

# IDENTIFICATION OF ISSUES AND BUSINESS MODELS FOR WIRELESS INTERNET SERVICE PROVIDERS AND NEIGHBORHOOD AREA NETWORKS

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## Abstract

*In the space of unlicensed wireless communication, the IEEE 802.11 group of standards has seen an unprecedented growth in installation and use. Commercial interests such as Wireless Internet Service Providers (WISP) as well as community-based Neighborhood Area Networks (NAN) have started deploying services based on the rapidly growing IEEE 802.11b standard. Such networks allow users to access the Internet at speeds greater than the ones provided by cellular wireless and other competitive services. Both WISPs and NANs provide service to the consumer, but the methods of generating revenue for sustained service differ. We have proposed in previous research that such differences can be represented roughly by four dimensions: technological, financial, legal, and social. This paper extends our efforts in two ways. First, it identifies primary concerns and issues along the lines of these four dimensions. Next, the paper identifies the implicit and explicit business models adopted and used by WISPs and NANs. Our methodology involves in-depth interviews of a group of experts who are proponents of major WISP and NAN efforts in the US. The results of the study provide insight into the primary issues. Further, the research helps in identifying some of the business models that are being used to generate revenue and sustain Wi-Fi services.*

## Introduction

The use of wireless networks has promised to physically disconnect individuals from their office and their desk. This technology has allowed mobile users to operate their laptops or handheld devices while traveling or working away from their office. Like other services, wireless services come with various costs including limited bandwidth, frequency spectrum

licenses, equipment expense, and maintenance costs. In the case of cellular wireless, the cost of licensing frequency spectrum is high, which provides a significant barrier to entry. In contrast, in IEEE 802.11b, also known as Wi-Fi (Wireless Fidelity), the frequency spectrum is unlicensed. (Recently, the FCC decided to release additional bands in the frequency spectrum as unlicensed (FCC, 2001).) Consequently, no licensing fees are required to provide services using this technology and the barrier to entry is low.

Two different types of services have emerged around Wi-Fi. One pertains to the use of wireless networks at locations called hotspots. Users take their laptops or handheld computers to these locations and use the wireless network for a fee, which varies and can follow several payment schemes. These services are generally available at commercial establishments such as coffee shops, bookstores, hotels, and airports (ABI, 2001). This approach resembles the classic wired ISP service, and has been dubbed Wireless ISP or WISP. The other type of service is provided by community-based groups, which also provide Wi-Fi service, but in community locations such as parks, libraries, and schools. These groups do not bill the user for the service, as it is provided as a community benefit. Such networks are generally called Neighborhood Area Networks or NANs (Pojar, 2001).

At first glance, it appears that beyond basic equipment costs, a NAN has no other issues, such as those related to security, billing, metering, etc. Therefore, it would appear that the common characteristics of a business model do not apply to NANs (Flickenger, 2002). On the other hand, because a WISP provides a service for a price, numerous issues related to billing, authentication, security, etc., are relevant. Digging deeper into this area, we find that issues arise related to bandwidth, equipment upgrades, maintenance, legal use of residential broadband connections, and other concerns. Further issues include technological changes, legal intricacies of the FCC rules and regulations, financial support and growth, and social community building resulting from the use of publicly available wireless networks, be it for a price or free. These issues apply to both WISPs and NANs, although to varying degrees.

## **Methodology**

Having developed a hypothetical distinction along the lines of technological, legal, financial, and social dimensions (Verma and Beckman, 2002), we approached a group of experts to gather their views, opinions, and concerns regarding the general state of wireless networks and to seek general direction for future research. Due to the constraints of time we were unable to go beyond one round of interviews for this paper. We intend to complete the second round soon and will publish the comprehensive outcome in a subsequent paper.

Use of Wi-Fi is in its initial stages. We are beginning to see its use in residential areas and small business settings. As our study is an attempt at establishing general direction for future research, we opted to gather opinions of experts in this field using the Delphi approach. We used this method because it is a good fit for examining unstructured and semi-structured problems (Schmidt, 1997). The Delphi approach, as opposed to the other approaches such as the focus group method or the nominal group technique, does not require the presence of the entire group in the same location at the same time. Interviews can be conducted via phone, fax or e-mail. Given the geographic location of experts, we decided to talk to them on the telephone and gather their opinion via semi-structured interviews. The questions were designed for open-ended discussions (see appendix 1 for questionnaire). We contacted nine experts via e-mail in the US. Of these, six responded in time for a telephone interview. We conducted the interviews over a two-week period. We gave all the candidates a brief overview of our research endeavors. The conversations were then noted and transcribed for research. We spoke to three experts who are related to WISP installations, and three experts who have worked with NAN operations. Their opinions were categorized and tabulated by issues to draw out common themes and patterns. The following sections describe issues that were most prominent along each of the dimensions.

## **Technological dimension**

In previous research, we proposed a framework consisting of four dimensions: technological, financial, legal and social (Verma, and Beckman, 2002). Examining the technological dimension, we found that the primary concerns of the experts related to four issues:

- Security
- Ease-of-use
- Standards
- Integration of technologies

We summarize the expert's comments on each of these issues here.

### ***Security***

The issue of security relates to the failure of current encryption technologies such as WEP (Borisov, Goldberg, and Wagner, 2001) to protect data, and a lack of standardized approaches to improve security. The solutions exist either as proprietary implementations or as patches to existing approaches. The other concern raised about security was a lack of proper end-user education. Vendors of Wi-Fi access points (AP) can choose to sell their products with encryption settings enabled or disabled. It appears that in certain cases, vendors have chosen to disable the encryption settings in order to reduce end-user configuration issues with encryption keys. Due to this default setting and a lack of end-user education on the merits of encryption, the experts found numerous open and unprotected Wi-Fi access points with default settings. Software such as NetStumbler (NetStumbler, 2002), or Kismet (KismetWireless, 2002) allows users to sniff out these default settings in the vicinity of Wi-Fi networks and then use these settings to connect. Windows® XP includes this functionality in the operating system itself. It appears that the problem is not that of the encryption standard, as it is one of end-user education; a more informed end-user might be prudent about what benefits encryption-based security provide.

### ***Ease-of-use***

Ease-of-use is another technological issue with the current implementation of Wi-Fi. This issue relates to the problems at various levels, including network configuration difficulties, user interface design, and general use of the technology. Recent improvements, such as automated Wi-Fi detection in newer operating systems, make it easier to use the technology. While the market is being flooded with products, the current implementation of technological offerings may not be mature enough for the average user.

### ***Standards***

The third issue concerns the standards that apply to interoperability. Here again, we found that the issue is of concern at various levels. Interoperability is a problem within IEEE 802.11b because variations of this standard have been implemented. It is also a problem between IEEE 802.11b, 802.11a, and 802.11g standards. In addition, security standards, such as IEEE 802.1x, have not been widely implemented. The experts also expressed a concern with the lack of billing standards between WISPs, thereby hindering the possibilities of roaming and authenticating across different service providers.

### ***Integration of technologies***

While cellular wireless and Wi-Fi operate in independent frequency spaces and have different licensing models, it is technically possible to integrate the two via authentication and billing services. However, the issue of integration between Wi-Fi and third generation cellular wireless services might hinder the growth or co-existence of Wi-Fi. While some products exist that allow the user to switch between the Wi-Fi and 3G services, the integration of such services is very limited.

## **Financial dimension**

In previous research, we identified the issues of payment schemes and franchising as being important in the financial dimension (Verma, and Beckman, 2002). The experts provided us with several other issues in this dimension. The financial dimension is perhaps one of the most prominent one that was described during the interviews. The primary issues in this dimension are:

- Return on investment (ROI)
- Fragmentation of the value chain
- Variation in payment schemes
- Integration of services

### ***Return on investment***

ROI can be easily justified in some cases (as with WISPs), but is more difficult to justify in certain other cases. WISP

developers appear to use one of two approaches in the design of their services. In one approach, the initial investment in the WISP is high because the developer chooses to build in future growth and capacity initially. The WISP's APs have a large coverage, and the backhaul bandwidth is high. In the other approach, the WISP developer chooses to start with a limited capacity, often at one-tenth the cost, and estimate future growth based on projected customer use patterns. In either approach, the ROI model for WISP is clear, although projected low initial volume may mean an extended planning horizon is required in the ROI calculation. A type of revenue model used by a limited subset of WISPs is franchising in which a service provider (or even an individual) may choose to provide their Wi-Fi services under the franchise of an existing brand. While franchise schemes use a variety of revenue sharing methods, the ROI for the service provider and the equipment owner is not clear. The future of such franchises is questionable due to high fragmentation of revenue.

Comparing Wi-Fi with cellular raises one concern about the potential ROI for Wi-Fi. The cellular wireless model of building cells around towers may not apply in the case of Wi-Fi. Differences in range and availability of spectrum provide dissimilar service systems. The cellular approach can guarantee service inside a cell, which extends over a large area, but a Wi-Fi network, which might extend a few hundred feet, cannot guarantee bandwidth or quality of service. Cellular network operators invest significantly in the initial setup of cells because the expected rate of return in that market is high. Smaller coverage areas and lack of ubiquity, however, may mean that high investment in Wi-Fi installations may not yield an adequate return.

An example provided to us by one of the experts illustrates a case of improved business return when Wi-Fi services are added to an existing enterprise. The enterprise is an association, consisting of representatives of businesses that surround a public park. It is in the best interest of the businesses to keep the park clean and attractive so as to attract customers and thus the association pays for maintenance of the park, including garbage collection, lawn mowing, and general beautification. A NAN group approached the association with a proposal to set up a wireless network in and around the park. The association would pay for the equipment, and one or more businesses that have existing bandwidth for business use would donate a part of it for public use. Once operational, the NAN service would become part of the total package, along with other park maintenance services, provided by the association. The free wireless service, which is now operational, encourages mobile users to work outside their offices a few hours a day, thereby bringing more customers to the surrounding businesses. This example illustrates the matching of the need for a free public wireless network with the needs of local businesses, thereby establishing a steady revenue source and providing a value-added service.

### ***Fragmentation of the value chain***

The fragmentation of the wireless value chain is a consequence of the current wireless market. Due to low barriers to entry, the Wi-Fi market space has become very crowded. Networks are being run by everyone from individuals to corporations. The overcrowded value chain has become so fragmented that small players have little or no incentive in the long run. Once the novelty effect of running Wi-Fi networks wears off, the small players will either have to leave, or be merged with larger players to act as affiliates for horizontally integrated services such as authentication or billing.

### ***Variations in payment schemes***

Several payment schemes are in use. The most common ones are flat-fee billing, pay-per-use billing, micro-payments, and value-added billing. Flat-fee billing, as the name suggests, bills the user on a fixed cycle such as once a month. The usage is not metered, although some providers might limit transfer rates. Pay-per-use billing is more cumbersome because it requires careful records of the time that the user was online. The fact that Wi-Fi cannot guarantee bandwidth complicates the issue of pay-per-use. Micro-payments are schemes in which the user can buy access to Wi-Fi services in smaller chunks such as a few minutes or hours. This scheme may bill the user after the service (via a credit card account) or work as a pre-paid service, although the problem of running a non-guaranteed service on a metered system may not be a popular choice among consumers. Value-added billing is a scheme where the user pays an incremental amount in addition to the dues for an existing service such as a club membership.

### ***Integration of services***

The issue of the state of the industry with respect to service integration is important. The current Wi-Fi market has very few vertically integrated efforts because the initial investment is high. Only companies with access to large capital can start this way. Project Rainbow, a joint effort by IBM, Intel, and a number of Wi-Fi operators (InfoWorld, 2002) may be a vertically integrated service when implemented. Currently, most vendors are horizontally integrated along the lines of billing and

network infrastructure. A consequence of this fact is a fragmented value chain, as discussed earlier. The high costs of vertical integration acts as a barrier to entry, forcing companies to be horizontally integrated. Horizontal integration, having a much lower initial cost, brings many players to the market, thereby fragmenting the value chain. Eventually, the market will move in the direction of vertical integration through new players or through mergers and acquisitions, although there is no clear indication of the timeframe or approach.

## **Legal dimension**

Previous work suggested that the primary legal issues impacting Wi-Fi business models were related to the legally binding laws and agreements that bring together Wi-Fi system manufacturers, high-speed Internet service providers, and end-users (Verma, and Beckman, 2002). Therefore, it was expected that the most important legal issues with respect to Wi-Fi business models would center on the role of the FCC and Acceptable Use Policies. While these issues were important to the experts, additional legal issues were identified. The primary issues in the legal dimension are:

- The role of the FCC
- Acceptable use policies
- Right to use
- Intent to connect

### ***The role of the FCC***

One of the most important legal issues related to the Wi-Fi market is the role of the Federal Communication Commission (created by the Communications Act of 1934 and amended by the Telecommunications Act of 1996). The FCC, as a governmental body, sets the regulations for all wireless communications within the United States, including those associated with the 802.11 group of protocols. The most important factor related to the FCC's regulation of the Wi-Fi market is that it is, for the end-user, unlicensed. Consequently, no person or entity needs a special license to operate Wi-Fi devices, as long as the manufacturer of that device adheres to the power limits placed on that type of device. Also related to regulatory issues is the possibility that the FCC will choose to enact tighter regulations relating to the power and/or frequency range of Wi-Fi devices. This type of action could seriously impact business models that rely on relatively un-fettered access to the 802.11 group of protocols.

### ***Acceptable use policies***

Another important legal issue concerns Acceptable Use Policies (AUPs), which are the legal contracts that bind the provider and user of wireless (and wired) services. Traditionally, AUPs have prohibited end-users from re-selling their Internet service to another party. Recently, however, some wireless "franchisers" have partnered with traditional ISPs, with the explicit permission that end-users can re-sell or re-distribute their Internet service through a wireless medium (typically 802.11b). Explicit AUPs with clear legal language will encourage people to use the service without the fear of violating someone's ISP contract.

### ***Right to use***

A third legal issues involves the "tragedy of the commons", which refers to public amenities that are free and therefore over-used. Because of the public nature of Wi-Fi it is possible that two users may end up interfering with each other by operating on the same frequency range. There is apparently no current case law that can determine unequivocally who (the first user operating on that channel, the most powerful transmitter, etc.) has the "right" to use a particular frequency when implementing a Wi-Fi system.

### ***Intent to connect***

Finally, an issue peripherally related to the legal dimension is that of "intent to connect". A problem arises when a computer end-user connects to a Wi-Fi network without the user's explicit knowledge or consent. This situation can occur with new personal computer operating systems that "automatically" sniff out and connect to any Wi-Fi network, which can happen without the knowledge of the user of that computer. The legal issue here is whether that user can be prosecuted for "hacking

into” that network if they did not have the “intent to connect”. This problem is also closely related to the default security settings with which most Wi-Fi systems are installed.

## **Social dimension**

Previous work indicated that the primary difference between WISPs and NANs, with respect to the social dimension, is that the fundamental purpose of NANs is to build communities and the fundamental purpose of WISPs is to make money (Verma, and Beckman, 2002). Therefore, one can expect that the social issues related to NANs relate to those that involve getting the community together and/or providing free high-speed computer connectivity for social gatherings. Conversely, the primary social issues related to the WISP business model are those that impact the ability of the organization to make a profit. The primary issues in the social dimension are:

- Changed nature of work
- Use in remote locations
- War-chalking

### ***Changed nature of work***

The most important social issue related to Wi-Fi is that it can fundamentally change the nature of work. This can happen by changing the “place” in “workplace”. If and when Wi-Fi service becomes ubiquitous, one will be able to work from any physical location. It will no longer be necessary to be physically connected to one’s workplace or to the Internet, freeing information workers to complete their tasks from a location of their own choice.

### ***Use in remote locations***

Another social issue is the use of Wi-Fi in remote locations where other high-speed access methods may not make physical or financial sense. For example, small communities that do not have universal cable or DSL Internet access can supply high-speed Internet access by sharing one or a small number of high-speed wireless connections. This process could work well for small and isolated communities. Wi-Fi can also be used for local and short-term ad-hoc network connectivity, such as might be useful for community art festivals or other occasions that bring the community together for an event that requires high-speed computer connections. One possible application related to this issue is the use of Wi-Fi for public safety uses, which could occur at times when more traditional high-speed computing networks will not work, such as might happen during a natural disaster like a tornado, flood, or earthquake.

### ***War-chalking***

Finally, the social issue of war-chalking (War chalking, 2002), the private “graffiti-like” marking of publicly accessible Wi-Fi connections, appears not be as relevant as perhaps thought in the past. It is most likely merely a statement about the security (or lack thereof) that is prevalent in many Wi-Fi configurations. War-chalking perhaps could be used as a marketing tool by Wi-Fi franchisers who would like to publicly identify areas that are covered by their particular brand of Wi-Fi provider. It can also generate some adverse feelings or reactions among those Wi-Fi providers that do not want the general public to know of and/or access their Wi-Fi node.

## **Other issues**

The primary issue raised by the experts that was not in one of the four dimensions (technological, financial, legal, and social) was that of standards. This issue was brought up several times, and cut across several of the dimensions. For example, the issue of standards is very important in connection with the financial dimension, as better and more complete sets of technical standards will allow for the development of more comprehensive and complex business models. One example of this is the implementation of standards for cross-billing of wireless usage for different “brands” of APs, which will help bring about the ability for users to connect anywhere at any time without having to be concerned about whose AP they are connecting through. Standards are also very important with respect to the technology dimension, as newer standards may allow for more powerful APs or more robust security schemes than are currently in place.

A second unclassified issue that was brought up relates to the FCC's original intended use of the 802.11 group of protocols versus how they have actually been used. The 802.11 group of protocols were originally meant for wireless connections between computer devices within an office. However, the protocol has since been adopted for numerous other uses, most commonly to allow high-speed connections to another computer or network over an area much larger than an office. (In fact, some countries other than the U.S. strictly limit the 802.11 frequency ranges to within buildings; no signal is allowed outside of the building containing the transmitter.) Because there has been a significant alteration in the use of the protocol from its intended operation, it is difficult to predict what will be the largest impacters on its adoption, diffusion, and general acceptance.

## **Business Models**

By combining the different issues and the opinions of experts along the four dimensions, we were able to gather information about the ways in which WISPs and NANs attempt to generate revenue. The technological dimension gives us an insight on the types of installations and their costs. The financial dimension allows us to look at different ways in which revenue may be generated. The legal dimension gives us an idea about the types of ISP agreements that can allow a user to resell or franchise his bandwidth and Wi-Fi connection. The social dimension acts as an element that will help in the diffusion of Wi-Fi services. The following are the types of models that we were able to discern.

### ***Primary Models***

The primary business models commonly used by WISPs extend existing wired ISP revenue models into the wireless market. In the short run, these models might be successful, but they target the corporate user who might need a wireless Internet connection while traveling. The high costs make these models unattractive to the average residential user. WISP operations consider popular businesses such as coffee shops, bookstores, and hotel lobbies as hotspots. It is a rare occurrence to find a commercial WISP providing service in a residential neighborhood. Irrespective of the payment schemes, the WISP model is still very expensive for the average residential customer. One possibility, as suggested by one of the experts, might be to provide wireless roaming at popular hotspots as a value-added service on top of an existing ISP contract. The value-added can be for a marginal fee, which would encourage occasional use and could eventually lead to a higher adoption rate.

### ***Emerging Models***

Micro payments, as suggested by some of the experts and discussed at length over Internet discussion groups, would provide value to the user along the lines of marginal utility. A business model based on this form of payment would allow users to use the service occasionally, without being bound into a long-term contract.

### ***NAN Models***

The business models powering the NANs are more implicit. At first glance, the NAN concept does not evoke the need for a business model. Because NANs do not impose authentication, security, and billing, the management of such networks appears very simple. However, there are fixed and variable costs involved in the installation and use of a NAN. Equipment and labor are typically one time costs, but backhaul bandwidth is a recurring cost. In most NANs, the bandwidth is paid for by neighbors who have a pre-existing commercial broadband connection. Occasional use of bandwidth outweighs the benefits of free Wi-Fi in the neighborhood. The case of providing community service in parks by including it as part of an existing service is an interesting option that may be pursued by community networks. Another approach that might work would be to run the NAN as part of a larger co-op effort and use a part of the membership dues to pay for the expenses of running a NAN.

## **Future Co-existence**

The experts were also asked about the future co-existence of WISPs and NANs. We received a mixed response, to this

question, although the reasoning for the responses appears to be similar. Some experts pointed out that NANs play an early adopter role in the area of Wi-Fi and help in the diffusion of the concepts. They also act as experimental grounds to test newer approaches to the technology and the service. However, because the NANs do not have a revenue model they are not viable in the long run. Other experts disagreed by pointing out that NANs and WISPs are fundamentally different services running on top of the same technology base. WISPs define their hotspots in commercial neighborhoods such as airports, hotels, malls, coffee shops, and bookstores. NANs are run in residential neighborhoods and on university campuses where the users do not explicitly pay for the services. Wi-Fi is simply provided as part of a larger service model such as college fees, co-op membership fees, or neighborly goodwill. Because both models are mutually exclusive for most implementations, the co-existence will remain in the near future. The size and coverage will be different, however. It is expected that WISPs will have wider coverage, and will allow more roaming possibilities than NANs, but the two models will continue to grow in the near future.

## Summary and Conclusion

The first round of the Delphi study has given clear directions for further investigation in each of the four dimensions. The important issues are summarized in Table 1. In the technological dimension the issues that need to be examined are security, ease of use, standards, and integration. The financial dimension encompasses issues of return on investment, fragmentation of the value chain, variations in payment schemes, and integration of services. The payment schemes that could be examined include micro-payments and pay-per-use. Overall, the cost of using Wi-Fi must come down to encourage the average user to subscribe. Emerging models such as micro-payments may play a role in niche markets. In cases where the revenue stream is very slow, NANs can explore the merging of Wi-Fi as part of existing community services. Along the legal dimension, the role played by the FCC, acceptable use policies, right to use, and intent to connect are important issues. The FCC may play a role in the near future that will mold the diffusion and growth of future wireless networks. By providing more spectra for unlicensed use, the FCC may be able to slow down overgrazing. The availability of the 5GHz spectrum is a step in this direction. As time goes by, we expect the ISPs to modify their AUP clauses so that end-users can choose to share a part of their bandwidth. Given the trend of newer ISPs allowing their users to do so is a favorable direction. On the social dimension, the changing nature of work, the use of wireless in remote locations, and war-chalking are important issues. It appears that apart from active discussions between NAN groups, and active sharing of ideas, the NAN concept has done little community binding. However, monthly meetings, gatherings and future work may help in bringing the communities together. The impacts of mobility on the social aspect of community interaction are unclear. Finally, other issues identified were the overall presence of standardization issues related to encryption, authentication, billing, metering, and legal operation. These issues appear across all categories.

It appears that although both WISPs and NANs utilize the same technology platform (namely, Wi-Fi) the two approaches provide very different types of service. As their market focus is mutually exclusive in most cases, the two will continue to co-exist. NANs will lead the way in experimenting with new services and will influence overall adoption. WISPs will establish services in markets where revenue and ROI are more stable and well defined.

<b>Technological</b>	<b>Financial</b>	<b>Legal</b>	<b>Social</b>	<b>Other</b>
<ul style="list-style-type: none"> <li>• Security</li> <li>• Ease-of-use</li> <li>• Encryption and authentication Standards</li> <li>• Integration of technologies</li> </ul>	<ul style="list-style-type: none"> <li>• Return on investment</li> <li>• Fragmentation of value chain</li> <li>• Variations in payment schemes</li> <li>• Integration of services</li> </ul>	<ul style="list-style-type: none"> <li>• The role of the FCC</li> <li>• Acceptable use policies</li> <li>• Right to use</li> <li>• Intent to connect</li> </ul>	<ul style="list-style-type: none"> <li>• Changing nature of work</li> <li>• Use in remote locations</li> <li>• War-chalking</li> </ul>	<ul style="list-style-type: none"> <li>• Standards related to technology, billing, etc.</li> <li>• Intended vs. actually use</li> </ul>

**Table 1: Important Issues**

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## Appendix 1: Questionnaire for Delphi Process

Generic questions to ask experts in the Wi-Fi or IEEE 802.11b area:

Interviewer: \_\_\_\_\_ Interviewee: \_\_\_\_\_

We are a group of researchers at SFSU, studying the business aspects of wireless networks. We are in the process of studying the various factors that could influence the development of business models for Wi-Fi.

We have narrowed the issues to four dimensions, namely technology, financial, legal and social. We would like to get your opinion on some of the issues in these dimensions. Further, we would like to get your input on some of the other issues that you think are important and need further research.

Demographics:

What role do you play in the field of Wi-Fi? Or, How are you connected to the field of Wi-Fi?

How many years have you been working with/using Wi-Fi?

Dimensions for study:

### 1. Technology

A) In your opinion, what are the most important technology issues related to Wi-Fi?

B) Are there any important issues related to:

- authentication services?
- billing services?
- security services?
- lack of a common worldwide database of open access wi-fi nodes?

### 2. Financial

A) In your opinion, what are the most important financial issues related to Wi-Fi?

B) Are there any important issues related to payment schemes (such as flat fee, pay-as-you-go, franchise, cooperative membership)?

C) An ISP or co-op could support everything from backhaul bandwidth to access points. This would be vertical integration of services. On the other hand, a company or group could pick one service such as providing backhaul bandwidth, or providing billing services, or centralized authentication services, and provide that service to a variety of co-ops and ISPs. This would be horizontal integration.

What is your opinion on the issue of horizontal vs. vertical integration?

### 3. Legal issues

A) What are the most important legal issues related to high-speed wireless networking?

B) Is the legal issue of "intent to connect" important? For example, Windows XP allows you to connect automatically to a network available in the vicinity without your explicit consent. However, it is also possible to explicitly connect to a known network. Is it important to legally distinguish between intentional vs. non-intentional connections?

### 4. Social issues

A) What are the most important social issues related to high-speed wireless networking?

B) Are any of the following important issues?

- The development of "paranets" (wi-fi networks that are closed to the Internet, and are not carried over any ISP connections. This is like a closed intranet, supporting the needs of a community by providing internal resources).
- The impact of possible consolidation of different databases of open nodes, on community ties in small or large areas?
- Phenomena like warchalking, (where people draw symbols in chalk representing availability of wireless access in the vicinity. These symbols display information such as the SSID, available bandwidth, etc. for a passerby to connect to the wireless network) and wardriving (where people drive around neighborhoods, trying to detect open networks and cataloging the availability along with latitude and longitude values recorded via a GPS system.)

5. What other issues do you think are important for studying business models related to Wi-Fi ?

6. In providing Wi-Fi access, do you think commercial (WISP) organizations will be more successful than non-profit (NAN) organizations or will they co-exist?