

Final Project for the Class, Internet and Society:
Technologies and Politics of Control

The Transition to Next Generation 9-1-1 in North America

The impact of the institutional ecology on shaping the future of America's First
Line of Defense

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Introduction

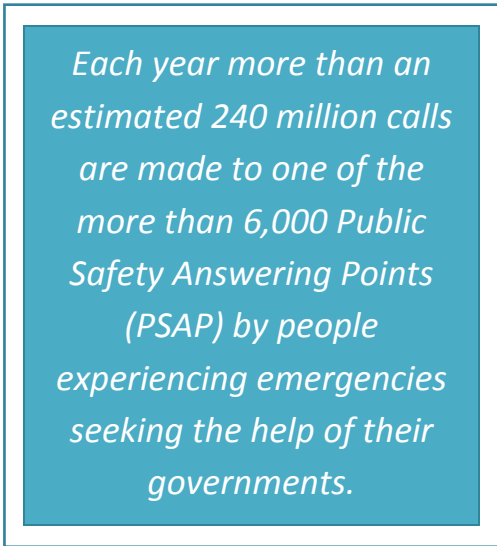
2 PM February 16, 1968 was an instant of an era distant in time and technology from today. “Hello,” said United States House of Representatives member Tom Bevill at the rural police station as he answered the first 9-1-1 call completed in the United States that had been placed by Alabama Speaker of the House Rankin Fite from the Haleyville Alabama City Hall. This single syllable answer culminated years of governmental and administrative study, technology investigation and no small amount of corporate intrigue.¹ The 9-1-1 system today can be considered America’s first line of defense. It is the instinctive reaction of most people experiencing an emergency or crime to dial 9-1-1 from their phone. The 9-1-1 system today is, however, at a crossroads and change is required.

This paper will discuss a significant proposal to accomplish that change and ask how what Yale University professor Yochai Benkler describes as the, “institutional ecology”² will affect accomplishment of an end state goal.

Context

The first 9-1-1 call occurred across a technology model that became entrenched within the 9-1-1 system and largely persists today. Yet, during the intervening years much has changed in the communications technologies used by the public who the 9-1-1 system serves. According the National Emergency Number Association’s (NENA)³, the member driven organization representing both the public officials responsible for running the 9-1-1 system and the industry community, “In the past 15 years, advancements in modern communications technology have created the need for a more advanced system to access emergency care. While the existing 9-1-1 system has been a success story for more than 30 years, it has been stretched to its limit as technology advances.”⁴

In answer to this challenge NENA with the support and partnership of other organizations including the US Department of Transportation and the Association of Public Safety Communications Officials International (APCO)⁵ have devised a vision for a Next Generation 9-1-1 system (NG9-1-1). The transition from the legacy system to NG9-1-1 will occur within an ecosystem of interacting interests. This



Each year more than an estimated 240 million calls are made to one of the more than 6,000 Public Safety Answering Points (PSAP) by people experiencing emergencies seeking the help of their governments.

paper will introduce the reader to and provide a brief analysis of how some of these forces will interact during the process of achieving the end-state goal. This paper will describe some of the factors motivating the proposed change, present a description of some of the interacting forces that will shape NG9-1-1 and discuss one example of how these forces are already at work to shape the future of 9-1-1.

Detailing the full scope of the interactions that will shape the ultimate outcome of the transition to NG9-1-1 is beyond the scope of this paper. Instead this paper will provide cogent observations and suggest areas that will require additional study. The paper demonstrates how the complex interactions of regulation, marketplace, history, politics and other factors are already at work in shaping what will be the future of the 9-1-1 system.

Key Findings

The results of the research conducted in support of this paper yielded a number of key findings. These include:

- the number one obstacle to the creation of a new 9-1-1 system in the United States is the lack of sources for the funding of the transition;
- the NENA i3⁶ technology proposal suggests the creation of a new technology layer to exist between the public network and the network used to deliver 9-1-1 emergency communications to the agencies with the responsibility to respond;
- this new technology layer creates both a new area for innovation and a regulatory and governance whitespace;
- the existence of this whitespace creates administrative ambiguity that will need to be filled by common law and administrative processes over upcoming periods of time;
- there exists expectations on the part of survey respondents that Federal Communications Commission will intervene to be a catalyst for change, however, it is unclear whether the FCC has the jurisdictional mandates necessary to enforce in the transition; and
- the factors surrounding the transition to NG9-1-1 justifies additional scholarly investigation.

Current State

Each year more than an estimated 240 million 9-1-1 calls⁷ are answered at one of the more than 6,000 Public Safety Answering Points (PSAP)⁸ in the US. The calls come from people experiencing emergencies or crimes and seeking the help of their governments. At the PSAP public officials answer the calls, perform any available triage, make split second decisions and in many locations⁹, coordinate the activities of the police, fire, emergency medical and other response resources. It is an environment in which the smallest savings of time counts. For instance, a study of ambulance services in England

estimated that the effect of a one minute reduction in ambulance response time for out-of-hospital cardiac arrest improved the odds of survival by 24 percent.¹⁰

In the words of the Broward County Florida Sheriff's Office, "seconds could mean lives."¹¹

The next section will present several examples of how technology, governance, industry and other factors impact the 9-1-1 system today. The purpose is to prepare the reader to understand the research results presented later.

Technology

In *The Wealth of Networks*, Benkler discusses how the, "institutional ecology" through a, "series of organizational and institutional choices," in the early days of new technologies have proven to influence the governance and use of those technologies well into the future.¹² This statement has proven true across the history of the 9-1-1 system. As communications technologies that interface with but remain outside the core functioning of the 9-1-1 system have evolved in dramatic fashion, the technology of the 9-1-1 system itself has remained fundamentally the same over many years. Each new technical challenge resulting from innovation in the ways that the public communicates, such as the proliferation of mobile telephones, has been met by the 9-1-1 system with what might be described as a series of bandages rather than a wholesale occasional rethinking that is seen occurring in reaction to such dramatic change in other environments.

One example of a sticky institutional technology decision along the lines that Benkler describes is the use of the Centralized Automatic Message Accounting (CAMA)¹³ signaling protocol. CAMA is used in the majority of 9-1-1 deployments to transfer and put to use information about the location of the caller. This information is critical to routing the call to the proper agency and coordinating the proper response.

Originally designed as a method for telephone carriers to transmit billing information, CAMA was adapted to transmit the Calling Party Number¹⁴ (CPN) in the 9-1-1 system. Commonly known as Caller ID, the CPN is a string of digits typically assumed to uniquely represent the caller's device and therefore the location of the caller. Unfortunately today, in many circumstances CPN used as a way to locate the originator of an emergency call no longer remains a comprehensively valid approach. Modern problems including telephone number spoofing and other circumstances in which the CPN is used for purposes other than representing the location of a caller increasingly defeat this once valid assumption.¹⁵

Another drawback to CAMA is that unlike the ways in which modern packet switched technologies operate where information is encoded digitally and sent as discrete data elements, CAMA

relays critical information using the technique of In-band signaling.¹⁶ That is, rather than a digital series of ones and zeros transmitted on a network optimized for data, the CAMA protocol sends information over voice optimized analog circuits encoded as a series of electronic signal fluctuations. One of the implications of this persistent foundational technology in the environment where lost seconds could mean lost lives is that rather than information being transmitted at a rate typical of modern data communications - in billions of data elements per second - "caller ID" information sent across a CAMA based circuit is relayed in a measurement of kilohertz (thousands of signal fluctuations) per second. This rate is but a small of fraction compared to typical data speeds. A comparison of how this occurs is the methodology used for dialing by rotary telephones.¹⁷ Where this factor becomes more important is when location information needs to be "rebid."¹⁸ This might be in the case where increased location granularity is required because the information did not transmit correctly or the caller is in a moving vehicle. Latency accumulates with each successive transaction. In the words of Fire Chief Keith Richter, "Time is our greatest enemy."¹⁹

The cumulative impacts are that using the CAMA protocol places limits on the usefulness of the information and injects latency into the response processes, "Seconds could mean lives."²⁰

The CAMA protocol is a modality as outdated as the 9,600 baud modems²¹ still used in many PSAP locations as part of the location determination processes.²²

Governance

The governance of the 9-1-1 system has evolved over many years through a set of processes that can be best described as organic. At the heart is a technology story that is wrapped within the interactions of politics and economics and the often enigmatic public policy practices that govern relationships between and among local governments, state governments and the US federal government. Long before the Internet made the concept of federation the predominant organization of technology, the 9-1-1 system grew iteratively through processes of local agencies, vendors and policy makers interacting to patch together a system that is now nearly universal in the US.

Throughout the history of the evolution of the 9-1-1 system the emergence of new communications technologies has occurred in an environment that has often lacked precedent in governance and legal and administrative context. Additionally there is a long history of interactions and occasionally conflicts between the roles of the federal government, administrative agencies and the jurisdictions of states and local governments. Article VI, Paragraph 2 of the US Constitution, "commonly referred to as the Supremacy Clause,"²³ reserves all legal authority not granted to the US federal government by the Constitution to the states. What this means in practice is constantly tested through

common law processes. For reasons that include the fact that the 9-1-1 system is a universal concept for both people reporting emergencies and crimes, the system and its governance have been buffeted by ongoing debates over legal and jurisdictional differences of opinion.

This is part of the reason that even though the US federal government played an initial motivating role suggesting as early as 1965 that a national system should be created,²⁴ it was not until more than thirty years later with the passage of the Wireless Communications and Public Safety Act of 1999 (9-1-1 Act) that the FCC was instructed by the Congress to make 9-1-1 the universal emergency number for all telephone services across the nation.²⁵

Over time the surrounding administrative and common law processes that govern management of the 9-1-1 system have proven to lag behind technological changes. For example since 1999, the FCC has sought to, “improve the quality and reliability of 911 emergency services for wireless phone users by adopting rules to govern the availability of basic 911 services.”²⁶ Additional actions by the FCC include, “The implementation of enhanced 911 (E911) for wireless services” and wireless carriers becoming required to provide Automatic Location Identification (ALI) as part of Phase II E911 beginning October 1, 2001.²⁷ As of the publication of this paper these efforts have fallen sort of meeting many of the FCC’s stated goals and timelines. This is a dynamic that this paper will prove as a cautionary note in the contemplation of how the future of NG9-1-1 will evolve.

Industry

The 9-1-1 system exists in a vendor ecosystem that consists of Network Service Providers (NSP), Application Technology Providers, Consultants, Systems Integrators and other for profit entities. NSPs manage the Public Switched Telephone Network (PSTN)²⁸ and also often offer the dedicated communication networks used within the 9-1-1 system. Technology providers deliver a large number of applications that public safety organizations depend upon. These can include the computer systems used to answer calls and determine location information, Computer Aided Dispatching systems, Mapping and Geographic Information Systems,²⁹ Land-based Mobile Radios and many other technologies. Consultants offer business and technology guidance and Systems Integrators offer implementation and other services. Often the responsibilities of several of these marketplace participants overlap.

Other Influencers and Interactions

Other factors influencing the 9-1-1 environment include:

- Public Safety Practitioners, including Police, Fire, Emergency Medical;
- Rate Payers;

- Industry standards bodies including, NENA, APCO, American National Standards Institute and other bodies responsible gaining general consensus about technical protocols and standards; and
- other services.

Owing to the urgency of purpose behind the 9-1-1 system and even in the face of the fact that many participants in the ecology are commercial competitors, there is often a sense of mission and almost an esprit de corps motivating participants in the ecosystem in which the 9-1-1 system is immersed.³⁰

At other times, however, achievement of public policy goals can be inhibited by political, social, marketplace and other circumstances. The 2001 comments of FCC Commissioner Michael Copps talking

Figure 1 9-1-1 Major Interacting Forces



about lack of progress toward the goals set out in FCC

Phase II E911 underscores this:

*“When dealing with life critical technology, especially in today’s environment, we cannot conduct ‘business as usual.’ We must make extra effort, expend extra resources, and do a better job. None of us has done that in the context of E911. Many carriers have not met deadlines for deploying E911 systems and handsets. Many manufacturers have not made equipment and software upgrades available quickly enough. Many in the public safety community have not secured funding for upgrades or made adequate progress towards installing needed new equipment.”*³¹

Foreshadowing latency that might be

injected by the institutional ecology into the

processes of achieving the transition to NG9-1-1, as of the date of this paper in 2011, the efforts of the FCC continue toward accomplishment of the goals of FCC Phase II E911.³² This perspective will become important as the reader will soon see because the survey results showed that the FCC is believed by the majority of survey respondents to be the most critical factor in accomplishing the NG9-1-1 transition. If the survey evidence is indicative, lack of effectiveness of the methods used by the FCC will pose major NG9-1-1-hurdles to be overcome.

The Question

The question this paper seeks to address is, “to what extent will what Benkler described as the ‘institutional ecology’ impact the process of achieving the vision for NG9-1-1?”

For the purposes of this paper the end state goal will be defined as adherence to the NENA i3 technical specification. This question is examined through data gathered from the perspective of NG9-1-1 knowledgeable members of the 9-1-1 ecology.

NENA i3

In 2000 NENA, “began the process of redesigning the 9-1-1 service system”³³ and in 2001 accomplishing overhaul of the system became an organizational goal. Through an ongoing process of development and peer review involving NENA members and other experts, NENA is producing a set of technical standards and policy documentation.³⁴ Proposed is construction of a new system moving the handling of 9-1-1 emergency communications away from today’s analog based approach to a system based on modern packet-switched protocols.³⁵

Seeking to replicate the best of the existing Enhanced 9-1-1 system and to add new capabilities better meeting the needs of today and into the future, a vision far different from today’s system has emerged. The goals of the new system include to:

- accommodate newer technologies and services including text, image, video, Telematics³⁶, and sensors;
- take advantage of increased telephone subscriber information;
- improve survivability and create greater network resilience;
- leverage the ability to utilize virtual PSAPs; and
- improve interoperability and information sharing.³⁷

Other significant goals of the NENA proposal are to make 9-1-1 no longer a “local” service but to create an, “interconnected public safety and security system,” that provides interoperability at county, region, state, national and international levels.³⁸

Also critically important is expanding the notion of 9-1-1 to include the “interdependent ‘chain of survival and recovery’,” across the entire, “public safety chain of care.”³⁹

One of the key technical aspects of the NENA i3 proposal is creation of the Emergency Services IP Network (ESInet). The ESInet represents a new technology not existent in today’s 9-1-1 system. The ESInet will be essentially a privately managed IP network inserted as a new technology layer between the PSTN and the PSAP.

9-1-1 calls today traverse the PSTN and travel along specialized circuits (CAMA trunks) directly to the PSAP that has jurisdictional responsibility for emergency response activates in the geography from which the 9-1-1 call originated. Determination of the proper PSAP to which the call is directed depends solely on an estimation of the location of the originator of the call. The Calling Party Number is used as a search key to retrieve information from the ALI database tables.

As envisioned in NENA i3 model, ESInets will be created on a regional, county and statewide level. NENA states that the ESInet, "is designed as an IP-based inter-network (network of networks) shared by all agencies which may be involved in any emergency."⁴⁰ The ESInets will be federated by standards based technology protocols and grow, as did the original 9-1-1 system, in an organic fashion over time to cover the country.

An individual ESInet will act relatively autonomously yet be woven together as if textile in a tapestry. For a period of time, it is envisioned that the ESInets will reside alongside the legacy 9-1-1 system utilizing gateway technologies to perform protocol conversions when internetworking is necessary.

Many new possibilities emerge with the creation of the ESInet. It is one of the key elements of the NENA i3 proposal that "encourages the creation of many new coordination and information access services to enrich collaborative interactions between all agencies involved in processing emergency service requests."⁴¹

One of the new "information access services," made available by the NENA i3 model is the use of Geographic Information Systems to make real time decisions about resources that may be applied to a problem. No longer will the decision about which PSAP to route an emergency communication be based only the presumed location of the caller. NENA i3 includes options for new real-time decision making criteria, including Policy Based Routing, where new forms of contextual information will become incorporated into the processes of not only of deciding where a 9-1-1 communication should be handled and increasing the quality of decisions about the resources to be applied.

In the opinion of this author, the ESInet proposal is one of the most important aspects of the NENA i3 model. It will break open the opportunity for responsible innovation in an industry that had, from a technology standpoint, become Balkanized over time. The ESInet will free public safety communications operators from proprietary technologies that have locked end-user organizations into vendor dictated solutions. The ESInet will also act as an economic magnet drawing new marketplace participants who will bring new innovation freeing the end-user organizations to seek new technology and organizational options.

Signs of this dynamic are already apparent. The industry for providing communications tools to the PSAP had over the past several years been characterized by rapid consolidation of existing firms. New economic energy is being created by the ESInet concept and the industry is seeing the emergence of new companies like Synergem Emergency Services, LLC. Synergem describes itself as, “a Vendor Neutral Systems Integrator,” that offers, “a variety of products and systems developed by leading strategic partners and then integrating all components to create a tailored, cost-effective and efficient intelligent Next Generation 9-1-1 (iNG9-1-1™) operating environment.”⁴²

Synergem has already begun to win business for the creation of ESInets. For example, “Using a \$2.4 million grant from the North Carolina State 9-1-1 Board, the North Central (N.C.) Regional Compact, a consortium of North Carolina 9-1-1 jurisdictions, contracted Synergem Emergency Services to design, develop and operate the state’s first next-generation 9-1-1 (NG 9-1-1) Emergency Services IP Network (ESInet).”⁴³

This paper will point out that beyond the technology innovation, the ESInet will also create the opportunity for new administrative and regulatory policies. Against the backdrop of an industry governed by many overlapping and intermingled legal and regulatory frameworks, the ESInet concept creates a yet to be regulated administrative whitespace.

Research Methodology

The conclusions of this paper are based upon original research conducted during April and May of 2011. The research is based upon two methods of collection. One is an electronic survey that was distributed to large number of people involved in and concerned with the evolution of the 9-1-1 system and an interview of a key influencer in NENA’s development process.

The survey was created in Google Documents and is available at the following link: <http://bitly.com/jO1Vmu>.

The survey link and requests for input were distributed to listserves run by the organizations of NENA and APCO, through public safety focused groups on the social networking site LinkedIn and on the Public Safety Wireless eGroup of the National Association of State Technology Directors (NASTD).⁴⁴ The request was also emailed to a list of individuals familiar with the topic.

The survey questions gathered demographic information and opinions on important aspects of the upcoming transition. Specific questions were asked about a potential emerging point of contention between influencers holding differing perspectives on how to handle the transition to a new method of utilizing location information. There seems agreement on the end-state goals, but how to get there

during the transition period is a subject of debate. The survey sought to judge how important respondents feel this issue is and what impact respondents feel implementation decisions will have on the resulting end state. The verbatim responses and interview unearthed other information not expected by the researcher that turned out to be important to the conclusions drawn in this paper.

Research Results

Survey Results

Response Statistics and Background Information

The shortened URL linking to the online survey was distributed through various means described below and received 835 clicks during the survey collection period which ended May 4, 2011. 62 of those who clicked through completed the survey. This represents a rate of 7.4 percent of those who visited the site who completed the survey. The survey remains open to data collection and the author is monitoring submissions for any significant trends that may change the conclusions reached in this paper.

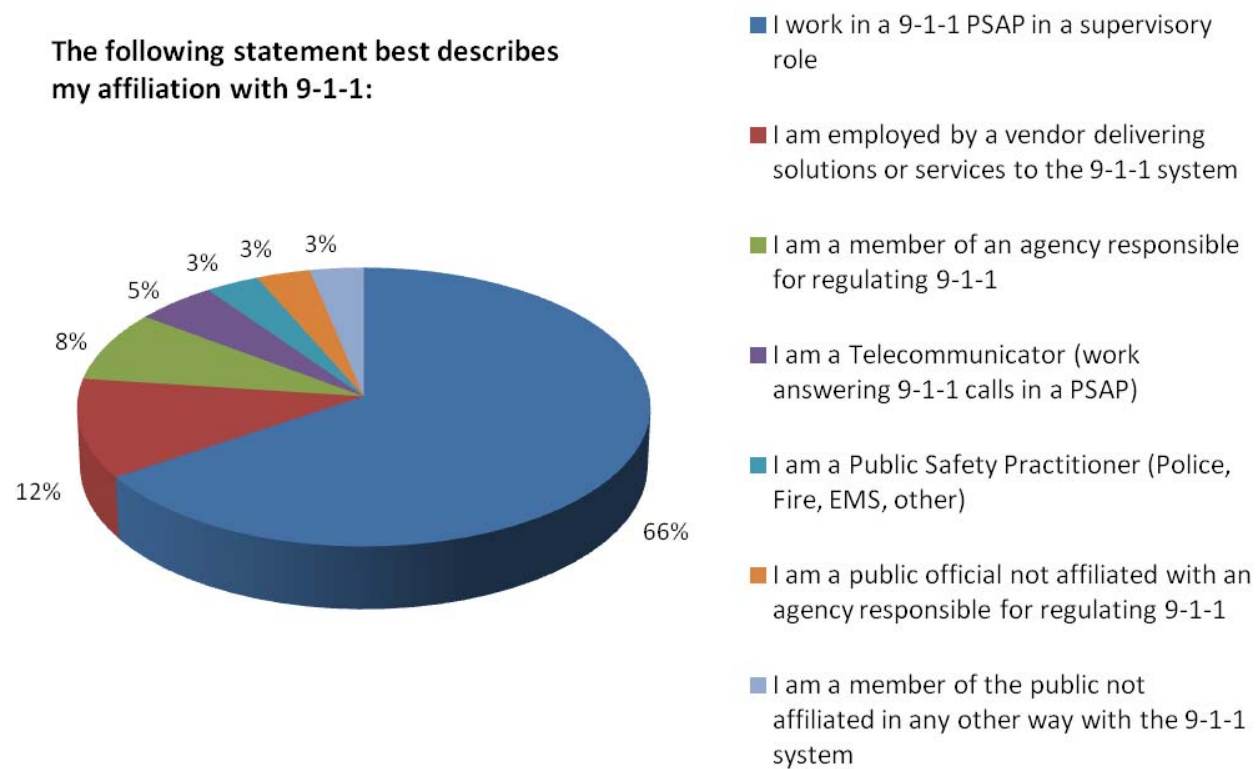
The author attempted to determine how many potential respondents received the solicitation. Although not able to compile complete statistics the author was able to determine the following:

- NENA listserv distributed 1,822 email copies to the 911Talk E-mail List and the survey invitation remains active on the 911talk message gallery;
- According to the APCO listserv administrator there are 43,000 users of PSConnect and the and the survey invitation remains active on the APCO Open Forum;
- the LinkedIn group Next Generation 9-1-1 (NG9-1-1) reaches 849 members;
- NASTD Public Safety Wireless eGroup reached 104 Subscribers; and
- The author distributed and additional 12 subject matter experts by email.

Respondent Demographics

During the research period, 62 individuals responded to a series of questions proposed by the author. To provide context on the professional makeup of the universe of survey participants and their relationship to the topic, respondents were asked to identify the role that they play in public safety and their professional affiliations. The overwhelming numbers of survey respondents identified themselves by choosing the answer, "I work in a 9-1-1 PSAP in a supervisory role," (40 respondents). Figure 2 shows the distribution of professional affiliations.

Figure 2 Distribution of Professional Affiliation



Respondents were also asked to identify the professional organizations with which they are affiliated. The largest industry organization affiliations represented are those who indicated that they are members of APCO with a large number having dual memberships in APCO and NENA. A complete list of industry affiliations identified may be found in the end notes.”⁴⁵

By and large the sample represents individuals with specific knowledge of the 9-1-1 system. Participants were asked if they were familiar with the NENA proposed model and 95 percent answered, “Yes.”

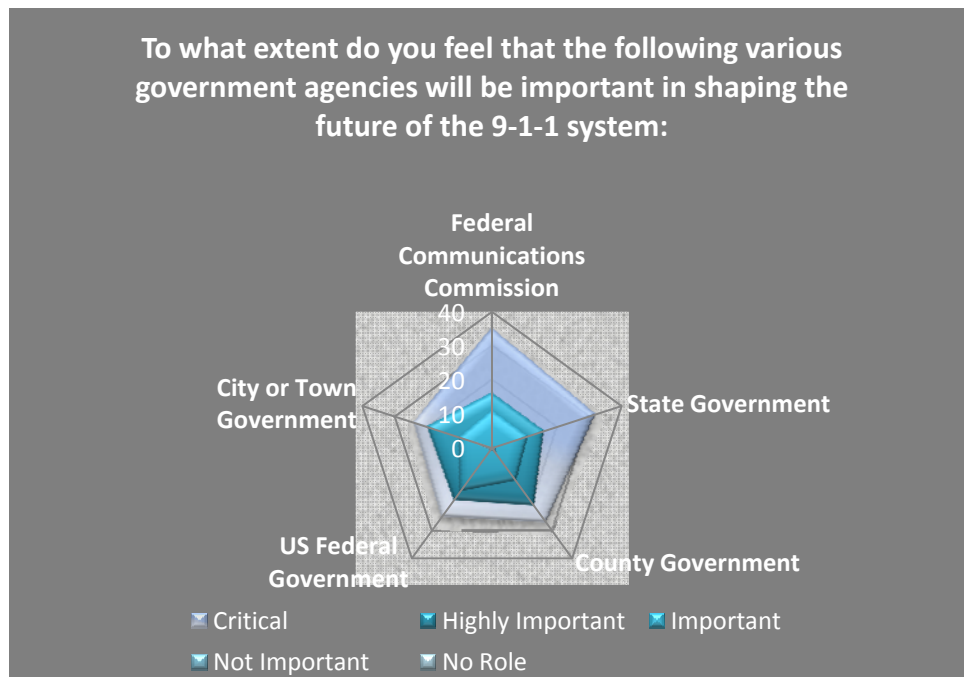
When asked, “How important is the need for a new system for 9-1-1 in the United States?” 83 percent answered either “Critically Important” or “Urgently Important.”

Institutional Ecology

A series of questions were asked to judge the opinion of respondents about the impact of various elements of the institutional ecology within which the 9-1-1 system exists and questions aimed at obtaining respondent’s opinions on how those elements of the ecology will act upon the evolution of the system.

Respondents were asked about the role that various agencies of government would play in shaping the future of the 9-1-1 system. Figure 3 shows that the majority of respondent felt that the US Federal Communications Commission and State Governments will be most “Critical” to shaping the future of the 9-1-1 system. A large number of respondents indicated that County Government, US Federal Government and City or Town Government will also be “Highly Important.” Interestingly from a historical context, there was an indication by a sizable minority of respondents that “City or Town Government” is not important or would play no role.

Figure 3 Role of Government



Achievability

Respondents were asked for their feelings about the achievability of the NENA proposal. Those surveyed were given the choices of: Highly Achievable, Generally Achievable, Achievable or Not Achievable and 49 percent chose an optimistic value saying that the NENA proposal is “Generally Achievable.” Three percent of respondents answered that they felt the model is not achievable and a significant number of respondents provided verbatim comments.

The verbatim comments overwhelmingly spoke to the need for a funding mechanism for NG9-1-1. One respondent said the model is, “Achievable but feel it is going to have a long timeline to achievement.” Another stated the model is, “Achievable if we have the resources and support available to make NG9-1-1 happen.”

Other comments having to do with the need for funding included “Funding will always prevent true implementation of any new technology.” Additional comments may be found in the end notes.⁴⁶

A respondent who chose to answer that the NG9-1-1 model is “Highly Achievable” wrote hopefully that, “Indiana has operated a NG9-1-1 network that is NENA baseline compliant since 2006. We will soon have processed the 11 millionth call using IP technology on a statewide basis. You can see a real-time display of the network at map.in911.net/map. A number of other NG services are available on the network today.”

Influencing Factors

Beyond government, respondents were asked their opinions on a number of additional factors that are part of the institutional ecology including: the people who pay for the system (Rate Payers), the people who run the system, industry players, industry standards creation bodies and regulators. Respondents were asked to rate these factors on a scale ranging from one to five (one equating to weakest influence and five indicating strongest influence). Interestingly, even though there was wide variation in the ways that individuals scored the choices, the average score of nearly all categories is “Four.” Only one category differed with “Rate Payers” scoring an average of “Three.”

In verbatim comments respondents contributed additional categories. Seven verbatim contributions mentioned funding or money with most contributors ranking money as having the most influence by choosing a weight of “Five.”

One contributor backed up the funding issue by saying, “Honestly, the biggest setback right now is funding, not the lack of knowledge or desire to move forward with NG9-1-1.” Another said, “Funding availability and funding cycle realities to support transition from legacy to NG911 technology. Legacy systems will exist for a long time.” Yet another pointed to the ongoing diversion of funds intended to support the 9-1-1 system by saying, “collected surcharge oversight - many states 'sweep' the 911 surcharges into general funds. Other states do not target the use of the surcharge money.” Interested readers may see the end notes for additional comments on this subject.⁴⁷

A significant number of the verbatim contributors talked about, “culture and perception” and “expectation[s] of public.” Most rated these factors as a “Four” on the same scale one to five scale. One respondent said, “[the public] will demand services.” Several mentioned the media as an additional influencing factor.

Several contributors talked about the importance of organization and politics. One contributor stated that politics are a “Ten” on the one to five scale and another who rated these factors a “Five,” stated:

“In NG9-1-1 the state and county government public safety communications leaders will be the key to implementing NG9-1-1. Today's legacy 9-1-1 is an adaptation of existing telephone technology and is largely a telephone company responsibility. NG9-1-1 is not telephone technology and the telephone companies will have little to do with operating the system ...”

One contributor said, “Legislators who determine funding have a very strong (5) influence. This is primarily at the state level today, but may be at the national level in the future.” Another said that, “Highly fragmented local government control of 6000+ PSAPs slows coordinated transition.”

Transitional Issues

In considering the subject of the transition to NG9-1-1 the author sought an example of interactions within the institutional ecology that would demonstrate how forces have begun to interact as the process of the transition begins. Evidence was found that there is a debate evolving about transitional aspects of the new model related to the determination of what in the present art is referred to as caller location information.⁴⁸ Recent articles appearing in industry trade magazines⁴⁹ indicate an emerging difference of opinion related to how location information will be handled in the new model. There is expression of a consensus among advocates on the end state goal; however, two emerging viewpoints on how to achieve the end goal are being espoused.

The choice is between an immediate move to the technical specifications of the NENA i3 model or the use of a transitional technology. The discussion of the technical aspects is beyond the scope of this paper. For a brief discussion of location determination also please visit the end notes.⁵⁰

The survey asked participants, “With respect to all of the tasks necessary to accomplish the transition to NG9-1-1, how important do you feel the method of location determination is?” A full 77 percent of respondents identified the method of location determination a “Critically Important” issue.

When asked to state their view indicating how the location determination transition should occur: 69 percent chose the answer, “Immediately move to the NENA i3 proposed model.” 20 percent chose, “Utilize RFAI or some other alternative method as an interim step,” and seven respondents chose “Other.”⁵¹

The final question on the survey about location information asked, "Please rate the extent to which you think the choice between strict adherence to the NENA i3 proposed standard or the inclusion of interim approaches such as RFAI will impact the future of NG9-1-1." Although there was strong sentiment towards the answer, "Strict adherence to NENA i3 is imperative," viewpoints expressed by the other respondents lead the author to conclude, notwithstanding points made in the conclusion of this paper that as one verbatim comment stated, "Strict adherence to i3 is very important, but should not prevent the use of other available information while i3 is put into place."

Full results of the survey are available at the following link: <http://bit.ly/lanSZt>.

Interview with Roger Hixson, NENA's Technical Issues Director

In a phone interview conducted with Roger Hixson, NENA's Technical Issues Director, Mr. Hixson stated that part of the purpose of the NENA proposal is to create an environment of competition among parties wishing to provide PSAP services. "Hopefully we are creating an environment in which anyone willing to meet the requirements of the public safety environment can become a certified 9-1-1 call handler," even to the point of having that not be a public agency. The goal is to create an environment infused with new innovation, but Hixson said, "We want responsible innovation, as much [innovation] as possible but responsible and coordinated, so the end result is a system that is as good or better than today at fulfilling the needs of the citizen."⁵²

The author asked Mr. Hixson about possible impacts of Benkler's "institutional ecology" on the future of the NG9-1-1 system and how many occasionally conflicting interests will interact to affect the future of the 9-1-1 system. Mr. Hixson said of Benkler's concept, "I think it is an interesting concept, obvious and subconsciously we know this but it deserves discussion. Even socially where you've been is a fact of who you are and how you see things." Mr. Hixson continued, "There's a definite set of conflicting priorities and business issues that come into play. People responsible for the system might say things like 'I'd just prefer that the change doesn't happen,' and all the way up to, 'I have opposing priorities.' They'll say, 'I can't do it now; I don't have the money.'"

The supplier ecosystem is also a significant factor in what can and cannot be accomplished, said Mr. Hixson.

Mr. Hixson talked about how "positive competition" built into the model will drive change and the fact that today E9-1-1 can be "costly and difficult" for not only public agencies but the vendors who support E9-1-1. Mr. Hixson said that, "NG9-1-1 makes this better," for both parties and because of this NG9-1-1 provides motivation for change.

With respect to the transition to the NENA recommended method of handling location information, Mr. Hixson said that today the environment surrounding 9-1-1 is one of significant pressures pushing from many directions. On the commercial side there will be the competitive pressure of new entrants making possible new services that may force established players to be more willing to move. There are many traditional players whose business models are changing because of marketplace forces that threaten their existence. The NENA proposal “makes it possible for public safety to get some of the benefits without the carriers [Network Service Providers] making significant changes. The system is designed to do what the agencies are ready for with minimal changes. The idea was to build in the basics for the future but allow the carriers to leave significant components untouched,” said Mr. Hixson.

Mr. Hixson continued that, “This is also true on the [location information] database side. The concept of the Location Information Server (LIS) is in the model because the future may require it. The carriers may see this as positive. [For one reason] they will no longer have to send their subscriber records to another party. Today these other parties are often [commercial] competitors. In the new model location information is acquired when a call happens, not pre-populated [across databases] as it needs to be today.”

Mr. Hixson said that to the extent possible, the NENA model is full of incentives to act. “In the past we had situations when we wanted to accomplish a goal we said, ‘you have to so and so.’ Members of the supplier community came back and said, ‘from what we know about your capabilities you can’t handle that today it, so we’re not going to provide it.’ In other words they said there’s no big hurry ...”

“With NG9-1-1 we’d like to take away that excuse,” concluded Mr. Hixson.

Conclusion

As a result of the information gathered for this paper several significant factors became evident that the author believes will impact the future of 9-1-1. Among the strongest factors expressed in the opinions of those who responded to the survey is the need for a reformed method of funding the transition. These unequivocal unsolicited sentiments expressed by the respondents in the verbatim comments outweighed a number of the factors suggested by the researcher in the structured response questions. Several verbatim comments pointed to breakdowns in the current funding model the importance of which was underscored by the use by respondents of emotion laden words including “embezzled.”

The 9-1-1 funding issues justify significant additional research beyond the scope of this paper. For the purposes of this paper it is sufficient to say that there is significant evidence that the diverse and often complex methods used today to fund the 9-1-1 system are inadequate to achieve the transition to NG9-1-1. One example of how this is true is the fact that these funding methods have not allowed the 9-1-1 system to keep current with contemporary communications innovations and in some jurisdictions do not today even maintain the system sufficiently to meet the traditional demands placed upon it.⁵³

A second significant influence on the future of 9-1-1 will be official governance. In particular the role of the US Federal Communications Commission was pointed out by respondents as the most critical influencing factor. By comparison, the entities that arguably built the first generation of 9-1-1, cities and towns, are considered by a significant subset of the respondents (13 percent) to be “Not Important” or play “No Role” in the NG9-1-1 future.

The combination of several factors that include:

- sentiments of respondents towards the “critical” influence of the FCC (a federal agency);
- sentiments expressed about the increased influence that state governments will carry;
- the premise embedded in the NENA i3 proposal that 9-1-1 will no longer be a “local” service but instead an, “interconnected public safety and security system,” that provides interoperability at county, region, state, national and international levels; and
- the fact that the NENA i3 architecture embeds these principals in the operating code of the system,

all indicate a significant shift away from the organic pattern of growth and governance of the original system.

These combined opinions and factors indicate the need for significant changes in how legal, financial, administrative and other entities relate to the system. The author predicts that a complex common law process will be required over time to uncover jurisdictional fault lines and deal with the underlying frictions.

One example of these fault lines is the significant role that survey respondents attribute to the FCC in achieving the NG9-1-1 transition. As an entity of federal administrative law reporting into the executive branch, the FCC operates under a, "statutory grant of authority"⁵⁴ issued by the US national Congress over "interstate and international communications."⁵⁵ It is through the exercise of enforcement of the entitlements granted to communications common carriers by the federal legislature that the FCC derives its power.⁵⁶ A question for additional study is the extent to which the FCC's jurisdiction provides the tools necessary for the agency to play a substantial role in the transition.⁵⁷

Among the complexities are the facts that in addition to the powers of the FCC; states, cities and other entities of law also exercise jurisdiction over communications common carriage.⁵⁸ These competing entities will continue the historical processes of the exercise of their authority as the transition occurs.

Subtly also exists within the proposed technology of the NENA i3 model. The proposed construction of ESInets which will be essentially privately managed IP networks represents a substantially different architecture within which 9-1-1 communications will be routed than the traditional 9-1-1 system. In many jurisdictions delivery of the 9-1-1 call today occurs over circuits run by the common carriers under tariff guidelines issued by numerous regulating agencies. These relationships are subject to complex time worn common law decisions.⁵⁹

The concept of the NENA i3 ESInet inserts a new layer of controlling infrastructure between the Public Switched Telephone Networks and the NG9-1-1 PSAP. During a period of transition, the carrier based networks will interface with the ESInets through a gateway mechanism. Later more native transmissions will traverse the ESInets. Unlike today where in most cases routing of a 9-1-1 voice call depends upon the location of the caller who has dialed 9-1-1, in the future within the ESInet 9-1-1 communications which will be multimedia communications no longer just voice, will be routed based upon new sets of information and policies. These policies will be different than the operating model of today in which the sole determination of 9-1-1 call routing is caller location.

How that information will be used, who will create those policies and how ongoing governance of the policies will work has yet to be determined. It is an example of the modern phenomenon

described by constitutional authority Lawrence Lessig in which code drives the need for changes in law.⁶⁰

The ESI-net concept will cause a migration of control over communications supporting NG9-1-1 as described by one verbatim commentator: "System operation will be the state and county public safety communications leader's responsibility. This is a major shift in responsibility between today's system and NG, which is not widely understood." In this way the operating code of the NG9-1-1 system itself will drive the need for new law and contribute to making the metaphorical muddy waters of governance even murkier. As cofounder of the Electronic Frontier Foundation, Mitch Kapor once said, "Architecture is politics."⁶¹

Mr. Hixson as well pointed out that the goals of NENA i3 includes: creation of increased competition, incentive for responsible innovation and encouragement of the entry of new players into the ecology. In addition to the politics inherent in the architecture, the technology vision described by NENA i3 also creates many public policy, legal, jurisdictional, financial, cultural and other interactional dynamics and challenges. On the way to the worthy goals of the proposed end-state these factors will drive increased complexity and may add latency to the processes necessary to achieve the desired end-state.⁶²

The emerging discussions about the way in which the change in location information handling will occur are early evidence of the confluence of interests to come. Although survey respondents converge on the optimistic view, comments in response to articles in trade publications⁶³ belie emotional responses that that will also exert influence.

As much as anything, the human factor is important. People will be people.

As in all public policy issues the transition to NG9-1-1 will involve multiple overlapping and intersecting factors and interest. The one thing that all parties can agree upon is the mission and the critical role of the 9-1-1 system to save lives, protect property and secure the homeland.

It is this author's faith as evidenced by the long history of overcoming obstacles in a more than 40 year history of success of the 9-1-1 system, that one factor above all will influence the outcome. This is the shared values and sense of purpose of the participants in the processes.

It is this factor above all that has resulted in the system's historical value to society and it is this dynamic that will play the most influential role over time to create Next Generation 9-1-1 success.

Endnotes

¹ Dispatch Magazine On-line, *History of 911*. Retrieved from <http://www.911dispatch.com/911/history/index.html>, March 2011.

² Benkler, Yochai. *The Wealth of Networks How Social Production Transforms Markets and Freedom*. New Haven: Yale UP, 2006. Retrieved from http://www.benkler.org/Benkler_Wealth_Of_Networks.pdf. Feb 2011. First mention in text, P21.

³ National Emergency Number Association. *About NENA*. Can be accessed at <http://www.nena.org/about>, Apr 2011.

⁴ National Emergency Number Association, *NG9-1-1 Project*. Can be accessed at <http://www.nena.org/ng911-project>

⁵ Association of Public-Safety Communications Officials-International. *About APCO*. Can be accessed at <http://www.apcointl.org/new/about/>. Apr. 2011.

⁶ National Emergency Number Association. (2007, Dec 18) *Functional & Interface Standards for NG9-1-1 (i3)*. Retrieved from <http://www.nena.org/standards/technical/voip/functional-interface-NG911-i3>

⁷ "Could Being Able to Text 911 Save Lives?" By Barbara Pinto and Alicia Tejada. ABC News. March 27, 2011 Retrieved from <http://abcnews.go.com/Technology/text-911-save-lives/story?id=13235321> Apr 2011

⁸ Federal Communications Commission. *PSAP Registry*. Washington, DC. Retrieved from <http://www.fcc.gov/pshs/services/911-services/enhanced911/psapregistry.html> Apr 2011.

⁹ In the majority of PSAPs both call receipt and dispatch are performed by the same person or by teams of people. In other locations there may be separate organizations responsible for dispatch and response coordination. For instance in Washington DC, Police, Fire and Emergency medical have separate dispatchers for each function. Hendon Publishing. *Washington, D.C., center consolidates public safety dispatch operations*. Originally Published in Public Safety IT Magazine, May 2008. Can be accessed at <http://www.hendonpub.com/resources/articlearchive/details.aspx?ID=206513>, May 2011.

¹⁰ PubMed. (2010, Aug 25). *Role of ambulance response times in the survival of patients with out-of-hospital cardiac arrest*. [Abstract] Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/20798090>.

¹¹ Youtube. (2010, Apr 15). *'Seconds could mean lives', Broward County Sheriff's Office implementing ShotSpotter technology*. Can be accessed at http://www.youtube.com/watch?v=p_Z13IV9duE.

¹² Benkler, pg 387.

¹³ Nebraska Public Service Commission. *E911 Terminology*. Retrieved from <http://www.psc.state.ne.us/home/NPSC/e911/Terminology.PDF>. May 2011.P 1.

¹⁴ National Institute for Telecommunication Sciences. *Telecom Glossary 2000*. Retrieved from http://www.its.bldrdoc.gov/projects/devglossary/_calling_party_number.html.

¹⁵ Today many technologies "spoo" the CPN replacing the actual telephone number with some other representation. This is done legitimately as in the way operators of Multi-line Telephone Systems may substitute an Emergency Line Identification Number (see: NENA, Multi-Line Telephone System & Private Branch Exchange, <http://www.nena.org/mlts-pbx>) to represent a group of telephones in a general area. There are more malicious circumstances where "phone number caller ID modification" is used by people wishing to maliciously disrupt public safety operations (see: Public Safety Communications, *The Trouble with Spoofing*, <http://psc.apcointl.org/2011/03/17/the-trouble-with-spoofing/> Mar 2011).

¹⁶ Wikipedia. *In-band signaling*. Retrieved from http://en.wikipedia.org/wiki/In-band_signaling. May 2011

¹⁷ Youtube. *Rotary Dial Telephone*. Can be accessed at <http://youtu.be/Gfx38rhn6x0>.

¹⁸ Rebidding For ALI. Oregon Emergency Management. Can be obtained from, http://www.oregon.gov/OMD/OEM/OR911/MSAG_GIS/Rebidding_for_ALI.pdf.

¹⁹ The Golden Minute. ESRI, Understanding our World. Retrieved from <http://www.esri.com/industries/public-safety/fire-rescue-ems/demos/video3.html>.

²⁰ *'Seconds could mean lives', Broward County Sheriff's Office implementing ShotSpotter technology*.

²¹ Wikipedia. *Modem*. Retrieved from <http://en.wikipedia.org/wiki/Modem>.

²² Colorado Department of regulatory Agencies Public Utilities Commissions. *Colorado PUC 9-1-1 Task Force. Qwest Next Generation 911 Evolving Architecture – PDF*. Can be accessed at <http://www.dora.state.co.us/puc/telecom/911TaskForce/911Summit/NextGeneration911EvolvingArchitecture.ppt> . Apr 2011.

²³ Cornell University Law School Legal Information Institute. *Supremacy Clause*. Retrieved from http://topics.law.cornell.edu/wex/Supremacy_Clause. May 2011

²⁴ John T. Woolley and Gerhard Peters. *The American Presidency Project [online]*. Santa Barbara, CA. Available from <http://www.presidency.ucsb.edu/ws/?pid=26800>. Apr 2011.

²⁵ Wireless Communications and Public Safety Act of 1999. HR 438 RFS. Retrieved from <http://www.govtrack.us/congress/billtext.xpd?bill=h106-438>

²⁶ Fact Sheet, FCC Wireless 911 Requirements, http://www.fcc.gov/pshs/services/911-services/enhanced911/archives/factsheet_requirements_012001.pdf

²⁷ Ibid.

²⁸ PC.com, Ziff Davis, http://www.pcmag.com/encyclopedia_term/0,2542,t%3DPSTN&i%3D49921,00.asp

²⁹ U.S. Department of the Interior, U.S. Geological Survey. *Geographic Information Systems*. Can be accessed at http://egsc.usgs.gov/isb/pubs/gis_poster/#what. “A GIS is a computer system capable of capturing, storing, analyzing, and displaying geographically referenced information; that is, data identified according to location.”

³⁰ There are many examples of this that include the day to day interactions for both public and private sector members of NENA and the various taskforces and standards committees sponsored by NENA. There are numerous examples of members of the vendor community and public officials working together in times of emergencies, such as activities during the aftermath of Hurricane Katrina to day-to-day examples such as community outreach and education events sponsored by NENA. An example is the education program related to Multi-Line Telephone System & Private Branch Exchange (see: <http://www.nena.org/mlts-pbx>).

³¹ Federal Communications Commission. (2011, Oct 5). *Speeches, Statement of Commissioner Michael Copps*. Retrieved from <http://www.fcc.gov/Speeches/Copps/Statements/2001/stmj115.pdf>.

³² Urgent Communications. (2010, Sep 10). *FCC approves wireless 911 location-accuracy rules*. Retrieved from http://urgentcomm.com/policy_and_law/news/fcc-approves-location-accuracy-20100921/

³³ NENA. *NG9-1-1 Project History*. Retrieved from <http://www.nena.org/sites/default/files/NG9-1-1%20History.pdf>. p1.

³⁴ NENA. *Standards - Recommendations - Informational Documents*. Can be accessed at <http://www.nena.org/standards/informatikkonal> .

³⁵ NENA. (2011, Mar 6). *2011 9-1-1 Tutorial V4.1*. Retrieved from <http://www.nena.org/sites/default/files/2011%209-1-1%20Tutorial%20V4.1.ppt>, p 6.

³⁶ Berryman, Marc E. “Automatic Crash Notification and 9-1-1: A Success Story.” *24th Annual Esri International User Conference*. 9–13 August 2001. Retrieved from <http://proceedings.esri.com/library/userconf/proc04/docs/pap1780.pdf>. Provides an explanation of how motor vehicle crash telemetry information is used as a form of telematics to improve the ability of public safety agency response to emergencies in Greater Harris County, Houston, Texas.

³⁷ NENA. *2011 9-1-1 Tutorial V4.1*. p 7.

³⁸ NENA. *2011 9-1-1 Tutorial V4.1*. p 39.

³⁹ Wilson William C., Grande Christopher M., Hoyt David B. *Trauma: Critical Care By Infomra Healthcare, USA*. Google Books. New York. 2007. Retrieved from <http://books.google.com/books?id=3H3AIEtvc8YC>., p vii.

⁴⁰ National Emergency Number Association. *Functional & Interface Standards for NG9-1-1*.

⁴¹ Ibid.

⁴² Can be accessed at <http://synergemtech.com/>.

⁴³ MissionCritical Communications, Synergem to Operate N.C. ESInet for NG 9-1-1. Retrieved from <http://www.911dispatch.com/911/history/index.html>, June 2010.

⁴⁴ The National Association of State Technology Directors. *Who We Are*. Can be Accessed at <http://www.nastd.org/NASTD/NASTD/AboutNASTD/WhoWeAre1/Default.aspx>.

⁴⁵ Organizational affiliations include:

- APCO;

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- NENA;
 - NASTD;
 - National Association of State 911 Administrators;
 - American National Standards Institute;
 - Alliance for Telecommunications Industry Solutions;
 - Internet Engineering Task Force;
 - NYS 911 Coordinators Association;
 - European Emergency Number Association;
 - Public Safety Communications Europe;
 - Regional 9-1-1 governance committee;
 - State 9-1-1 advisory subcommittee;
 - Michigan Municipal Risk Management Authority; and
 - Michigan Communication Directors Association.

⁴⁶ Another respondent elaborated more fully saying:

“Funding is the one issue that will determine how achievable the goal is. Federal funding is currently limited; funding models for 911 programs varies significantly from state to state and jurisdiction to jurisdiction. Even if the feds require certain minimum standards, the change to NG 911 is extremely costly. In most states, entire frame relay systems (that were designed during a time when digital data wasn't even a consideration) have to be completely replaced.

These changes have to be coordinated with private sector telephone companies, and often they are looking at the bottom line, and can be reluctant partners to legislated (and underfunded) changes. Training staff for each call center has to be completed. In Oregon, we have stable funding for our 911 program, and are setting a portion of those funds aside for the upgrade to NG911, but it will take several years to accumulate enough to completely pay for the upgrade. In the process state legislators are coming up short in many other areas like education and health care, and may try to raid 911 dollars to make ends meet. If successful, that would push back the time table for NG911”

One of the respondents who had said that the model was not achievable stated “They refuse to look at funding in a realistic manner.” Another said, “Additionally they do not factor in the funding model, development and testing for urban, suburban, and/or rural areas.”

⁴⁷ The controversy about 9-1-1 fund raids and other funding challenges is beyond the scope of this paper. One verbatim commoner states, “In NYS the Wireless Surcharge has been embezzled by the State Government and utilized for purposes other than 911 support. As such the costs of the PSAP making effort to remain on the leading edge of technology falls to the local County or municipality. NY is one of a handful of States in the Country where this is the case, it is an issue that must be resolved in NG911 is to become a reality.” Readers who are interested may find the following sources of interest: [msnbc.com](http://www.msnbc.msn.com/id/32109599/ns/technology_and_science-wireless). *Cash-strapped states raid 911 funds*. Can be accessed at http://www.msnbc.msn.com/id/32109599/ns/technology_and_science-wireless. NENA 9-1-1 Goes to Washington. (2010, Mar 26). *Prepaid 9-1-1 Fees Debated*. <http://www.nena.org/government-affairs/story/tr-daily-prepaid>.

⁴⁸ NENA, *2011 9-1-1 Tutorial V4.1*. p 39. In the world of NG9-1-1 increasingly emergency communications will no longer be only a voice call. All manner of new communications modalities are expected to become important including SMS text messaging, video, imagery and technologies to better serve people with disabilities.

⁴⁹ See comments: 911 Magazine. (2100, Mar 8). *NENA i3: Something Less Than the Holy Grail of NG9-1-1*. Can be Accessed at <http://www.9-1-1magazine.com/Vendor-Corner-S-Meer-NENAi3>. Mar 2011, and Dispatch Monthly Online. (2011, Apr 28). *Tech Companies Support NG911 Standard*. Can be accessed at <http://www.911dispatch.com/tech-companies-support-ng911-standard/>.

⁵⁰ As mentioned above location determination in the 9-1-1 system today depends upon legacy CAMA circuits. When a 9-1-1 call is trans-coded from the PSTN to the dedicated circuits used by public safety electrical frequency variations are used to represent the Calling Party Number. These are embedded in the signaling information that companies the voice transmission. These electrical signals are interpreted and converted into numbers at the receiving PSAP. Software at the PSAP uses the retrieved digit string as a database search key to obtain information about the location of a caller that resides in the Automatic Location Information (ALI) database. There are

numerous ALI databases in use associated with the individual PSAP receiving the call. The ALI database is pre-populated utilizing various methods dependent upon the originating caller's modality of communications.

The NENA i3 model proposes changing this non real-time method to one that provides better approximations of the location of the caller and opens the door to the use of richer information sources including Geographic Information Systems (GIS). The NENA model specifies the use of the telecommunications session within a new Session Internet Protocol based internetwork for public safety communications referred to as the Emergency Services IP network (ESInet).

A telecommunications session is compared to a traditional telephone call in the way that a newspaper might be compared to visiting a website. In a newspaper you have static text and cross references are performed manually. On a web page you may see static text, but it is often accompanied by numerous forms of active multimedia. In the same way that a web page combines differing content elements, a telecommunications session allows multiple medium to be coupled with the voice call. Location information becomes a digitally described resource. No longer will location be represented by static text delivered by the interpretation of analog electrical signals, it will be a digital pointer that can be used to surround the communication with information and context. (for more information, please visit SIP Center. *What Is SIP Introduction*. Can be retrieved from <http://www.sipcenter.com/sip.nsf/html/What+Is+SIP+Introduction>.)

For instance, Global Position System coordinates related to the originating device may be obtained from numerous sources including the smart devices themselves and the information may be inserted into the telecommunications session instantly as the person signals their emergency. These coordinates can then be linked with a universe of important information including maps, utility schematics, isometric drawings of building, hazardous material databases and many other sources of information useful to obtaining situational awareness and making efficient and effective decisions.

⁵¹ There were also several insightful verbatim comments:

- *"Nothing across the board can be implemented immediately. Too many variables from jurisdiction to jurisdiction. Some telco technology won't support the mentioned standards yet. Rural America is not up to the same standards in their telecommunications infrastructure as larger jurisdictions, and simply can't be swapped out right now. The nena standard should be the goal, but all current protocols need to be integrated until changes are completed."*
- *"Although I lean toward the NENA Model I feel there is much work to be done prior to implementation."*
- *"Support for ALI-style database lookups will need to continue and be part of a hybrid approach as we hopefully move quickly to follow the I3 roadmap. But I do not know enough about the ATIS interim proposal to know whether it is a reasonable approach - or whether it is overly self-serving for the big telcoms that control most of E911 infrastructure now."*
- *"I am not sure exactly what method or means should be used. My concern is that it provides the best location information available to public safety telecommunicators by whatever means."*

⁵² Phone interview with the author conducted, Fri Apr 8, 2011.

⁵³ Aurig, Ted. 9-1-1 Magazine. (2011, Jan 18). *Massive Public Safety Layoff in Camden City NJ*. Can be accessed at <http://www.9-1-1magazine.com/PPT-Aurig-Camden-Layoffs>.

⁵⁴ Wikipedia. *Independent agencies of the United States government*. Retrieved from http://en.wikipedia.org/wiki/Independent_agencies_of_the_United_States_government.

⁵⁵ Ibid.

⁵⁶ The Yale Law Journal. *The Exercise of Constitutional Powers by Common Carriers*. Vol. 25, No. 3 (Jan., 1916). Retrieved from <http://www.jstor.org/stable/786399>, pp. 205-210.

⁵⁷ The history of Phase II E911 provides ample evidence of the limitations on FCC powers to enforce change.

⁵⁸ As an example, the Nebraska Constitution states, "There shall be a Public Service Commission, consisting of not less than three nor more than seven members, as the Legislature shall prescribe, whose term of office shall be six years, and whose compensation shall be fixed by the Legislature... The powers and duties of such commission shall include the regulation of rates, service and general control of common carriers as the Legislature may provide by law. But, in the absence of specific legislation, the commission shall exercise the powers and perform the duties enumerated in this provision." Justia US Law. Section IV-20, Public Service Commission. Can be accessed from <http://law.justia.com/constitution/nebraska/c0104020000.html>.

⁵⁹ As an example, please see Public Service Commission of the District of Columbia. *Order number 13602*. Can be accessed from http://dcpsc.org/pdf_files/commorders/orderpdf/orderno_13602_FC1005.pdf.

⁶⁰ Lessig, Lawrence. *Code: version 2.0*. New York: Basic Books, 2006. codev2.cc. Web. 5 February 2011.

⁶¹ The Industry Standard. (1999, Apr 9). Opinion Lawrence Lessig "The Code Is the Law, retrieved from <http://www.lessig.org/content/standard/0,1902,4165,00.html>.

⁶² 44 percent of survey respondents believed that the transition will take "Five to Ten Years."

⁶³ 911 Magazine. NENA i3: Something Less Than the Holy Grail of NG9-1-1. Comments.