The Challenging Interface of Technology and Policy: A Case Study of Communications Interoperability

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Three hurdles are identified that have to be overcome to make interoperability a reality: technology, common frequency and standard, and funding. Of these funding and the collective action problems associated with it poses the most significant obstacle. Based on collective action theory and case studies two strategies are examined that have been utilized to overcome the funding obstacle. Success it is suggested depends largely on the ability of policy makers to align technological capabilities with other policies and overall goals.

Communication interoperability is "the ability of public safety personnel to communicate by radio with staff from other agencies, on demand and in real time." (PSWN:1) Three steps have been seen as requirements for interoperability: technological innovation, setting common standards and frequencies, and providing adequate funding. This paper looks at the interface of technology and policy in digital government. It uses a specific case – establishing communication interoperability among first responders – to analyze how alignment of technology and policy is crucial for success in digital government initiatives.

1. The Path toward Interoperability—and Its Three Obstacles

• Inventing a Suitable Technology: An interoperable public safety communications network has to integrate the radio networks of thousands of public safety organizations. Conventional analog radio equipment is ill-equipped to perform this integration task because it does not scale well.

• Defining a Common Frequency and Standard: Once a suitable technology that scales well is identified, its success depends on its employment of a common frequency and standard. This is difficult given that public service agencies have traditionally used different frequency bands for their radio communications.

• Securing Necessary Funding: For interoperability to be implemented, all existing radio communications infrastructure used by public service agencies must be substituted with new equipment. In addition to the new hardware hundreds of thousands of users may need to be trained to use the new equipment. Finally, this transition must take place in real time, while emergencies continue to happen that require first responders to be in active communication.

Interoperability may have a chance only if all three of these obstacles—technology, common frequency and standard, and funding—are overcome. Surmounting these obstacles is what some studies and reports have deemed the fundamental challenge for interoperability (PSWN; NIJ 1998; ERC).

2. Taking the Technology Hurdle through Digital Innovation

As interoperability requires a technology that scales well and is capable of simultaneously accommodating many users, given the constraint of limited radio spectrum bandwidth it is technology's central task to use the available bandwidth as efficiently as possible. This implies a network capable of managing itself, allocating and deallocating channels based on priority. Managing channel allocation generally points toward a network technology with a strong center, a kind of superfast dispatcher in charge of assigning communication rights to users. Networks that employ this kind of technology are called "trunked" networks, implying that they have a strong trunk, or center, managing them.

3. Flavors of Policy: Crippling or Enabling Technology

With the appropriate technologies to enable interoperability available, the focus shifts to overcoming the other hurdles. In the following I will look particular at the funding hurdle. Independent studies have verified the need

for tremendous amounts of funding to finance the necessary network upgrades for interoperability. One such study estimated a total capital need of $18.3 billion to replace the existing communications infrastructure. Importantly, the costs to be borne by local agencies account for more than 80 percent of that amount ($15.4 billion), compared with $1.2 billion for federal and $1.7 billion for state agencies. This implies that the organizations most burdened with finding sufficient funding are precisely the ones that have no direct access to larger federal or state budgets (PSWN).

In addition, the amount of funding needed involves more than just the cost of replacing equipment. Provision also has to be made for planning, procurement, training and maintenance costs over the entire life cycle of the new systems. In fiscal 2000 the White House sought, but Congress denied a budget request for $80 million in "seed" money available to states to plan statewide public safety wireless communications systems and create demonstration projects. Even if these public funds had been available (and the only federal funds for that purpose), it would have taken a staggering 225 years of funding at that level to replace the public safety radio networks nationwide.

In contrast, and with an even more severe budget crisis as a backdrop, European governments have taken a closer look at what the new communications networks could offer, not primarily in terms of monetary *needs*, but of technological capabilities enabling monetary *savings*. For example, the Belgian government has instituted the ASTRID program, creating a nationwide digital radio infrastructure to be *shared* by all Belgian public service agencies. This sharing arrangement saves agencies significant amounts of money because it avoids the inefficiency of having multiple networks—one for each agency—covering the same or overlapping geographic areas.

Sharing communications infrastructure is nothing novel. In the U.S., some agencies have been sharing infrastructure for years and reports examining potential strategies for funding improvements in communications systems have advocated sharing arrangements as a way of reducing costs (PSWNa:6-1). Sharing arrangements require that two or more agencies decide to share the cost of building infrastructure. But often procurement cycles and funding opportunities vary among communications agencies. Securing funding—hard already—is almost impossible at any specific moment in time. One could, of course, envision a sharing arrangement in which one agency, having received funding, builds the agreed-upon network and later lets another agency use it, perhaps for a fee. But why should one agency shoulder all the risk in building an infrastructure when it is uncertain that others will join? This is a fundamental dilemma in funding network infrastructures. The early adopters of a new communications technology bear a higher risk than latecomers. Because it seems acting early does not pay, everybody waits for others to make the first move. Political scientists call this a "collective-action problem."

There are a number of ways that this collective action problem can be overcome. An obvious one is for one agency to shoulder the financial burden when it needs an infrastructure anyway and the cost for permitting others to share is minimal. Or an agency leader may just desire to be entrepreneurial. But these are exceptions. In most cases, public safety agencies have neither the funds nor the entrepreneurial spirit. A more promising solution is to have central coordination: the government steps in and finances the infrastructure buildup, shouldering the risk as a public good. This is precisely what the Belgian government did in the ASTRID program.

Old analog public safety communication networks are inefficient from an economic perspective: Their capacity is underutilized, except during emergencies. Sharing network infrastructures among public safety agencies, like the ASTRID network, will at least permit agencies to share the cost of building and maintaining the infrastructure. It will still be underutilized outside of emergencies, but at least every agency will not have to operate its own overprovisioned and underutilized network and instead will share with other agencies. The British government has taken this idea an important step further. Because of the standard the European Union has chosen for interoperable communications systems provides for communications prioritization capabilities, it can reach beyond first responders to public *service* agencies, with non-time-critical communication demands, and thus further balance network traffic loads. The enhanced network efficiency that results from such a balancing translates into higher revenues and, ultimately, lower costs for users. Moreover, this creates an intriguing business

opportunity. A private-sector company could build and run the network infrastructure, while public service agencies would pay fixed annual usage fees. With so many public service agencies as potential users, this setup would provide a strong economic incentive for the infrastructure provider to sign on agencies. And this is exactly what the British government implemented. With British Telecom as infrastructure provider and Scotland Yard as a “launch customer” the British Airwave system started operations in 2001 and is open to a very broad spectrum of public service agencies (DTI). The Airwave network will replace aging non-interoperable technology for tens of thousands of users in a nation of over fifty million people, and taxpayers will not have to pay for the initial network buildup.

4. The Underlying Issue: Enabling Collective Action

The need for public safety agencies to communicate through interoperable radio networks is obvious. Of the three hurdles to developing this capacity identified earlier in this paper, the first—creating the appropriate technology—has turned out to be the least difficult to clear. Creating a suitable funding mechanism, on the other hand, seems to be much more troubling issues. Implementing interoperability requires one to overcome a distinct collective-action problem.

When Mançur Olson analyzed collective action (1971), he discovered that stakeholders would act if they could identify selective benefits and costs. Consequently, public policies requiring collective action have to employ specific strategies to incentivize individual stakeholder action. Very generally speaking, two such strategies have been identified. First, governments can take a "command-and-control" approach, mandating a certain behavior and prompting stakeholders to fall in line either by threatening them with fines or taxes or by inducing them with subsidies. This "type-1" strategy has been standard public policy. A second, "type-2" strategy turns to market forces and the private sector to provide an incentive framework. Neither strategy is inherently better in the abstract. The real trick is to select the appropriate strategy for a concrete collective-action problem, taking into account its specific context.

In the quest to establish appropriate sources of funding, the United States opted for public funding, with federal funds for the early stages. The emphasis was on central leadership and coordination. In principle, this was an appropriate approach: Federal and state budget surpluses enabled a command-and-control funding approach based on subsidies to be taken. Yet neither Congress nor many of the states decided to offer generous nationwide funding to upgrade public safety agencies' communications networks. It was a missed opportunity. U.S. policymakers drastically underutilized the power of their purse.

On the other hand, the British opted for a type-2 strategy to overcome the collective action hurdle: an untried market-based approach. Did the British suddenly turn themselves into public-sector entrepreneurs? Unlikely. Their decision was almost completely driven by budgetary constraints. As there were no public funds available to finance the conversion to interoperable systems, alternatives had to be sought. The ingenuity, perhaps uncovered accidentally, was to leverage the power of the technology (a) to share the infrastructure among the stakeholders and more importantly (b) to create a private sector funding opportunity. Innovation occurred when there was no alternative option left. A key to understanding the British success lies in the successful alignment of means and ends, of strategies and context.

5. Lessons for Digital Government Policy

A number of lessons can be learned from this case, both for public policy decision makers, who understand the importance of interoperability in digital government and want to accelerate the process of achieving it, and for those interested the broader picture of innovation and competitiveness in times of crisis.

• Pragmatic Steps for Policy Makers Interested in Interoperability: There is no silver bullet for defining the most appropriate policy to provide interoperability of communications systems for public safety organizations. The best approach depends on the political contexts and on the policymakers' strengths and weaknesses, as well as the type of "selective benefits" that will sway stakeholders to act. It would be shortsighted to transplant to attempt to

transplant to the United States the solutions that worked for Britain. The British were successful because the strategy they chose to overcome the two collective-action issues—commonality of frequency and standard, as well as funding—were well aligned with their capacities and the overall political context in which they were operating. They played the cards they were dealt very well. Consequently, to achieve interoperability policymakers have to select a strategy based on the available means. For example, changed budget priorities as a result of the war against terrorism may make it feasible to establish more substantial federal and state-sponsored interoperability funds than before. Offering subsidies to tens of thousands of public safety agencies that make interoperability-related investments provides a very immediate "selective benefit" and will prompt them to act.

• Broader Lessons for Innovation through Public Policy: But there is more to the story. The British succeeded in overcoming the funding hurdle by not attacking it through traditional means, and instead opting for an alternative, untried strategy. They took, perhaps out of necessity, the riskier route. Most importantly, they aligned their overall strategy well with the first hurdle: technology. Unlike in the United States where technology seemed to be either a given or something to be decided by consensus, the British and their partners in the European Union chose a technology that permitted them to overcome the funding hurdle. Traditionally one would see little connection between the choice of technology and the funding structures (apart from the amount of money needed to acquire the technology chosen). Only by leveraging the unique properties of digital trunked networks could the British create an opportunity for the successful public-private partnerships we have seen. It was the correct European perception that technology is not an external constraint or an unrelated decision, but intricately linked to the social context of its use.

6. Conclusions

This paper has identified three hurdles that have to be overcome to make interoperability a reality: technology, common frequency and standard, and funding. Policymakers concerned with overcoming collective-action problems, as one frequently encounters in the network economies, may benefit from understanding the spectrum of solutions tried on the path to interoperability, and the importance of alignment between the desired policy goal and the means—technological capabilities and policies—employed.

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