most of the early providers are now planning to switch to LTE. As a wireless data standard, LTE has become the predominant standard for high-speed data.

LTE is still in its infancy, but most carriers are rolling out systems. The LTE standards are set by the Third-Generation Partnership Project (3GPP) organization, which is comprised of European, U.S. and Asian standards formulation groups. The United States is represented by the Alliance for Telecommunications Industry Solutions (ATIS) which has also done work for wireless 911. Telecommunications Industry Association (TIA), another U.S. standards body, is also involved.

Many public safety applications that could be supported by LTE include:

• Streaming video (surveillance, remote monitoring)

- Digital imaging
- Automatic vehicle location
- Computer-aided dispatching
- Web access
- E-mail
- Remote database access
- Report management system access
- Telemetry/remote diagnostics
- Mapping/GIS
- Text messaging
- Voice over IP (including interoperability with legacy and new LMR infrastructure through the use of appropriate gateways)

Many of the public safety LMR providers have teamed with commercial providers to develop LTE for the public safety market.

Some points need to be considered in the use of LTE. LTE is a data standard, and is standardized as a transport only. This means that certain applications are still proprietary. Enhanced functions such as short messaging, email and video are all covered by standards. Other applications that use data, such as CAD and GIS, will still be vendor-specific.

In LTE, each cell sector operates in 10 MHz portions of spectrum. 20 MHz is available, but currently for public safety only 10 MHz has been approved. All users operating on that cell sector share the spectrum. Numerous tests of LTE have shown that this is not enough spectrum to handle large incidents. The cell sector will slow down, or be busied-out enough to make communications ineffective. Bandwidth toward the edges of coverage can be too small for usage. Virtual spectrum and bandwidth can be increased by adding additional sites (cell splitting). RF design becomes more complex as cells are located closer due to overlap considerations. One other area of concern is the signaling. When the iPhone was introduced into large metropolitan areas like New York, it wasn't just the data overload that was preventing effective usage, but the signaling path. Signaling is the method by which users are connected to the system. This is also a concern for LTE, and will be proven when larger usage is in place. LTE standards bodies have addressed standardizing more efficient signaling and continue to work in this area.

LTE operates at a reduced power level compared to LMR. LTE as a commercial standard is based on 200 mW. This means that many more cell sites could be needed compared to LMR to supply the same coverage area. In some cases, this could be as much as 10 times the number of sites compared to LMR, depending on terrain and other factors. LTE allows for femtocells (a small base station for home or office use), microcells,

and even picocells to increase coverage. The costs of building a private network are prohibitive, and commercial carriers typically build out to what they need to turn profit. Wireless coverage for LTE (or any other commercial wireless service) for public safety is dependent on the carrier's build out.

Currently, most commercial LTE equipment to operate in the 700 MHz band does not have the ability to cover the complete band. Depending on the carrier, most have the bulk of their spectrum in either the higher portion of the band, or the lower portion. For now, this limits interoperability between carriers. This will probably be addressed as the technology matures, similar to how multiband radios now exist to cover UHF, VHF, etc. There is a large push by both government and smaller providers to do this.

For commercial use, LTE is usually set up for higher download speeds than upload. This is due to the general consumer surfing the web, checking emails, watching videos, etc. For public safety, there is a need for robust upload speed for applications such as sending reports, providing video from an incident, etc. Many of the partnerships between LMR providers and commercial wireless providers are swapping to provide better upload capability. Bandwidth in LTE is extremely flexible, and depends on the network operator to tune to its needs. Typically as you get closer to the cell site, bandwidth increases. It can also be programmed to average-out speeds over the cell sector to provide the same level for all access. For public safety, a large-scale incident may need close coordination of bandwidth considerations by the network operator.

Interim voice standards have been proposed, but this is not mission-critical voice, or voice PTT. Since public safety is a small market compared to the commercial markets, mission-critical voice or voice PTT may not be standardized for a long while, if at all. Vendors are addressing this issue, and some de-facto standards may be realized in the near future, but they will be somewhat proprietary to the vendor. Currently, most carriers are falling back to 2G/3G technologies for voice on LTE equipment on their rollouts, known as Circuit Switched Fallback (CSFB). The other standard being considered is Voice over LTE via Generic Access (VoLGA), which only uses current LTE standards and does not fall back to 2G/3G technologies. Future standards will make use of IP Multimedia Subsystem (IMS) technology.

Voice over LTE is a whole area of discussion within itself. As previously stated, there are no standards for PTT voice, especially mission-critical. Voice in general needs quality of service to work effectively. When used in a data system, voice must get priority to work properly. Also, since LTE is just a transport protocol, there are no mechanisms to retry data; this is done at an application level. For voice, this means that the transport must be reliable, quick, and error-free to ensure quality voice. LTE will have a priority mechanism built into the standard to prioritize 911 calls. This same priority may be possible to be used by public safety agencies, especially if voice PTT is used. Although basic priority may be built-in, the standard needs to address when the majority of the voice is at priority level, typically during a large-scale incident.

As stated before, there are no immediate plans to commercially standardize voice PTT. There is much work being done in this area. Organizations such as the National Public Safety Telecommunications Council (NPSTC) and federal agencies such as National Telecommunications and Information Administration (NTIA) Public Safety Communications Research (PSCR) and Department of Homeland Security (DHS) Office of Interoperability and Compatibility (OIC) are evaluating different methods. Currently voice PTT is done with a separate device or PTT server, which many independent interoperability device manufacturers have as well as major manufacturers and service providers. Using this method, the PTT servers can generate virtual groups by sending simultaneous PTTs. Although this may be effective, the signaling required makes it a very ineffective model for group calls.

There are standards in different stages of development addressing the same, mostly using IMS technology. Currently, most work is going into Multimedia Broadcast and Multicast Services (MBMS) with some limited support in the current release. Basic functionality has already been included in LTE Release 9. Most equipment is currently using Release 8, so it may be a while before these features are incorporated. (Currently, LTE standards groups are working on Release 10). With this service, multiple subscribers receive the same data, which is only sent once. Users receive the data by joining multicast groups associated with the service, which should be the foundation for any group type of call for public safety.

Currently, there is no direct subscriber-to -subscriber usage in LTE without the network, similar to all commercial technology. Some manufacturers are working on a combo LTE and Project 25 device to bridge the technologies. The same is happening with TETRA in Europe. Major players such as Harris, Motorola, Cassidian, Alcatel-Lucent, Verizon, and Etherstack are working on combination networks and devices. For Project 25, the Inter RF Subsystem Interface (ISSI) is also being looked at as a bridge between networks.

Much of what has been stated has been to the disadvantage of LTE. This does not mean that LTE is unusable, only highlighting the concerns about LTE at this stage in its development. For enhanced dispatching services, such as text, data, and video, LTE service still offers much to users in more efficient dispatch, and more information available to the personnel in the field. The need for LMR will not go away in the foreseeable future as the primary dispatch mechanism, but many dispatch activities such as status and lookups could now be handled by data rather than voice.

The counties may realize interoperability at the data level. Sharing normal features such as text, email and video are all available for use. Depending on how the counties decide to use their fiber network to allow shared use will also allow shared CAD, database lookup, and other features to be interoperable.

Since mission-critical or PTT voice depends on PTT servers, that would be a separate area of decision for the counties (sharing PTT servers and access). If servers are shared,

then the counties may realize multiple-county group calls over LTE within their coverage areas.

At this stage of LTE development, it is not seen as a near-term benefit to the counties. Commercially, it may be a long while before LTE is complete enough to be useable in more rural counties. As stated previously, a private build out would be prohibitive for small counties. For the long term, LTE will offer great benefits and interoperability to the counties. Future planning should be started now so that as LTE is realized, the counties can most effectively use the technology for increased efficiency, aiding interoperability and providing more tools for the responders.

Wireless architecture does not change between 3G -type technologies and LTE. Most features that are commonly used now may be planned for migration into LTE. Other features that require LTE-type bandwidth such as video should be evaluated for interoperability needs, and then planned for future migration.

Summary:

LTE is really no different from other forms of wireless transport, except for the potential of interoperability, assuming that standards are adopted, and possibly some voice services. These are long-term features; otherwise planning is not different from that for mobile data. Over the longer term, the counties should stay abreast of developments and coverage in their area. As LTE becomes a useable reality, other high bandwidth features such as video may be evaluated for interoperability and implementation in conjunction with CAD and logging.

Next Steps:

- Evaluate current wireless needs for interoperability between counties.
- Evaluate future needs that require LTE.
- Evaluate regional network for usage and consolidation.

4.9 Land Mobile Radio - LMR

There are many ways to share LMR systems from single tie lines, cross-connect switches or RF interoperability projects. One common theme is the lack of frequency available. This limits the availability to do much with the exception of the standardized interoperability channels that are available.

Planning for a consolidation on an RF frequency level would probably run into local concerns. As all of the counties involved are looking at some major changes in the radio systems, coordinating channels may be beneficial to interoperability. With narrowbanding nearly upon us, this would need to be looked upon as a long- term plan since most counties are well into their planning and implementation stages. If other decisions are made to

consolidate other services, then some radio planning should be factored into a long-term plan.

The fiber network could be very beneficial to the interoperability between counties. With a shared fiber network, anything from a single channel to complete access to another county's resources can be realized. With the network available at each dispatch point, access to the radio system could be made available to anyone sharing the network. An agency could have one or more channels available to be shared or complete access to the radio channels in case of a dispatch center being evacuated. At the bare minimum, it could provide for a common intercom channel between agencies. Then, through the use of cross-patch, this channel could allow channels in separate counties to talk.

Another possibility is to provide remote consoles in each county's dispatch center. In case of failure it would allow someone to quickly access the channels for monitoring. This does have drawbacks, as each county uses a different vendor, so operations would be different for the dispatcher -- a training issue. Also, it assumes there is physical space at the remote counties' facilities to provide secondary positions.

Most counties have their own backup centers, although in most cases the backup centers do not have full ability or access of the main dispatch center. If access is lost between the dispatch center and the radio system due to equipment failure, the fiber interconnect would not provide for takeover if connected at the same point. It could allow for some strategically placed control stations around the network that could provide some backup capability. Regardless of technology, planning should allow for diverse access to critical radio channels.

For each channel that is shared, each center would have to provide its own line cards for its consoles, as well as connection to the fiber multiplexor. The dispatch center would also have the capability to cross-patch out-of-county channels with in-county channels as required.

This does not appear to be an area to be explored for cost savings unless functional consolidation is evaluated. From an interoperability standpoint, providing access to the radio channels over the fiber network would greatly improve interoperability between counties.

There are many ways to place radio audio on the network. One method is to provide access at a channel basis. Since most of the channels appear at each dispatch center, it is possible to provision a T1 across the fiber network. This would allow savings over individual channel access, but does not have the diversity of using individual channel converters. A simple T1 channel bank would be less than $1,500, but also needs to be multiplexed onto the fiber backbone.

Another method is to purchase IP converters for less than $2,000 per channel. Currently, each county uses a different console vendor. Costing varies but is typically less than $1,000 per channel and assumes that spare capacity is available in the console switch.

This does not factor in any multiplexers or routers to be placed on the fiber network, and assumes that the fiber network runs to each of the tower sites. Once converted to IP at each tower, the audio can be available to anyone provisioned on the network. Audio can be converted at any point in the stream, but any design should evaluate the availability of that audio to the regionalized network, and analyze this under different fault conditions.

The final method to be evaluated is to buy a console system that has the capabilities of networking. Both Zetron and Avtec allow console systems to interconnect with each other, thereby allowing full access to each of the system's resources. This would provide complete interoperability, but also would lack the redundancy requirements, being a single-point connection to the radio system. In this type of architecture, an adjacent console system only has access through the console system. A failure in the console system would prevent other systems from accessing those resources. Regional design should ensure that diverse access is provided for critical channels.

Ideally, from a technical perspective, having independent access to the individual channels and having an interconnected console system would provide the most diverse and redundant solution, but the most expensive.

In analyzing any costs, evaluate the future need for backup centers. It could be expected that another county would immediately take over dispatch (assuming personnel available), if a county lost use of its dispatch center. This applies to radio only, as other resources such as 911 and CAD would have to be planned appropriately.

Note that currently each county is using a different vendor for its console systems. Steuben is using Motorola Centracom, Schuyler is using Moducom, and Allegany is using Zetron Integrators. With the potential exception of Schuyler, neither Steuben nor Allegany have the capability of a major expansion.

Method	Cost *note 1,2	Pros	Cons
1 or more intercom channels to be used for cross-patch interconnect	$3K per county per line	• Least expensive • Would work with existing consoles • Requires least amount of channels	• Cross-patching introduces delays and possible voice loss • Requires manual intervention at each county
Provision T1 between dispatch centers	$2K per county, each end for 24 channel bank $1K per channel for console expansion	• Least expensive • Would work with existing consoles	• Does not provide redundancy in case of loss of channel access

Method	Cost *note 1,2	Pros	Cons
	card each console system		
Convert each channel to IP	$2K per channel for IP converter $1K per channel for console expansion card each console system	• Channels can be configured and accessed individually • Not dependent on local county's console system • Available to anyone on the network with permissions • If implemented fully, can replace need for backup dispatch.	• Potential cost (depending upon design of fiber interconnect to sites)
Remote dispatch consoles	Varies among vendors, up to $75K $2K for a 24 channel bank per county. Each position would need 4 or more channels	• Provides full access to another county's radio system • Inexpensive	• Does not provide redundancy if central console equipment has a failure • Need physical space for positions • Dispatcher must be trained on multiple systems
Interconnected console system from one vendor	Varies greatly depending upon options, models, and number of positions and channels	• Provides full interoperability • Training on one system • Possible elimination of backup centers	• Expensive • Depends upon console operation for failover

Note 1: Does not include fiber multiplexers, potential encryption needs (ION) or service costing

Note 2: Assumes that consoles have expansion capability

Summary:

There are multiple options for radio systems to share, each having its own cost considerations. Initially, the counties evaluate their needs, whether it is interoperability on a limited basis, or complete takeover capability for an adjacent county. The most flexible option is to convert radio audio to IP at the earliest possible entry point in the network. Although the most costly, this will allow the greatest level of flexibility for long-term planning. As the fiber networks are being installed, careful consideration must be given to the design and availability of radio audio on the network.

Next Steps:

- Evaluate interoperability needs.
- Evaluate backup plans for dispatch centers.
- Evaluate design for fiber interconnect to channels/towers.
- Evaluate current console replacement cycles.
- Plan for long-term needs for spectrum and consolidation of services.

4.10 Logging Systems

Legacy logging systems typically are found close to the radio/telephone tie points in either the dispatch center or telephone room. Especially with analog recording, the interface needs to be near the phone line or T1.

With IP networks, logging systems have undergone somewhat of an evolution. Typically loggers are near the primary source. In the case of radio, this may actually be remote from the PSAP, located in a separate equipment room at a radio site. Most recorders now allow remote IP connections for playback, where any computer may be a client.

Most modern recorders now record directly from IP networks and convert analog audio to packet data. This allows the recorder to effectively be anywhere in the network assuming all audio is packetized.

The advent of NG911 is forcing the logging recorders to record more than just audio, where all data associated with an event is recorded. The second major point of NG911 is the ability to share events. This architecture promotes the use of shared recorders.

With major government initiatives funding NG911 and multiple organizations setting standards, data transport through the network is gradually being standardized. Many

manufacturers have shown interoperability for NG911 logging recorders using standardized protocols.

From a radio recording perspective, it does not seem that the counties would benefit from any shared recording at this time. The counties rely on local analog-based connections for radio and for telephone. Although it would be possible to packetize the audio and share over the fiber network, this would not provide much in the way of cost reductions, as the cost of the digital conversion and transport would probably outweigh the sharing of a logging system.

As the counties convert audio to IP (radio and telephone), centralized logging may make more sense, and both the record and playback paths would already be available on the network. This may also be examined if audio data from the radio system is placed onto the fiber network.

Currently, this is not an area that would provide any near-term cost reductions, but may be re-examined at a later date if the counties move toward any shared 911 or data systems.

As most of the cost of logging is in the channel licenses, centralized logging for basic recording would not save much. Most individual centers would still need to locally record 7-digit and administrative lines. The point at which centralized logging may make more economic sense is during the migration to regionalized 911. The amount of data needed to be recorded will be higher by a magnitude, and this is when the economics may provide much larger savings.

From an interoperability perspective, the sharing of playback licenses may be evaluated. With the fiber network and IP client workstations, playback could be accomplished anywhere within the network.

Summary:

Logging systems are best considered in conjunction with, and after other elements of the network are evaluated. Without access to all recordable audio on the network, centralization is not possible. The easiest feature to implement would be the ability to provide access to certain playback features, although its need may not be justified.

Over the long term, logging systems must also adapt to the multiple events envisioned with NG911. Along with evaluations of shared systems for 911 and CAD, logging systems should be considered, as they are a central element to any type of regional ESInet.

Next Steps:

- Discuss potential needs for playback availability to other counties.
- Discuss potential 911 consolidation.
- Evaluate sharing of radio resources.

- Discuss future path for NG911.
- Evaluate interoperability needs for logging.
- Evaluate centralized logging.

4.11 Technical Summary

The Southern Tier Network could be beneficial to many areas of public safety communications, both as an aid to interoperability and as a possible means of consolidating services with potential cost savings. The combination of partner counties could be modified depending on the level of technology desired by each county.

The main areas that should be considered are 911 services and CAD/RMS packages. The advent of NG911 should have all counties looking at network consolidation. The biggest decision would be in examining the ownership and responsibility of the network, and setting up a multi-county board. Consolidation at an IP level would provide potential cost savings, backup and overflow capability for each county, and an increased level of interoperability. Moving forward, the greatest cost savings would be in implementing the newer features of NG911.

Combining CAD and RMS packages may not provide an immediate cost benefit, but would provide an immediate improvement in interoperability, especially if combined with a network consolidation for 911.

Mobile data, whether at the 3G or 4G level, should be started as a long-term plan. The advent of LTE services and some standardization on this platform could aid in the efficiency of dispatch operations, provide better data and tools to the responders in the field, and promote interoperability in the field. Future efficiencies could result in cost savings over the long term.

Over the short term, planning at the RF level for radio probably will not be possible. Long-term plans may be started now, looking at combining services between counties, and planning for effective spectrum usage and coverage. The fiber network could provide the framework for increased interoperability between counties by providing radio access to adjacent counties. The counties could start planning by identifying critical channels and where it makes the most sense to provide access.

If other parts of the counties' systems are combined, planning for centralized logging capability should be evaluated. This could provide cost savings, but only if the recorded resources become network-based.

The most important issue is planning for a regional network. If properly planned now, all elements of the system can be accommodated and realized in a more efficient method.

Once an element or resource is converted to IP, whether it is 911 audio, radio audio, or data, it can be effectively routed to any part within the system.

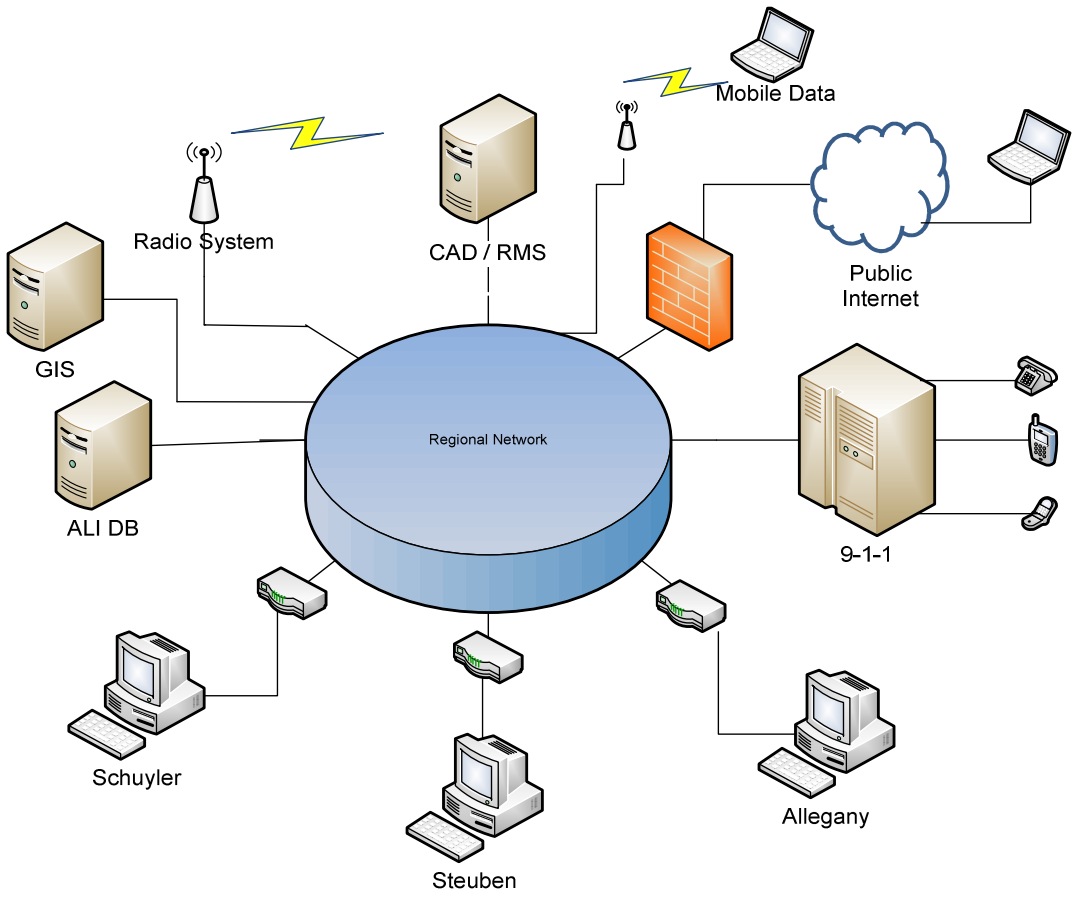

Figure 10 Complete Regional Network – All Services

Next Steps:

- Review individual elements as discussed under each section.
- Discuss needs between counties.
- Review the fiber network, and its potential benefits to allow sharing of resources.
- Evaluate long-term needs, especially for NG911.
- Identify short-term items to be considered for detailed evaluation.
- Identify long-term items for planning.

- Ensure network design meets the needs for both short term and long term.

5. Non-Consolidated Shared Services Cost Analysis

The non-consolidated shared services costs provide estimates for each item. Initial on-time costs along with reoccurring costs have been estimated. Not all items would need to be selected.

5.1 Initial Onetime Costs

Onetime Costs

Item	Total	Allegany	Schuyler	Steuben
Network Costs	$300,000	$100,000	$100,000	$100,000
911 Systems - CPE				$0
Local CPE	$685,000	$175,000	$120,000	$390,000
CAD/RMS/GIS - Note 1				
Local Hardware	$50,000	$30,000	$20,000	$0
Mobile Data - Note 2				
Mobile Computer, etc		NA	NA	NA
LTE - Note 3		NA	NA	NA
Consoles				
Consoles - Shared System	$1,100,000	$300,000	$200,000	$600,000
LMR				
LMR - Interoperability - Note 4	$150,000	$50,000	$50,000	$50,000
LMR - Shared System-Option - Note 5	$50,000,000	$25,000,000	$10,000,000	$15,000,000
Logging System - Note 6				
Local Hardware ($300,000)	$315,000	$110,000	$105,000	$100,000
Total - LMR Interoperability Option	**$2,600,000**	**$765,000**	**$595,000**	**$1,240,000**
Total - LMR Shared Option	**$52,450,000**	**$25,715,000**	**$10,545,000**	**$16,190,000**

Table: Initial Onetime Costs

5.2 Reoccurring Shared Services Costs

Reoccurring Shared Services Costs

Reoccurring Costs

Item	Total	Allegany	Schuyler	Steuben
Network Costs	$30,000	$30,000	$0	$0
911 Systems - CPE	$102,750	$26,250	$18,000	$58,500
CAD/RMS/GIS - Note 1	$76,000	$50,000	$26,000	$0
Mobile Data - Note 2				
CAD License per Unit @ $360/year	$19,800	$7,200	$5,400	$7,200
Connectivity per Unit @ $480/year	$26,400	$9,600	$7,200	$9,600
Public Safety LTE - Note 3				
Consoles				
Consoles - Shared System	$110,000	$30,000	$20,000	$60,000
LMR				
LMR - Interoperability - Note 4	$300,000	$100,000	$100,000	$100,000
LMR - Shared System-Option - Note 5	$1,600,000	$700,000	$400,000	$500,000
Logging System - Note 6	$45,000	$15,000	$15,000	$15,000
Total - LMR Interoperability Option	**$709,950**	**$268,050**	**$191,600**	**$250,300**
Total - LMR Shared Option	**$2,009,950**	**$868,050**	**$491,600**	**$650,300**

Table: Reoccurring Shared Services Costs

Note 1	Use Steuben County Tiburon CAD/RMS
Note 2	Use Tiburon as CAD switch. Use commercial wireless service for mobile connectivity - Allegany 20 units, Schuyler 15 units, Steuben 20 units
Note 3	Currently LTE are being developed. Public/Private systems will be developed in the future. Too early to cost.
Note 4	Would provide ability of each county to communicate/dispatch for partner counties.
Note 5	Shared LMR
Note 6	Shared logger

Shared Services Cost Analysis

The following analysis shows the overall cost of CAD shared services. The cost of the shared services CAD is added to the existing operational and labor costs.

Current Operating Costs versus Shared Services - Population	Current	Shared CAD - Population Based	Shared CAD - 911 Calls based	Shared CAD - Valuation based
Allegany	$631,828	$13.8075	$14.53	$0.0003768105
Schuyler	$697,617	$36.4521	$79.80	$0.0005818095
Steuben	$2,702,447	$27.3732	$27.56	$0.0005195157

Table: Shared Services Cost Analysis

5.3 Shared Services Summary

For Allegany and Schuyler Counties their current CAD costs are minimal. If Allegany and Schuyler upgrade their current CAD systems they would need to compare the costs of the shared services CAD hosted by Steuben County against the features, functionality and costs a standalone CAD system. Under this model for Allegany and Steuben there is no cost saving for shared CAD. However, the benefits of shared information that could be realized from a shared CAD system must be evaluated.

If the three counties were to share a common radio infrastructure there will not be a saving to existing costs, however such a system could be configured to improve interoperability and capabilities. Blue Wing has provided estimates of conceptual models based on certain parameters. These estimates provide a foundation for future planning.

In many consolidations savings from current budgets are hard to achieve because of the modest funding requirements. When potential partners have similar needs, requirements and are planning systems replacements improved functionality becomes possible but lower cost is still difficult to achieve.