Overview of State and Local Government Interests in Spectrum Policy Issues

Nancy Jesuale

Abstract - **This paper examines some of the policy issues and concerns of local municipalities with respect to dynamic spectrum policy, the establishment of secondary markets for spectrum use and the organization of first responder communications. The paper discusses local and state methods (current and future) for achieving interoperability between first responders and how local policy approaches affect those methods. The paper also discusses the convergence of public safety radio with other forms of communications, including municipal broadband and "Wi-Fi" networks and points out specific policy collisions that should be addressed. Finally, this paper suggests ways that cognitive radios and secondary spectrum markets could be implemented to provide the most benefit to local governments while protecting their interests in localism and self determination.**

I. The Importance of Localism in Spectrum Policy affecting local government

To understand the interests of local and state government in spectrum policy, it is a requirement to understand not only the functions of local government, but how local government functions. It is heterogeneous. Local control of critical public services is decentralized from the State. Within any state, there are wide variations in the structure of cities and towns, in their form of local government, and in the make-up of their tax base and citizenry. Towns and counties in South Dakota or Nebraska are distinctly different from those in New Jersey or Connecticut both in the make up of the tax base and the local issues and priorities of the residents.

However, in all cases, local and State government, rather than Federal government, are the primary providers of government services to citizens. Schools, fire and rescue, policing, courts, jails, health clinics and services, housing, streets, sewers, water and electricity, airports and ports, economic development, and the policies that govern all of these services are primarily housed in local and state government. Within states, local municipalities (cities and counties) provide the most fundamental services and infrastructure for the quality of life of citizens.

Diversity creates a unique identity for each local municipality. Local identity is manifested in local government ownership and control of its core functions; public safety, public education, public health, infrastructure (roads, utilities) and economic development (jobs and prosperity). The local citizenry, businesses and institutions directly enforce local accountability with local activism.

Localism is important to understand in spectrum policy development for two reasons:

1) Autonomy in the delivery of *local* services is a preeminent concern for local government. In fact, a community's identity is manifest in its direct provision of public safety services, land use policies, economic development and schools.

2) Localism makes financing the cost of public safety radio systems extremely difficult in all but the most affluent or largest communities. Because of the need for a large and affluent tax base to finance local radio infrastructure, there is a great deal of difference between communications capabilities in metropolitan and rural areas. In fact, the largest urban areas are likely to build and support multiple public safety radio systems, both conventional and trunked, while rural areas suffer from vast areas of no coverage at all, due to a lack of available resources to fund transmitters and towers, engineering and planning.

II. **Studies about local government uses of, and needs for spectrum are lacking**.

Local first responder networks, owned and operated by municipalities and States can benefit from new spectrum policies and new technologies, especially if

those developing policies and technologies are responsive to an informed projection of local requirements. Today, discussions about spectrum at the local and state level policy are more likely to based on anecdotal information and perception than studied analysis.

The State of Oregon recently completed a study that inventoried public safety radio infrastructure in the state, and analyzed the level of interoperability between first responder's communications systems statewide.[1] The study found that there are vast differences between urban and rural public safety communications systems. Almost no community outside of the largest cities has mobile data capability. However, 75% of users surveyed report that their *demand is growing faster for data than for voice* capability. The 800 MHz band and trunking technology are *only* used in the metropolitan areas of Oregon. Rural and wilderness areas rely on the 50, 150 and 450 MHz bands to achieve coverage, and use only conventional radio systems. 98% of systems in the state are analog. None are P-25 systems.[2]

In Oregon, systems outside the urban areas are operating without sufficient financial resources. Most radio system equipment in the state is 15 years old or older. More than 1/2 of radio systems in the state are maintained by contracted "radio shops", as the system owner (local government) can not afford on-staff radio technicians. Sixty percent (60%) of respondents reported that they have inadequate quantities of communications equipment to do their job. Local tax revenue, 911 taxes and capital reserves of local government provide nearly all of the funding for radio systems. Federal funds are among the least available sources of revenue for operation and construction of radio systems.

The highest measurable levels of interoperability in systems were in the urban areas using trunked radio systems serving multiple agencies and jurisdictions. In non-urban areas, interoperability is mostly accomplished by bypassing the radio system, and relying on paging and telephone relay between dispatchers.

When respondents were asked what actions would improve interoperability, about 80% of responses named planning (frequency planning, regional planning, and a statewide forum). The most serious impediments to interoperability are funding, coverage holes and incompatible radio systems using different frequency bands.

The data from Oregon provides some much-needed quantitative evidence of exactly how local public safety radio systems are operated and managed. Though there are probably many states that would have a completely different profile from Oregon's, there are likely many states (especially in the western United States) who would resemble Oregon's profile very closely.

Several states have begun development and deployment of statewide first responder radio systems. These systems usually have a price tag of $100 million to nearly $ 1 billion, and still may not serve the largest police and fire organizations from the largest cities. This is because these organizations often opt not to “join” in the State efforts, for reasons directly related to localism. Often they will independently invest in the same radio technologies as the State, (providing a duplicate footprint of coverage) in order to retain control over their own local access and costs. This suggests that effort to conform local deployments to a state or Federal radio system for interoperability must be a matter of joint municipal/state/federal policy and finance diplomacy, and is not really addressing any technical issue. It will be extremely complex to conform local and state approaches with any top-down national effort to standardize or mandate radio design, technology, engineering or deployment.

III. Interoperability in Today’s Topology Costs Too Much and T Accomplishes Too Little.

Public safety radio systems have historically been funded and developed on the local level. These systems support 911 response as well as general law enforcement activities. Today an urban police or fire vehicle is likely to have $10,000 of communications equipment on board, and still be unable to talk to

[1] "Public Safety Communications Interoperability: Inventory and Analysis for the State of Oregon" Sparling Inc. and Center for Wireless Network Security, Stevens Institute of Technology, NetCity Engineering; January 2005.

[2] P-25 is abbreviated from the Association of Public Safety Communications Officers (APCO) Project-25, an effort defining industry-wide standards for public safety radio systems.

other agencies reliably. A large municipality is likely to have $30-100 million in radio system infrastructure deployed, and still be experiencing severe interoperability issues.[3]

The "interoperability" problem for first responder communications networks is directly related to the limited public safety radio technologies that have existed for fifty years or more, the inability of local tax revenues to support continual reinvestment in public safety communications coverage and capability, and the dispersed public safety spectrum allocations. Police and fire have been required to rely on old as well as proprietary technology, scarce radio spectrum spread over many frequency assignments, and a security and control strategy that accomplished prioritization and security by building separate networks for each agency in a region.

Today, different equipment and different infrastructure are required to operate in different licensed public safety frequency bands. Thus, the City of Los Angeles, for instance, operates five distinct radio systems; an 800 MHz mobile data system, an 800 MHz trunked radio system; a 450 MHz voice system, a 450 MHz data system and an 800 MHz conventional radio system. It is currently developing plans for a 700 MHz system. Operating costs top $6 Million per year. It also spends another $20 Million per year on telephone services, cellular telephones, pagers and other communications services. These costs do not include the radio and wireline facilities necessary to run the municipal water and power utility (Los Angeles Department of Water and Power), or those used by Los Angeles County, both in the same geographical footprint. These separate systems and the associated cost to operate and maintain them are a result of the disparate frequency bands available in any given region, and historic lack of technology to "bind" these frequencies effectively in the past. This example is repeated in major urban areas across the Country. Each of these infrastructures is supported by the local tax base, and the costs are staggering. Los Angeles is currently in the process of studying the feasibility of combining some of its radio communications systems with Los Angeles County. San Diego City and County and other major system operators around the Country are exploring or developing regional partnerships and joint radio infrastructure.

Other states and local governments are spending millions of dollars to retrofit existing networks with bridging devices to overlay interoperability between existing radio systems, or are overbuilding them with statewide replacement networks. Yet, these solutions, even using 700 and 800 MHz trunked radio technology or P25 systems will not produce appreciable gains in bandwidth, and they ultimately only support voice and narrowband data uses.

IV. Organizational Change in Local and State Government is helping to advance convergence in networking

Outside of first responder communications, local and state governments have seen their IT and telecommunications costs increase dramatically with increasing demand for broadband network devices including computers, switches, routers, and servers, and mobile end-user devices including laptops, PDAs and cellular phones. As annual recurring costs climb (often by as much as 10% per year) for bandwidth and mobility, the economies of converging municipal IT uses onto municipally owned telecom facilities (such as fiber, conduit, radio towers, and spectrum etc.) have become more obvious and compelling.

Today, IP and circuit switched networks are being layered onto the same physical telecommunications "transport" or "backbone" facilities. More and more often a good portion of the transport is owned and maintained by the local or state government. Fiber and microwave have been placed along most major state, federal and county highways, for instance to support transportation systems, utilities and public safety networks. To date, many major cities including New York, Los Angeles, San Francisco, Portland and Washington DC and several States have built their own fiber telecommunications infrastructure to their largest locations. When municipalities provision data or voice services to themselves over these networks, they are referred to as **Municipal Broadband Networks.**

Municipal broadband networks most often include a fiber optic/microwave "backbone" network carrying high speed Ethernet traffic, some leased circuits, and wireless "in-fill" for last mile and mobile uses.

[3] An "interoperability problem" occurs when first responders at a scene are unable to use their radio networks to communicate with each other.

One factor in the developing convergence of municipal and state networks has been the development of central information technology (IT) management within local and state government. Even five years ago, it was not uncommon for a major city or state government to have an IT department within every operating department, each with enough autonomy to order telecommunications and IT services, equipment and circuits and design single purpose networks. Decentralized management of IT and telecommunications was not conducive to convergence.

These functions have now largely been centralized into IT organizations led by Chief Information Officers (CIOs) or Chief Technology Officers (CTOs). These are often cabinet level positions in local and state government, in contrast to the common structure five years ago, where a telecommunications manager or radio system manager might have been buried in a electronics shop far from the higher levels of decision-making. This change is reflective of the tremendous increase in the overall percent of municipal and state budgets that IT expenditures represent.

V. Some Municipalities are Advancing their IT Capabilities Using Commercial Off-the-Shelf Technologies (COTS) and Unlicensed Spectrum.

Municipal broadband networks are being extended and augmented by Wi-Fi, mobile cellular data, microwave radio and meshed network solutions, designed to reach not only fixed (wired) locations, such as offices, but also mobile workers. Municipal broadband networks have traditionally only provided data service, but with advances in voice over internet protocol (VOIP) and compressed video over Ethernet, municipal network architects are developing very robust and economical strategies for voice and video service over their municipal broadband network architectures. Adding telephone service to the municipal broadband network (often as VOIP) "raises the bar" for reliability of the network and benefits all other applications. This has helped public safety radio begin moving toward digitization, open standards, higher bandwidth, and the same convergence principles spurring other municipal broadband initiatives[4]. Public safety radio communications is moving toward becoming another local government *application* rather than another network.

VI. Spectrum use and spectrum policies in local government are not limited to fire and police.

Other major municipal and state spectrum users include transportation agencies, public utilities (including electric utilities, water, sewer and storm water, security, parking enforcement, highways, light rail and transit, corrections, health and human services and public education). As all of these local and state government entities move toward IP-enabled technologies, including VOIP and mobile computing, and move away from proprietary protocols and standards local governments are ***converging*** critical infrastructure services, including public safety onto municipal, state and regional networks designed for multiple uses.

VII. "Wi-Fi" capabilities have not gone unnoticed by first responders

Broadband "in-fill" using Wi-Fi hot spots is taking hold in public safety. As a cruiser, ambulance or fire truck approaches a secure "hot spot" it can upload and download vast amounts of information quickly before switching back to its narrowband network. Updated mug shots, incident video, photos, GIS data and daily briefings can be sent and received over a broadband connection.

Sensor technology and other micro-scale technologies are developing rapidly to allow the data transmission device to be very mobile, perhaps pinned to an officer's uniform, embedded in their radio, or automobile, or integrated into their clothing. Developing sensor technology, bio-technology and "machine-to-machine" technologies suggest that network circuits will be flooded with data as soon as the network has the capacity to transmit that data at little or no incremental cost.

[4] Data and voice networks originally deployed to support single applications (e.g. a telephone network, an email network, a SCADA network, a GIS network), are now converging onto a single broadband architecture which supports all applications.

Many local governments, including Portland, Seattle and San Francisco are looking at Wi-MAX and mesh network technologies to solve the distance limitations of Wi-Fi, and to expand their communications capacity for data, image and video. Once the transmit distance of an 802.11 tower can be measured in miles rather than feet, and mesh technology can fill in coverage gaps, these technologies will augment (and may eventually completely replace) conventional local government radio systems.

VIII. Convergence of Networks Using Licensed Bands:

However, using COTS "WiFi" and WiMAX which only operate in unlicensed bands today, creates serious concerns for public safety and municipal government. The lack of protection from interference, lack of security, certain congestion in unlicensed bands, and the uncertainty of continued protection of their licensed bands are among the deterrents to developing further public safety uses of these technologies.

Though demand is high in local government for inexpensive alternatives, until those devices are adaptive across the public safety bands they won't displace local requirements to also invest in expensive public safety radio equipment.

Once public safety networks can be constructed using licensed bands *and* COTS, municipalities could direct mission critical and non-critical mobile traffic onto the same infrastructure, and potentially leverage millions of dollars of public investment. Thus, COTs networks which can be deployed to serve both public safety and other municipal uses provide greatly increased tangible benefits to local finance directors and local decision-makers.

IX. Agile, Adaptive Radio Technology Could Provide Impressive Economical and Technical Efficiencies

Cognitive or adaptive radios will allow the disparate frequency bands used by public safety to be "stitched" together. Tunable radios and devices that can sense available transmit and receive frequencies, will provide stunning improvements in interoperability among systems in a region and in a State.

Returning to the Oregon example, where wildfires are common disasters; urban firefighters who use 800 MHz trunked systems, could provide aid at the wildfire scene, and still communicate using their radios, even where the available frequencies are likely to be in the 50-150 MHz range. To the degree that spectrally adaptive radios and base stations can be deployed in existing public safety spectrum bands, public safety could continue operating in bands spread from 50 MHz to 4.9 GHz, and maximize the use of these bands for system expansion as need for capacity and capability grows. There is no clear benefit to public safety to lose either the preferred characteristics of the lower frequencies for wilderness and remote areas, or the propagation and coverage characteristics of the 700-900 MHz bands in the urban environment. But first responders are increasingly more mobile, and as they move from metro to rural environments or even from city to suburb, their radio needs to be on, and transmitting.

X. Cognitive Radio, Secondary Markets and Time Dimension Spectrum Access will benefit local government under three distinct policy paradigms.

Base stations and edge devices that are either software defined to licensed frequencies, or adaptive to licensed frequencies will greatly decrease the cost per device, and cost per radio system for local government. Their primary user (public safety) as well as their secondary users (other municipal departments) will benefit from the economies of scale of being able to use the same, or only slightly adapted equipment developed for the commercial and consumer sectors.

If those base stations and devices can dynamically re-tune across all public safety bands, they will solve interoperability problems between first responder networks within a region, between regions, and even across the country. The current problems cities and counties face of adding frequencies in an already congested band will be relieved if they can add frequencies from a different, non-contiguous band, and the electronic devices in the system can adjust. Finally, as system controller devices use more sophisticated, yet standardized user prioritization, or Quality of Service (QoS) schema, one could imagine that spectrum usage could grow far more efficient within public sector systems.

1) Secondary Market for Public Service Agencies: Perhaps the most obvious first foray into secondary markets for local government is serving its own "secondary market". Currently, FCC rules prohibit public safety licensees from providing spectrum to non-public safety users. However, as local government requirements for mobility and real-time access to data networks and mobile workers increases, it is not unlikely that secondary users interested in available spectrum on the time dimension[5] would include a variety of government users including schools, government offices, transportation and transit, health care clinics and hospitals, public universities and other public service entities. Though there is very little market among these entities for service or bandwidth in conventional public safety systems, once those systems can support mobile IP over typical COTS edge devices, using licensed spectrum not subject to congestion or interference, the secondary market should be robust for fallow and on-call licensed spectrum resources.

2) Lights and Sirens Access to Commercial Networks: Where we currently segment public safety and commercial users at the physical network layer and then burden local government with the expense of massive network infrastructures, we should move toward the secure segmentation and prioritization of public safety at a higher layer, and allow first responders to access any available facilities across the nation. If public safety had cognitive radios that could transmit over commercial networks when first responder networks were busy or unavailable due to coverage "holes" the efficiency of both commercial networks and public safety communications networks would be increased dramatically, while infrastructure needs are reduced due to economies of scale. Just as police vehicles and commercial traffic can traverse the same roads and highways with different priority ("lights and sirens") public safety signals could traverse any electronic highways that offer the best route to transmit.

One important characteristic of public safety traffic, especially voice traffic, is its density and compact nature—compared to most commercial public uses of spectrum for voice. While a typical cellular telephone call may be 20 minutes in length, the average length of a public safety voice transmission is well under 15 seconds. Thus, the short, bursty, but critical profile of public safety spectrum access makes it easy to draw an analogy between the "lights" and "sirens" use of the streets, and the potential for "lights and sirens" use of commercial voice, television and data infrastructure.

Among the most critical stresses on public safety information systems are the need to add channels to these systems to increase capacity, and the need to add infrastructure to gain both coverage and capacity. However, the addition of infrastructure adds layers of complexity to system management, and forces the capital and operating costs of systems out of the range of achievability for the local governments attempting to pay for them. Radio coverage for a public safety network that was adequate in many urban geographic regions at one time is actually shrinking. This paradox is especially vexing to first responders, whose job becomes more complex as the RF environment becomes more hostile. As steel girder buildings, underground parking lots and other structures are added in a community, radio coverage disappears on that real estate. This is as a result of both population growth and growth in demand for mobile communications. As cellular towers are added, the radio environment begins to overpopulate enough to cause first responder systems, not designed to filter out these "neighborhood" transmissions, to simply shut down because they cannot hear their control channel. The shrinking zones around a public safety transmission site can change overnight. Cellular towers are going up so fast in metropolitan markets that it is not uncommon for hundreds of commercial transmit antennas to be added in the typical public safety coverage footprint in a year. Instead of benefiting from commercial wireless deployment, public safety is more often disadvantaged by it. In a paradox caused by isolation, public safety loses ground when more commercial capability is deployed. However, this would be reversed if lights and sirens access were available on commercial radio infrastructure.

If first responders were to access commercial systems for spectrum resources, they would be subject to the survivability and reliability of those systems. Today, this is not feasible, as commercial cellular towers are

[5] The time dimension would allow licensing or use on a dynamic basis by assigning a frequency to a transmission and then reassigning that frequency after the transmission is complete. A user could be assigned any frequency that was not in use by another user at that moment in time.

not generally constructed to survive disasters reliably. A significant problem for public safety will be the reliability and survivability of any system resources it accesses. Since a lights and sirens preemption would take place during a surge of public safety communications activity, it would include events that may have compromised commercial systems abilities to operate; either because their facilities have been damaged (for instance, in a hurricane or earthquake) or when consumer use is also high (which will happen in a riot, a natural disaster, an attack). Unless private commercial systems are constructed with public safety levels of reliability and redundancy, and accommodate public safety calls as priority traffic, a public safety operation could not count on them as a substitute for stockpiled public safety spectrum resources.

3) Public Spectrum Leasing to the Commercial Marketplace: Development of the ability for local government to lease its' public safety or other government spectrum and/or infrastructure, (towers, rack space, buildings, power systems) to commercial entities on a secondary market, may be an attractive way to incent local governments and public safety agencies to consolidate elements of their radio systems and radio system operations. If multiple agencies could migrate to a single, high capacity, high coverage radio system in a geographic area, queuing theory suggests that the need for actual frequency assignments to public safety would go down.[6] For instance, in 2002, the City of Portland provided the Office of Engineering and Technology at the FCC data comparing the number of frequency assignments it would take to accommodate the 100 + public safety and public service agencies currently served by the City's consolidated radio utility. Without the trunked, regional consolidated system, the number of channel assignments necessary to serve the Portland market would have to double. Along with the additional channels come the operations costs, hardware costs and other system costs, which would also be duplicated.

Even when trunking efficiencies are in place, and multiple users are served on a single radio system, the nature of first response activity requires that spectrum resources be "stockpiled" for emergency use. A system that is using 70% of its capacity for day-to-day communications is not going to have sufficient resources for a spike in traffic that is always associated with the response to major events. Thus public safety systems are designed to capacity requirements for the spikes, and not the average traffic load. This leaves 50% or more of frequency capacity lying in wait (stockpiled) during time intervals between a spike.

If communities could lease a portion of their stockpiled spectrum capacity to other users to finance a consolidation and improvement program, then there could be a financial incentive to move to system consolidation and modernization among local governments. However, leasing out fallow or stockpiled capacity is an irrational option unless public safety agencies have the ability to take back resources with an immediate "ruthless lights-and-sirens preemption" during an event to accommodate the expected surge in public safety traffic. Developing technologies could provide means for this type of just-in-time preemption of secondary leasee use, the impact of which would either be a data rate reduction or the temporary reduction in the number of channels/callers. Such a "secondary-use-with-preemption scenario would not require either the local government leasor or the commercial leasee to lose access to entire blocks of spectrum, or the complete spectrum resource.

The combined application of these concepts; 1) Secondary markets for public service agencies, 2) Lights and sirens access to commercial networks, and 3) public spectrum leasing to the commercial marketplace; could create a flexible co-existence of prioritized first responder/critical public service traffic with commercial/consumer traffic on both industry and government deployed infrastructures. First responder use of spectrum would expand as necessary for rescue, law enforcement and public protection, and during its contractions, consumers and commercial entities would benefit from additional spectrum availability. Contracting and expanding spectrum rights would be enabled by cognitive radio technology, new spectrum policy, and local contracting between buyer and seller of spectrum.

[6] Day-to-day operations use. In a crisis or disaster, there will be predictable spikes for the duration of the event.

XI. Current Telecommunications and Spectrum Policy and Law have a chilling effect on local government innovation in reallocating spectrum resources.

The record of municipal and public safety comments in the recent FCC NPRMs on Secondary Markets and Cognitive Radio proceedings show a cool reception to-date, to both concepts with regard to whether either could provide tangible benefits to public safety communications[7]. Local governments are concerned, in the case of cognitive radios, that the Commissions' enthusiasm for these technologies may harbinger a similar enthusiasm to restrict or even remove dedicated public safety spectrum. With respect to Secondary Markets, local governments are concerned that again, their dedicated spectrum and spectrum reserves could disappear as telecom companies lobby not only the FCC, but state and local decision-makers to release it for commercial purposes.

Local governments are already facing a storm of backlash from the telecommunications and cable television industries who wish to protect their traditional and "core revenue" markets, whether served or under-served, from local and State government intrusion. The battles are being carried out primarily in State legislatures and the courts, and are moving to Congress as efforts begin to overhaul the Communications Act. Wherever local governments have used municipal or State resources (fiber, cable plants or wireless networks) to serve any user, they have been immediately besieged by litigation. Today, and for a decade the telecommunications industry has consistently lobbied for State and Federal legislative preemption to restrict local government from serving any user. Even when a local government has merely opened its constructed facilities to other units of local government (Portland, OR), the industry has responded with litigation and legislative efforts to declare their loss of revenue anti-competitive and the local government an unfair market entrant. Legislation, regulation and the Courts have gone as far as declaring that municipalities may not serve any user other than themselves, in some cases even when they offer the service for free. In other cases, they are strictly forbidden from offering services for a fee. Some of these efforts are aimed at shutting down existing resource sharing arrangements, which lower municipal investment and operating cost. As long as State and Federal legislation and regulations are used to protect commercial incumbent revenues by restricting local and State efforts to serve other entities, create public private partnerships, or leverage municipal investment, local and State governments risk too much to fully realize the potential economies of convergence and consolidation.

Municipal deployments of Wi-Fi networks which offer any service to the public are of major concern to the telephone and cable industry, who are looking to their digital-subscriber-line (DSL) and cable-modem businesses as their primary source of revenue growth. The trend among both small and large cities to promote low-cost and ubiquitous mobile data networks has the industry's attention. Equally disturbing to the telephone and cable industry are the municipal broadband networks which rely on municipally-owned fiber and wireless infrastructure for data, video and voice transmission, and cut industry revenues for Centrex and data service. Potential loss of market share, and downward price pressure, are causing an industry response that is focused on pushing state legislation designed to protect their traditional revenue sources, and prohibit municipalities from having the legal right to offer *any* telecommunications service to any entity, including in some instances, itself.

Philadelphia announced during the summer, 2004, that it would deploy Wi-Fi throughout the entire city. This network would be designed to offer broadband services to public safety and other public sector uses. It was to be run by a non-profit corporation. It was also to be designed to offer low-cost Internet access to under-served communities in Philadelphia. According to city officials, less than 60% of the city's neighborhoods have broadband access currently. Within months of their announcement, the telephone industry successfully lobbied the Pennsylvania General Assembly to pass a bill with a provision that would make it illegal for any "political subdivision" to provide to the public, "for any compensation, any telecommunications services, including advanced and broadband services...". Industry took the position that such initiatives on the part of municipal government provides a disincentive to industry to invest in plant modernization because it puts their future revenues at risk.

[7] See comments of APCO, NLC, etc. in FCC Docket WT 00-230 and ET 03-108

The Pennsylvania law follows similar legislative efforts in 2004 by telephone companies in Utah, Louisiana and Florida to prevent municipalities from offering telecommunications services, which could include both fiber and Wi-Fi networks. In late December a bill was introduced in the Ohio state legislature that would restrict municipalities from offering telecommunications services (the definition is broad enough to include wired or wireless broadband service) to residents and businesses. Though there is no evidence that municipal entry into the telecommunications service provider marketplace reduces competitive opportunities for industry, the argument has been compelling enough for a dozen states to take action limiting municipal ownership of telecommunications systems and industry efforts to limit municipal participation are being introduced in nearly every state.

In contrast to the efforts described above, when ***homeland security*** is the public goal under discussion, it creates empathy among state regulators and legislators toward the idea of public entities having legitimate interests in providing telecommunications services in the marketplace, at least for themselves. As a result of Hurricane Katrina in Louisiana and Mississippi, Congress and the States are calling for more funding and development of government-owned wireless network infrastructure and spectrum.

Public Safety agencies recognize their protected status in the spectrum allocation debate, and do not wish to jeopardize it by becoming part of the municipal telecommunications debate.

These efforts to prevent municipalities from offering advanced and extended services on municipal networks are not limited to debate about serving the public. Cities such as Portland, and States such as Utah are currently facing very expensive industry lawsuits for providing network services *even though these networks* ***do not*** *provide service to the public.*

If municipalities were to offer public safety spectrum in a secondary market, or services using public safety spectrum, that provide valued services to any entity, including government, business or directly to consumers, under the secondary markets proposal, it is likely that incumbent local exchange carriers, wireless providers and the cable industry would move to seek protection through the courts, the state legislators, congress and the FCC itself.

XII. Conclusion

Decision-making concerning telecommunications infrastructure that supports first responders, public utilities and the operation of local government is viewed in the city halls of America as the responsibility of local officials. The localism and diversity of American communities are important factors to understand and respect while crafting national changes in spectrum policy. Regional differences, including geography, income and tax base, density, and availability of basic infrastructure significantly impact local decision-making on all kinds of policy, and play a significant part in local telecommunications policy and local spectrum policy. At the local level of government, activism plays a very key role, especially in matters of consumer protection, public finance and the use of public funding. Top-down state or Federally mandated policies that are aimed at restricting local authority to decide when and how to implement local infrastructure, especially when the infrastructure is locally funded through the local tax base are controversial and often opposed by cities and counties. Therefore, it is extremely important to involve local decision-makers in sweeping national spectrum policy revisions, particularly when discussing the needs and requirements of citizens, public institutions, utilities, local economies, education and public safety. **As the debate moves from the concerns and needs of an amorphous "market" or "industry" to the more personal "citizenry" or "students," diverse local interests are going to surface.**

Advancements in telecommunications technology are converging previously separate industries. As broadband capabilities develop, separate industries, like cable television and telephone (wireless and wired) are evolving into the same industry with segments operating under different legacy regulatory and policy structures. The same is happening with telecom services provided by local government entities, including transportation, electrical, water, sewer providers and first responders. Indeed, local government organizations are themselves converging as this paper points out, in a very analogous way to private industry. As evolving units of local government converge networks in order to adopt the same technological advancements and efficiencies

evident in the commercial sector, they are also impacted by legacy policy. Among the most chilling of these to their efficiency of spectrum use and local investment, is the isolation of public safety networks (through frequency allocation and licensing rules) from other municipally owned networks, commercial carrier network frequencies and commercial off the shelf technology. Another expensive policy-based deterrent to effective and efficient development of municipal broadband converged networks are the robust activities of incumbent telecommunications interests to protect their traditional core markets (using litigation, legislation and refusal to interconnect) from "erosion" caused by municipal innovation.

Spectrally adaptive technologies could greatly enhance public safety communications coverage, reliability and interoperability, but they are not a complete answer. To create efficient, affordable and interoperable public safety communications infrastructure, federal policies that restrict local governments from behaving efficiently and reacting to the same technological advancements, convergence principles and economies of scale that commercial network providers respond to must be revised.

The greatest gain in effectiveness and efficiency for local government networks will come when secure public safety communications systems can be constructed, secured and operated using commercial, off the shelf technologies (COTS) tunable to licensed local government public safety frequency bands. Dedicated spectrum for public safety will always be important to national homeland security goals and effective first response, and cannot be displaced by providing subscription service for first responders on commercial systems. However, dynamic access to commercial system capabilities and infrastructure on a “lights and sirens” basis could provide a temporal, on-demand surge in available spectrum capacity and capability for public safety when and where it is needed, without requiring band set-asides, if concerns for security and reliability can be addressed.

Municipalities and states may also have incentives to share dedicated licensed spectrum if trusted technical mechanisms are developed to dynamically lease and retrieve spectrum in the secondary market. These mechanisms must protect first response networks from the potential harm of not being able to retrieve spectrum from a leasee during a crisis. If trusted mechanisms are developed, secondary spectrum use leasing could provide a source of funding for first response network infrastructure and operations that is badly needed. Moreover, spectrum leasing by local government would allow the policies and conditions under which local government spectrum is offered in a secondary market to be determined locally, and to be in line with local policy priorities and imperatives, rather than a top-down national generalization. National policymakers must be careful when encouraging secondary spectrum markets not to punish local governments for effectively bringing their spectrum resources to a market. The current policy atmosphere is punitive toward local government entry, and a disincentive for creative sharing of spectrum resources between government licensees and commercial ventures.