An Evaluation Framework for Requests for Proposals of Municipal Wireless Networks: A Case Study of Three Municipalities

Greg Brabander, Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena, CA 91109, USA; E-mail: gbraban@jpl.nasa.gov
Pat Cahalan, California Institute of Technology, 1200 East California Boulevard, Pasadena, CA 91125, USA; E-mail: psc@cs.caltech.edu
Kim Douglas, Claremont Graduate University, 130 East Ninth Street, Claremont, CA 91711, USA; E-mail: kdouglas@its.caltech.edu
Chris Malek, California Institute of Technology, 1200 East California Boulevard, Pasadena, CA 91125, USA; E-mail: cmalek@hss.caltech.edu
Samuel C. Yang, California State University, Fullerton, 800 North State College Boulevard, Fullerton, CA 92831, USA; E-mail: syang@fullerton.edu

INTRODUCTION

A municipal wireless network (MWN) is a government-sponsored wireless metropolitan area network (MAN). The number of municipal wireless networks proposed and built in the U.S. has continued to grow over the last five years, with some analysts are forecasting an 8,400% increase in area covered by MWNs by 2010 in the U.S. (Information Week, 2006)

When a municipality (i.e., town, city, or county) decides that it needs an MWN, it typically partner with vendors who can supply the expertise to design, install, and operate the network, as well as the necessary equipment. To find such partners, they issue a Request for Proposals (RFP), a document which details the municipality's goals, its business model for funding the deployment and future maintenance of the network, and any relevant constraints and assets the city may have. Issuing a clear and effective RFP is crucial to the success of the ensuing project. Effective RFPs clearly articulate the city's goals along with a realistic business model so that vendors can respond with valid and diverse proposals (Richardson, 2005). Ineffective RFPs may fail to attract vendors, give rise to projects which may never be completed, or produce networks too expensive to maintain in the long run.

In this paper, we formalize an evaluation framework that can be used by decision makers and city planners to specify their RFPs for MWNs. In addition, the paper conducts a case study of three municipalities; it applies the developed framework to actual projects of three cities in order to assess the likelihood of the success of the ensuing projects. It is found that an effective MWN RFP forms the basis for planning a successful project. Such RFP includes clearly-defined goals and financial models, which should be clear as to avoid the need for later clarification. An effective RFP should result in a network built on schedule and on budget during deployment, as well as a network consuming predictable expenses to run. Finally, the RFP should communicate in detail the types of services the city expects from the network, so the vendor can work to deliver them and the city can avoid future issues of accountability.

MOTIVATIONS OF MWN DEPLOYMENTS

A *municipal wireless network* (MWN) is a wireless metropolitan area network that is sponsored, and possibly built and operated, by a municipal government (which may be a town, city or county). It is built to provide wireless MAN service to people, typically within the city limits of a municipality but sometimes exceeding them based on cooperative agreements (Cherry, 2006). The service may be offered at low or no cost. Municipalities deploy MWNs for four major reasons: to stimulate economic development, to provide a last-mile alternative, to address digital divide issues, and to enhance city services (Shamp, 2004).

In terms of *economic development*, a major hypothesis among municipal governments is that the municipal supply of broadband Internet service to its constituents will directly stimulate a city's economy, as well as induce people to both visit the city and possibly relocate to it (Ford, 2005; Ford and Koutsky, 2005). This goal may include promoting the city's reputation as a technologically advanced community, bringing in tourists and encouraging people to move to the city. Research has indicated that MWNs have a positive impact on business vitality in communities (Ford, 2005; Ford and Koutsky, 2005; Goth, 2005).

In terms of *last-mile access* issues, in some cases incumbent carriers may not be interested in deploying a broadband communication network to a city or to an area of a city due to a perceived low ROI. The low ROI may be due to the fact that broadband deployment is expensive and requires much capital invested upfront with uncertain demands and future revenues. In other cases, broadband services may be available only at a high cost from a monopoly carrier in the city. In all these cases, a city may decide it has an obligation to provide another last-mile alternative to its citizens.

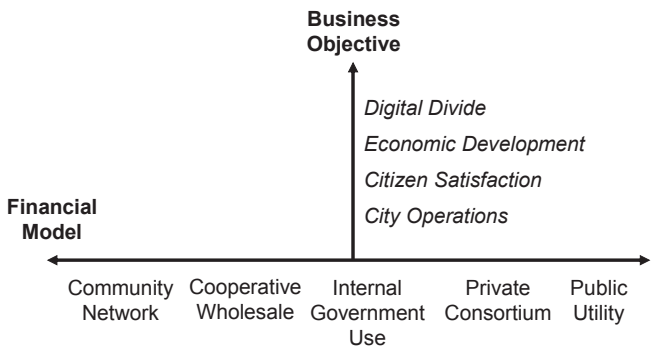
Digital divide may also be a reason behind an MWN deployment. Digital divide refers to the gap between those who have ready access to computers and the Internet and those who do not have access to those technological resources. The economically disadvantaged and those with low literacy skills (computer or otherwise) are more at risk of being on the disadvantaged side of the gap. As a result, they may be increasingly marginalized in a modern knowledge-based economy. Many cities see a great need to close this divide and treat MWNs (in combination with computer training and low cost computer programs) as a way to do so.

Lastly, many cities want to deploy MWNs in order to streamline and enhance *city services* and help their municipal workers to more effectively perform their jobs. The municipal employees include emergency responders such as police or firemen and other workers such as parking enforcers and building inspectors. In addition, cities also want to make it easier for its citizens to access city services by providing web portals to city departments, accessible via the MWN.

EVALUATION FRAMEWORK

A successful deployment of MWNs requires that there be a clear purpose for such a network and a set of identified benefits. It is necessary to balance competing or overlapping objectives and establish priorities so that outcomes are clear and can be measured. Municipalities should carefully evaluate community needs so that technological, financial and opportunity readiness can be realistically assessed. The Civitium report (Richardson, 2005) starts with the RFP Lifecycle process with business planning. Intel (Intel, 2005) puts business plan development very early in the process, placing it just after identifying a core action group and reaching out to technology providers. Five business models are currently used by communities to deploy wireless broadband and "choosing a business model that provides sufficient funding and allows the community to meet its project objectives is critical – and can be difficult." (Stone and Richardson, 2005, p. 10) Other models in the literature, such as strategic alliance and new operator (Chang, Yu, and Tsai, 2006),

Figure 1. An evaluation framework of MWN RFPs



are also included in the proposed set of five models. The five financial models are built from different mixes of public and private funding streams, acknowledged capital assets, and control opportunities:

- Community Network: This type of network is wholly funded by the government through grants, taxes or other revenue.
- Cooperative Wholesale: Government funds the deployment, serves the public needs and sells excess capacity to private providers.
- Internal Government Use: Public or grant monies fund the broadband deployment for government use only (e.g., police, fire, and utility).
- Private Consortium: Both community and subscribers pay for service though the community may also leverage city assets.
- Public Utility: This model is akin to that used for water and gas in which there is a separate enterprise that may show annual profits and losses.

The model fundamentally affects the city's priorities. If the city feels that its operational needs are already well met and that invigorating the business community is paramount, then clearly the model would not be one of focusing on city operational needs. If a controlling piece of legislation prohibits a network wholly funded by the municipality, then a community network model would not apply. Therefore, city stake-holders need to clarify and prioritize the near-term benefits they seek and assess how the MWN fits into the city's strategic objectives.

In addition, an effective RFP for a MWN should contain evidence of a community process in which one or more of the following business objectives can be identified and prioritized in the context of the municipality: (Intel, 2005, p. 6)

- City Operations: Increase efficiency through real-time, high-speed, remote access to databases related to government services (e.g., police and building inspection)
- Citizen Satisfaction: Improve access to services and enable a higher degree of interactivity with and responsiveness from those services.
- Economic Development: Enhance local commerce through improved business and community support.
- Digital Divide: Assure egalitarian access to the network through affordability and publicly accessible environments.

By combining the five financial models and four business objectives, this study proposes an evaluation framework shown in Figure 1. Through the RFP, the vendor should be given clear directions regarding the city's business intent so that the competing implementation factors of cost, speed, and quality of service can be optimally balanced for the local application. If an issued RFP does not communicate such intent, a vendor is then typically left to making best guesses (usually biased to lowest cost) and would not be able to deliver a clear and effective response. In this study, we analyze three cases of RFPs issued by municipalities around the U.S. and examine their business objective and financial model.

RESULTS

Houston, Texas

Houston covers an area of 639 sq. miles and has 2 million people. Within its city proper, it has 40 colleges, universities and institutes. The city released its RFP for a city-wide wireless network (Houston, 2006) on March 17, 2006.

Business Objective: Improve City Services

Throughout the RFP, though there are statements regarding the digital divide and reference to public safety, the document emphasizes city or public services as the business priority. Houston's objective is to expand the network's use beyond the intelligent parking meters to work-order management of field personnel and automation of traffic signaling with the ultimate goal of fundamentally reducing the city's communications expenses (Houston, 2006, p. 10). The goal of public access is primarily achieved through a financial model in which service providers offer affordable and reasonable rates to businesses and consumers.

Financial Model: Private Consortium

Houston adopts a view that the city sets policy and serves as a catalyst and service providers are the financiers and managers (Houston, 2006, p. 20). The clearest indication of Houston's expected financial model for the MWN is the statement on "Private Sector Cooperation – The City's role shall be that of a catalyst – to improve and enhance the market for broadband services in Houston. The City seeks to fulfill this role by collaborating with the private sector in a mutually-beneficial partnership." (Houston, 2006, p. 11) This is followed by Section 2.4 on "Use of City Assets" and the statement "The City intends to leverage its significant real estate holdings, as well as rights…" The same section gives more details on the number and placement of signal towers, traffic lights and other rights the city intends to contribute.

Nevertheless, buried in the business model statement the city claims all rights to the "Capture Portal in terms of both revenue related to commercial content and advertising on this page, as well as management of the pages' design, branding, layout, development and maintenance" (Houston, 2006, p. 21) which suggests that the MWN will be branded as the city's own. Thus one can surmise that the city's expectation is that the service provider's financial model will largely depend on its ability to sell network access to other service providers and retailers.

Conclusion

The Houston RFP provides a clear and workable perspective on the city's MWN. It is non-ambiguous on the city's intentions, which is improving its operations though "Value to the Community". In addition, this value is measured by the wholesale, discounted, and promotional rates offered to the population and is listed first in the evaluation criteria (Houston, 2006, p. 17). In this respect, "Value to the City" in terms of compensation and proposed rates will undoubtedly weigh heavily and be less negotiable in meeting expectations.

Fairfax, Virginia

The city of Fairfax, Virginia covers 6.3 sq. miles and has a population of 22,000. It published an RFP on March 16, 2006 for the installation of a Wi-Fi network that will encompass the city as well as some of the immediate surrounding areas. An analysis of the Fairfax RFP shows that the RFP is not clear on the scope of the network, how it is to be built, or who will pay for it. The RFP may need more clarification and detail as to the city's expectations.

Section 3 "Goals" of the RFP is where the RFP defines its goals for the network. The critical goals (Section 3.1) for this project are loosely defined. For example, Section 3.1.1 requires that the network encompass a "service area consisting generally of the City of Fairfax" (Fairfax, 2006, p. 4) but does not specify exactly where the coverage boundary should be.

The RFP may have intended to keep requirements at a high level based on the first paragraph of Section 12.0 "Definitions of Basic Requirements". Paragraph 12.1 states: "Throughout this RFP, the City has elected to define basic requirements for the network, while encouraging maximum flexibility and creativity by Offerors. The requirements below are defined on a summary level, and Offerors are encouraged to propose (and elaborate on) a solution that best meets the City's stated goals." (Fairfax, 2006, p. 11) However, when evaluated using the proposed framework, this open, summary approach does not clearly define the business objectives of the network, and the responding vendors may have to estimate more detailed objectives and devise solutions that may be suboptimal.

A later section, Section 14.0 "Business Model and Policy Questions", does not contain a more detailed description of the MWN's business model. The section contains a series of questions put forth to the vendor to clarify how its proposal will meet Fairfax's needs for a wireless network. As an example, Section 14.2 asks: "How does your proposed solution/approach specifically address the

City's stated goals and requirements?" (Fairfax, 2006, p. 13) According to the proposed framework, a better approach would be that the city first answers these questions by means of focus groups, town hall meetings, and/or surveys before issuing an RFP.

The Fairfax RFP does not specify much detail in terms of specific business objective and financial model. As a result, vendors may not be able to provide focused responses to the RFP. Based on the proposed framework, it is recommended that cities first identify the feasibility of the project and specifically discern how best to build the network.

South Sioux City, Nebraska

South Sioux City, Nebraska has an area of 30 sq. miles and a population of 12,000 people. In contrast with Houston and Fairfax, South Sioux City has a completed, deployed MWN. South Sioux City's MWN is entirely devoted to city services. It is noted that Nebraska is one of the 15 states with "anti-MWN" legislation, having passed State Bill LB-645 which categorically forbids municipalities from providing communications and information services of any kind to citizens (Freepress, 2006).

Business Objective: Improve City Services

South Sioux City had a legacy mobile wireless network used by 20 police and emergency vehicles. The legacy network was an 800MHz leased radio system used to connect to the city's own local-area network. The legacy technology had a limited bandwidth, and it severely limited the ability of public safety officers to transmit or receive video/photo data concerning suspects during investigations. In addition, the leased radio system had a yearly maintenance cost of $27,000 (South Sioux City, 2006). As a result, the city chose to roll out a new MWN using pre-certified WiMAX technology. The technology satisfies the requirements of mobile access (i.e., maintaining connection while clients are moving at vehicular speeds) and long range.

Financial Model: Internal Government Use

In addition to a well-scoped business objective, South Sioux City also has a clearly-defined financial model for its MWN. The initial capital investment for the MWN was funded by a Department of Homeland Security grant, and maintenance costs are covered by the retirement of the legacy radio system.

Conclusion

Due to a well defined scope of work and an established budget, South Sioux City was able to effectively increase the capacity of their wireless network from 9600 bps (using the legacy system) to 1.5 Mbps downstream and 512 Kbps upstream (using the pre-certified WiMAX technology). The MWN covers the entire target population, and the coverage even exceeds the original target in some areas. The success of South Sioux City's MWN has led to similar deployments of MWNs by several other municipalities in Iowa, Nebraska, and Minnesota adopting similar business objectives and financial models (South Sioux City, 2006).

DISCUSSIONS

In addition to the important criteria of business objective and well-defined financial model, there are other factors for municipalities to consider when deliberating an MWN deployment. These factors include municipal characteristics and legal issues.

Municipal Characteristics

Many different municipalities are considering MWN deployments, from 50-person townships, to rural counties covering hundreds of square miles, to major cities with millions of people. The particular characteristics on the city have a large effect on design, expectations, and costs. These characteristics include:

- City-specific requirements: What area of the city and what percentage of that area must be covered? What is the minimum desired service level (bandwidth)? How will the backhaul be handled?
- City assets: What assets does the city bring to the table? Many cities can offer utility or light poles, or rooftops of government buildings as places to site antennas. They may also have an existing fiber optic network which can be leveraged as backhaul connections.
- Maintenance operations: Once deployed, the MWN has to be maintained and operated. The responsibility of maintenance has to be clearly defined (e.g., maintained by city workers, vendors, or both).
- Evolution path: Due to rapidly evolving technologies, an MWN can be expected to become obsolete in three to five years, the timeframe of which generally follows typical IT upgrade cycles. The city needs to clearly specify what the expected life of the deployed MWN is and what process to take to initiate the upgrade cycle for the next MWN.

Legal Issues

There are two major legal considerations for municipalities considering the deployment of an MWN. The first is the primary hurdle: state and federal law. Currently, there are legislations pending at both the federal and state levels concerning the role of public entities in deploying telecommunications services which have traditionally been provided by the private sector. There are currently federal bills in committees in both the House and the Senate regarding MWNs. One is Senate Bill S.1294 (Community Broadband Act of 2005), which is an amendment to the Telecommunications Act of 1996 intended to preserve the right of localities to provide broadband services (S.1294, 2005). A competing House Bill, H.R. 2726 (Preserving Innovation in Telecom Act of 2005) actually prohibits municipalities from providing broadband or telecommunication services unless private enterprise has already failed to do so (H.R.2726, 2005). Since federal laws may supersede state laws, any municipality interested in deploying an MWN should maintain an active political presence and be cognizant of the legislative environment. However, given the popularity of MWNs (and subsequent legal challenges that will arise from cities fighting any federal law prohibiting MWNs), it seems unlikely that any congressional passage will have a major effect in the immediate future.

Regarding state legislation, there are two states—Iowa and Ohio—that have pending "anti-MWN" legislation, and 15 states that have already passed laws prohibiting or restricting MWN deployment. One such state, Pennsylvania, has a compromise law that allowed the Philadelphia MWN project to go forward, but prohibits other municipalities from deploying MWNs (Hamblen, 2005; Patton, 2006).

The second legal issue is obtaining licenses in the event an MWN deployment uses wireless technologies that operate in licensed spectrum (regulated by the Federal Communications Commission). Many wireless technologies use unlicensed bands, but the advantage of using licensed band is a lower interference generated by competing systems (of carriers or consumers). Municipalities wishing to deploy MWNs in licensed spectrums need to coordinate with the FCC

CONCLUSION

This paper discussed the motivations for MWN deployments and proposed an evaluation framework of RFPs issued by municipalities. The research considers three municipalities and applies the developed framework to their actual projects. It is found that an effective MWN RFP forms the basis for planning a successful project. Such RFP includes clearly-defined goals and financial models, which should be clear as to avoid the need for later clarification. From the cases studied, regardless of the size or scope of the RFPs, clear business objectives and focused financial models should increase the likelihood of useful vendor responses. In addition, vendor proposals can be fairly compared. In contrast, responses to an RFP that lacks a clear business plan and financial model may only be compared either quantitatively (by cost, for example) or qualitatively, and thus cannot be uniformly evaluated. Moreover, other factors such as city characteristics, costs, and legislative environment which influence the MWN design and analysis process are also discussed.

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