

Estonia, The Internet, and Wireless Development: A Brief History and Looking Forward

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## Table of Contents

<b>I. Introduction</b>	3
<b>II. Why Estonia?</b> An Unexpected First Step Toward Wireless & the Current State of Affairs	5
<b>III. Broadband Wireless Access Technologies:</b> An Overview	9
<b>IV. Looking Forward:</b> A Policy for Estonia's e-Governance Academy	16

# I. Introduction

Over the past 20 years, we have seen significant changes in information technology, from the earliest personal computers and dial-up modems to increasingly powerful and portable systems, outfitted with “always-on” broadband Internet connections.

A major revolution in the way the world uses computers and networking technologies occurred when broadband Internet connections became available to the masses and began replacing dial-up connections in homes, universities and offices. It was at this point that the Internet began enabling the average person to access content beyond text and simple images, making computers and the Internet even bigger parts of our lives than they had ever been before. As we have interacted with computers more and more, primarily due to the fact that we have been able to connect with each other faster than ever, the Internet has come into its own as we know it today.

Alongside the Internet revolution, another significant revolution was taking place: the rise of mobile phones. Mobile phones also find their roots in the early 1980s, when the first handheld cellular radio devices became available. While the technology has changed quite a bit over the past 20 to 30 years, this preliminary revolution in mobility gave us a taste for what our computers could become, even if most people did not instantly realize exactly what was happening.

Over the past few years, we have seen wireless proliferation continue with the rise of Local Area Networking (LAN) technologies. At present, the most notable of these technologies is WiFi, which is the commonplace name for the Institute of Electrical and Electronics Engineers (IEEE) 802.11a/b/g/n standards, respectively. More recently, other personal area networking technologies have emerged, such as Bluetooth (IEEE 802.15.1 standard) – and Zigbee (IEEE 802.15.4 standard). But despite the increased mobility and ease of use that such networking technologies afford many members of society,

by no means is the wireless revolution in computing complete. In fact, one could argue that it is just now starting.

With this in mind, long-range Broadband Wireless Access (BWA) technologies are some of the most important things for societies to consider as we move into the future. Technologies such as WiMAX (IEEE 802.16 standard) and WiBro, the Korean standard of the technology, promise faster network connection speeds than most people have ever used, and as the technology continues to be developed, increased mobility with our networked devices. Ultimately, this heightened mobility will allow societies to be even more connected on internal as well as global levels. In essence, the move toward BWA technologies represents the fusion of the world's two major technological revolutions of the last two decades: phones are becoming computers, computers are becoming phones, and the opportunities that our networked devices will present to us in the future are many.

Of course, while there are many opportunities this type of technology presents, questions about how BWA technologies (and which technologies, specifically) will develop and eventually be integrated into society remain. In conducting research as part of my Fulbright Scholarship, it has been my aim to begin to answer the numerous questions that we, as both citizens of individual countries, as well of the world, are beginning to face with regard to the opportunities that integrating wireless technologies into our world poses. In answering these questions, I have given both formal and informal interviews, read numerous articles on wireless technologies both in Estonia and around the world, taken excursions to remote parts of Estonia, and ultimately, I formulated a conference entitled *The Policy of Broadband Wireless Access Technologies*.

This document does its best to address how and why Estonia has pursued wireless technologies so vigorously to date, why Estonia has had the success they have had, and what the future holds for

wireless technologies in Estonia and in general. Ultimately, I will suggest a policy regarding Broadband Wireless Access technologies for the e-Government Academy, and potentially for all of Estonia.

## II. Why Estonia? An Unexpected First Step Toward Wireless & The Current State of Affairs

When I tell my friends and colleagues in America about the research I have done in Estonia, most are surprised to hear the topic was wireless technologies. A few people understand instantly and say, “Yeah, Estonia’s incredibly developed with regard to wireless!” but the truth is that most (somewhat ignorantly) assume the opposite; that I must have come to Estonia to *teach* about wireless networks, as a country that is so recently independent and has so few resources coming out of such adverse times couldn’t *possibly* be a world leader in wireless technologies.

For someone who hasn’t been paying a lot of attention to the Baltic States since the fall of the Soviet Union, this notion is at least a bit forgivable. I feel somewhat bad admitting this after living in Estonia for almost a year, but when I arrived, like many Westerners I had a stereotypical image in my head of what “Eastern Europe” would be like. In many ways I expected the standard of living for everyone to be *far* below that of the U.S., for all of the buildings to be in disrepair or entirely abandoned, and to encounter bureaucracy like I’d never seen before.

In reality, however, what I’ve found defines Estonia and Eastern Europe are not the remnants of the Soviet Union, but the progress these countries have made since breaking free of Soviet occupancy more than 15 years ago. Living in Tallinn for 11 months has made it clear to me that the stereotypes Americans typically have toward many former Soviet states are seriously due for an overhaul, as countries like Estonia lead the pack of former Soviet satellites toward prosperity. Sure, there are a few abandoned buildings and I’ve had overly-bureaucratic experiences in Estonia, but these are clearly exceptions to the rule.

Instead, the new rule seems to be “technology everywhere.” In Estonia, I found more cell phones than people and nearly ubiquitous WiFi coverage across the country, both commercially and in homes of citizens. I found national identification cards embedded with a microchip, which allow citizens to utilize a variety of online “e-services” in day-to-day life, from e-Tax systems and e-Banking to e-Healthcare, and in October 2005, **for the first time anywhere in the world**, nationwide e-Voting. I even found Estonians designing a variety of mobile-solutions (m-solutions) that simply haven’t been given much (if any) consideration for use in America and the western world, such as payment systems for mobile phones (that threaten to replace credit card payments), location-based ‘friend finders,’ and even emergency services, such as e-Police systems.

I love sharing the story of the Estonian ‘wireless miracle’ with outsiders, and when I explain a bit about my research and how the country has embraced wireless technologies, without fail I get the question, “*How come?*” And with good reason: why is Estonia more progressive and developed (specifically with regard to information technology) than are Latvia, Lithuania or any other former Soviet country, for that matter?

After hearing a few facts about my research and about the technological climate in Estonia, most people assume that the progress this country has made roots back to the exceptional focus the country has placed on technology since gaining independence, in programs like *TigerLeap* and *Look@World*. In fact, this is what *I* assumed before I got arrived in country. But as I began talking to the people who actually *guided* Estonia from repressed Soviet state to world leader in wireless technologies, I found myself surprised: Estonia’s technophilic nature is not so much a cause of progress, but rather, a symptom of it.

So, what initially distinguished Estonia from its counterparts? The answer I found was actually quite surprising. According to Avo Ots, professor of Radio Engineering at Tallinn University of

Technology and former member of the board of directors for Estonian Mobile Telecom (EMT), the Estonian focus on technology originally was unintended. Instead, what happened was that during the Soviet Era, when the USSR was stagnating under failing Communism, the top half of Estonia was receiving Finnish television broadcasts. Thus, Estonians were not only exposed to the Finnish language, but to Western ideals and the tremendous technological innovation that was taking place across Finland (take Nokia, for example).

Because Helsinki's T.V. feeds were all transmitted wirelessly, there was nothing Russia could do to stop Estonians from receiving and watching Finnish television. So, as Finnish technical innovation occurred, Estonians watched attentively and took notes, noticing the stark differences between the lives they were living and the lives they were consuming through television. When the Soviet Union finally collapsed, Estonians embraced technology with open arms just as they had seen their Scandinavian neighbors do years before with great success. The analogy that comes to mind is that of water gathering against a dam; eventually the pressure breaks the dam and all of the water rushes through.

To me, the fact that one of the earliest wireless technologies is in large part responsible for Estonia's progressive nature with regard to wireless technologies like WiFi and mobile phones is just fascinating. In fact, the sheer numbers in Estonia with regard to the adoption of wireless technologies and Internet technologies are staggering. The mobile phone saturation rate is over 100% (meaning that some people have two and even three mobile phones), and in addition to the many citizens who use WiFi routers to broadcast their Internet connection across their respective homes, apartments, and summer cottages, there are over 850 public, commercial and municipal WiFi hotspots around the country—in supermarkets, coffee shops, ferry terminals, shopping malls, casinos, movie theaters, bookstores, car dealerships, computer stores, furniture shops, conference halls, bars, bowling alleys, pool halls, sports arenas, campgrounds, golf clubs, spas, parks, government buildings, libraries, marinas,

beaches, grammar schools, middle schools, high schools, universities, town squares, museums, theaters, bus stations, airports, botany gardens, and even in castles.<sup>1</sup> About 2/3 of the hotspots in Estonia are free to use, and the remaining 1/3 require a nominal fee (which is at most 24 EEK, or USD\$2)<sup>2</sup> for 24 hours of use—*far* less than access charges in most countries.

If we look to the technological horizon, it further solidifies the connections between wireless past and present in Estonia. Companies like WiFi.ee, Skype, the e-Governance Academy, and Estonian Internet Service Providers (ISPs) Elion Enterprises, AS Levira, Norby Telecom, and Baltic Broadband are all developing, deploying and giving demonstrations of new technologies and how they can affect positive change in citizens' lives. And it seems to be working—over the past year, WiFi.ee's catalogue of hotspots in Estonia grew over 50% and will cross the 1000 hotspot threshold by the end of 2007's first quarter.<sup>3</sup>

Judging the wireless growth in the past few years, it seems quite certain that Estonia will continue to lead the way in the future with regard to wireless technologies and to information technology in general. But what is the future of wireless, you may be wondering? Is the answer just more WiFi? The long answer is yes, but the short answer is no: Broadband Wireless Access technologies will extend WiFi's reach and impact, but they also stand to revolutionize the ways in which we live, consume media, do business, and conduct ourselves in a variety of other ways.

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<sup>1</sup> WiFi Internet access is available in Laitse Castle and Narva Castle.

<sup>2</sup> XE Currency Trader. (<http://www.xe.com/>)

<sup>3</sup> Email communications with Veljo Haamer, founder of WiFi.ee

### III. Broadband Wireless Access Technologies: An Overview

The category of ‘Broadband Wireless Access technologies’ is not something that the average person knows much, if anything, about. And while neither are specific BWA technologies like WiMAX, WiBro, HIPERMAN (High Performance Municipal Area Networks) and 3<sup>rd</sup> Generation (3G) cellular networks, there is no denying the fact that the world soon will use them, even if people are not directly aware of each technology’s use. With this in mind, this chapter is an attempt to generally discuss the technologies in order to educate and inform people the average person—one who will not create or maintain the technologies, but may very well be using them in the near future. While I will at times use and discuss technical terms, I will do my best to keep my discussion at a level that can be understood by all.

While a number of different BWA technologies all may play roles in our future world, the wireless technology that is attracting the most attention around the world is IEEE standard 802.16, officially known as WirelessMAN (Wireless Mobile Area Network). In Europe and North America, this technology is commercially, and most commonly, known as WiMAX, whereas in Korea the “e” standard of 802.16 is most widely used, and is known as WiBro. To date, the Intel Corporation and Samsung Electronics have been most responsible for developing WiMAX and WiBro, respectively, and have joined with more than 450 other companies in the WiMAX Forum, a non-profit consortium designed to “promote and certify compatibility and interoperability of broadband wireless products.”<sup>4</sup> While both technologies appear to have very viable futures, I will mostly discuss WiMAX here, as this technology has already begun to be rolled out in Estonia. With this being said, however, many of my comments—particularly the ones relating to policy—can be applied to other BWA technologies as well as WiMAX.

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<sup>4</sup> WiMAX Forum. (<http://www.wimaxforum.org/home/>)

*So, what exactly is WiMAX?* The name ‘WiMAX’ is actually an acronym, which stands for ‘Worldwide Interoperability for Microwave Access,’ and contrary to popular belief, WiMAX itself is not actually a technology, though the name WiMAX has become synonymous with the technology it refers to. The Organization for Economic Co-operation and Development (OECD) explains:

WiMAX is...a certification mark, or 'stamp of approval' given to equipment that meets certain conformity and interoperability tests for the IEEE 802.16 family of standards. A similar confusion surrounds the term WiFi (Wireless Fidelity), which like WiMAX, is a certification mark for equipment based on a different set of IEEE standards from the 802.11 working group for wireless local area networks (WLAN). Neither WiMAX, nor WiFi is a technology but their names have been adopted in popular usage to denote the technologies behind them. This is likely due to the difficulty of using terms like 'IEEE 802.16' in common speech and writing.<sup>5</sup>

As the name WiMAX suggests, IEEE 802.16 was created as part of an effort to streamline wireless Internet connectivity around the world, and that is just what proponents of the technology hope will happen as they develop and begin to roll out the technology.

In its most basic terms, WiMAX can be thought of as long-range WiFi. The technologies are in fact very different, but for the average person the biggest differences have to do with each technology’s respective broadcast range, and the speed of each type of Internet connection. For reference, standard WiFi routers broadcast Internet signals up to 300 meters in radius, while WiMAX antennae have been said to broadcast over distances of up to *70 kilometers*. According to Alcatel WiMAX expert Bruno Potdevin, however, WiMAX signals realistically broadcast over radii between 15 and 20 kilometers in urban areas.<sup>6</sup> Even so, the low estimates of WiMAX’s broadcast range are 50 times longer than that of WiFi. Furthermore, WiMAX offers increased speed over WiFi. Laboratory tests of WiMAX yield speeds of up to 75 Megabit/second, however, Mr. Potdevin again clarifies that “in a real world situation,

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<sup>5</sup> The Implications of WiMAX for Competition and Regulation, OECD, March 2006, page 8.

<sup>6</sup> Bruno Potdevin, Speech at “The Policy of Broadband Wireless Access Technologies.” Tallinn, Estonia. 24.4.2006

WiMAX's speeds is more like 25 Mbit/second.”<sup>7</sup> In most cases, this is quite a bit faster than existing Internet connections—WiFi or otherwise.

*So why not use WiMAX today?* For one, WiMAX networks haven't been rolled out in most areas. While WiMAX licenses have been sold in most countries (including Estonia) and technological development *is* taking place, the technology is currently prohibitively expensive when compared with existing wireless solutions, especially WiFi. Not to mention the fact that virtually no individuals have WiMAX cards for their computers—either built-in or externally attached. So even though one WiMAX base station could theoretically potentially provide hundreds of 1.5 Mbit/second connections, or even thousands of 256 kbit/second connections, it is unlikely that we will see WiMAX-to-individual connections any time in the near future. This is not to say it is impossible or will never happen, but that it is unlikely given the current cost of WiMAX equipment combined with WiFi's nearly ubiquitous nature in today's world.<sup>8</sup>

Instead, what is likely to happen in the short term is that WiMAX will be used for what is called “backhaul”—the actual Internet connection that is broadcasted via WiFi or is distributed through a router or switch. No matter the location, one must have a router that at some point connects to an existing Internet connection in order to broadcast a wireless Internet signal. At present, the majority of WiFi connections are wired connections at their root, whether it be a phone line, an Ethernet cord, or rarer, a fiber optic cable that provides the initial connectivity. With this in mind, it makes sense that any WiFi or wireless connection is only as fast as the wired connection it draws from.

As a technology, WiMAX appeals to many people because it can accommodate more users per base station than can Universal Mobile Telecommunications System (UMTS) solutions, such as 3G. For example, with UMTS, 60 users can operate simultaneously through one base station. WiMAX, on the

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<sup>7</sup> Bruno Potdevin, Speech at “The Policy of Broadband Wireless Access Technologies.” Tallinn, Estonia. 24.4.2006

<sup>8</sup> WiMAX Forum, FAQ. (<http://www.wimaxforum.org/about/faq/>)

other hand, allows for 250 users to simultaneously utilize a base station's connectivity, without a drop-off in speed.<sup>9</sup> In urban areas, or in areas that have high Internet-usage among a diverse group of users, this difference is tremendous.

Of course, while WiMAX allows for more users to be connected to the Internet and to one another at the same time, there *are* some advantages of UMTS/3G over WiMAX at its current state of development. At present, 3G solutions provide users with fully-mobile Internet connectivity, meaning that someone using 3G to talk, surf the web, or stream media can move around freely and still maintain his or her respective connections, including video-enabled VoIP telephony and IPTV. WiMAX, on the other hand, has much higher data transfer rates which make it much more suitable for high-bandwidth applications, but is currently being deployed for fixed access Internet connections, as the mobile version of WiMAX (IEEE 802.16e, also known as WiBro) is still in developmental stages and will not be rolled out on large scales outside of Korea until 2007 at the earliest.

Some tests of WiBro have occurred in Korea, the US and around Europe, including at the Winter Olympics in Turin, Italy, in February 2006,<sup>10</sup> but mobile WiMAX is not yet ready to be deployed on large scales. When mobile WiMAX/WiBro *is* ready to be deployed in urban areas around the world, it will represent a drastic improvement upon even the most up-to-date UMTS solutions. According to Varun Singh of DMEurope.com, "UMTS allows users to make a single video call, [but] WiBro can handle multiple video calls simultaneously, allowing for multi-point video conferencing while simultaneously keeping open an audio, video, TV or internet multimedia session."<sup>11</sup> Indeed, the options for WiMAX, both fixed and mobile are many.

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<sup>9</sup> Bruno Potdevin, Speech at "The Policy of Broadband Wireless Access Technologies." Tallinn, Estonia. 24.4.2006

<sup>10</sup> "WiBro to get a workout at Turin Olympics." ([http://news.zdnet.com/2100-1035\\_22-5982548.html](http://news.zdnet.com/2100-1035_22-5982548.html))

<sup>11</sup> "Telecom Italia, Samsung sign agreement for WiBro trials." (<http://www.dmeurope.com/default.asp?ArticleID=11794>)

Whether or not WiMAX, WiBro, UMTS, or other wireless solutions are implemented to provide Internet connectivity to people will depend on the needs of each area in which users exist, and the needs of the type of users each network will attract. As Potdevin explains,

UMTS offers complete mobility. But you don't need complete mobility with broadband access. What you need is mobility with a certain level of broadband access, like with mobile television. People in Korea, for example, who use Mobile TV want to deploy WiMAX because Evolution-Data Optimized (EVDO)<sup>12</sup> standards are like mesh networks that ebb and flow, respectively... People like to play online in Korea, so you need a broadband technology, but broadband with a very low latency time. WiMAX/WiBro fulfills this need, whereas EVDO does not.

Furthermore, Internet users in rural areas will have very different needs than will those in cities. As I have discussed above, with a diverse population of users who want to be connected at all times and have high-traffic Internet usage, WiMAX appears to be the more suitable solution for Broadband Wireless Access.

We must keep in mind, however, that WiMAX's exact roles in societies are still being determined as the technology itself improves and the costs of implementation and integration decrease. The WiMAX we see today may look well different than the WiMAX of the future, but there is no denying its potential to connect a large number of people—particularly those who live in areas that are difficult or impossible to reach with wires—to the Internet. Whether this will be done with fixed WiMAX or the mobile variety remains to be seen, and will depend on the locale in which this technology is deployed, and the needs of the people who use it.

### **Broadband Wireless Access Technologies in Estonia**

There is no denying the influence of the Internet around the world, and in particular in Estonia. As of September 18, 2006, there were over 1.08 billion Internet users throughout the world, meaning

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<sup>12</sup> To get into the specifics of EVDO would be beyond the scope of this paper. For a primer on EVDO standards, please consult <http://en.wikipedia.org/wiki/EVDO>.

that nearly 17% of the world's 6.5 billion people use the Internet.<sup>13</sup> In Estonia, to compare, more than 60% of people aged 6 to 74 use the Internet (roughly 713,000 people)—almost 4 times the worldwide average. And in the next 12 months, Estonian Internet adoption is expected to increase by at least another 8%, as Estonia approaches an Internet connectivity saturation rate among citizens.<sup>14</sup>

When looking at other wireless technologies such as mobile telephones, and how Estonians have gravitated toward them, we see similar technocentric tendencies. As I have mentioned, more than 90% of Estonians have at least one mobile phone, and many people have two and even three of them. When looking at sheer numbers, in fact, one sees that there are more mobile phones in Estonia than people.<sup>15</sup>

When I look at what is happening in Estonia and around the world today, it is clear to me that with long-range wireless technologies on the horizon and improving every day, these two types of wireless networks will eventually become one. At times, citizens will be connected to the Internet via the networks that cell/mobile phones currently use, and at other times people will use their mobile phones to make calls via WiFi networks. The point is that Internet users don't care about *how* they are connected to the Internet, **but just that they are connected.**<sup>16</sup> As we move toward Broadband Wireless Access, it is easy to envision a world where connectivity is comprehensive and users can always be connected—if *they want to be*, of course.

In Estonia, WiMAX is just starting to be rolled out, which will continue through 2009 at the earliest. Four WiMAX licenses were auctioned off and awarded to Levira, Elion, Baltic Broadband and Norby Telecom. Levira is furthest along in the development and deployment phases, and is the process of installing WiMAX hardware on each of Estonia's television towers at the county level, though Elion

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<sup>13</sup> <http://www.internetworldstats.com/stats.htm>

<sup>14</sup> Email correspondence with Veljo Haamer, editor of WiFi.ee, on September 18, 2006. Data collected by TNS EMOR.

<sup>15</sup> *Ibid.*

<sup>16</sup> Personal interviews with Avo Ots and Veljo Haamer, September 2005 – July 2006.

is in close pursuit, having partnered with Alcatel.<sup>17</sup> Both will provide fixed access WiMAX, which will be used for backhaul and ultimately translated into WiFi so that citizens can use existing equipment to connect to the Internet. According to WiFi and WiMAX expert Veljo Haamer, Levira's nationwide WiMAX solution should be rolled out by early 2007, while other WiMAX license-holders Elion, Norby Telecom and Baltic Broadband are more focused on the Tallinn-area and are lagging a bit behind Levira's efforts.<sup>18</sup>

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<sup>17</sup> "Elion to launch WiMAX in 'a few weeks.'"

([http://www.telegeography.com/cu/article.php?article\\_id=14587&email=html](http://www.telegeography.com/cu/article.php?article_id=14587&email=html))

<sup>18</sup> Email correspondence with Veljo Haamer, editor of WiFi.ee, on September 18, 2006.

## IV. Looking Forward: A Policy for Estonia's e-Governance Academy

Throughout this paper, I have been touting the possibilities that Broadband Wireless Access technologies and access to the Internet present to the world—*there certainly are many*. But as good as wireless technologies are, I must stress that if both wired and wireless Internet access exist, **the wired connection is always better**—primarily for security reasons. While it happens infrequently, there certainly are possibilities for information that is sent over a wireless network—even a password protected network—to be deciphered by a third party.

*So why not use wired Internet access all the time?* Again, as I've begun to suggest, it's not always possible to do this. For one, wires are constricting and inconvenient on a personal level, so with fewer physical constraints, our freedom to work when and where we want to work increases substantially. With wireless Internet access, we can move around individual access points, such as around a house, office or café, and generally speaking, it also allows us to be more flexible in our lives. For example, if we can check our email at a hotspot on the road or wherever we may happen to be, we are less tethered to the home/office and conceivably can do more in each day, and ultimately, in our lives.

Wireless technologies also allow for many users to connect to the Internet at once, whereas a wired connection (without a hub or switch) connects only one person to the Internet, no matter the speed of the connection. Also, it is often difficult to lay cable and wires over long distances and rough topography, so wireless technologies are extremely effective in delivering broadband Internet to locations where people either never before have had connectivity, or are relying on extremely slow dial-up connections. The appeals of wireless all add up to foster increased utilization of the Internet, which most would argue is a good thing, as the Internet enables us to do, and understand, much more in our lives than ever before.

The most important thing to note at this time is that not only does wireless Internet allow for us to have easier access to the services and knowledge we already use via wired means, but it will also lead to the creation of new goods and services that have yet to be created. Examples of how this has already begun to happen can be seen by looking at novel e-services in Estonia such as electronic voting, e-parking systems, and online political portals, such as *TOM*, which allows citizens to correspond directly with politicians and suggest policies to be discussed and possibly even enacted in Parliament. As is the case with any technology, there will undoubtedly be risks moving ahead with wireless deployment and development, but in my humble opinion, the potential benefits of wireless technologies far outweigh the downsides present today.

At this stage, we should make sure we're all on the same page. We can think of wireless Internet in 3 general categories: **personal networks**, **commercial hotspots** and **public/municipal hotspots**. Personal networks are wireless Internet connections for households or offices that are usually—or ought to be—secured and used privately. This category also includes ad-hoc networks, which, despite not being actual Internet connections themselves, give users many benefits in terms of personal networking. Commercial hotspots, on the other hand, are hotspots that are either provided by individual businesses for customers and are free to use, such as in select cafés and pubs, or are hotspots that are open to the public but require a small fee to use, usually these are provided to businesses by hotspot aggregators like T-Mobile or Elion. The last category of wireless Internet that exists are public, municipal hotspots. These are provided by governments or public institutions and are open to all users and are free to use. These types of hotspots generally exist in government buildings, libraries and in some cases, public parks.

Notice that to this point in my discussion of policy, I have not mentioned *specific technologies* used to deploy Internet wirelessly, but rather, I've spoken generally about connectivity. **This is**

**deliberate.** I touched briefly on this in Chapter III, but what I mean is that *connectivity* is what is important; the importance of a specific technology is proportionate only to the connectivity it enables. Thus, one technology is not *by definition* better than any other technology, but rather, the worth of any technology depends on the situation in which it is used. Furthermore, wireless technologies should be used in interoperable ways with the sole aim of connecting users with each other and connecting users to the Internet. Whether the technologies in play are WiFi, WiMAX/WiBro, 3G, GPRS, GSM, Satellite technologies, or any other solution does not (and should not) matter to the end user so long as he or she can connect to the Internet and to other Internet users. I cannot stress this enough.

Because this is a policy paper for Estonia's e-Governance Academy, my comments from here on out will relate primarily to public/municipal wireless hotspots and commercial hotspots, as the latter two types of wireless Internet access points will have much more of an impact on society than will simply implementing wireless (primarily WiFi) connections in individual homes. What I mean is that personal wireless networks in the home (and in the office, though to a slightly lesser extent) already exist today in the form in which they will exist over the next few years. Even if WiMAX or other BWA technologies replace the wired backhaul on which we depend today for our personal Internet connections, our personal networks will look the same; simply stated, putting WiFi in the home is the choice of a homeowner or apartment tenant—a choice that can already be made relatively seamlessly. On the other hand, in public settings (outside of our homes, apartments and offices), long-range wireless technologies stand to change the world dramatically from what we know and experience today.

To date, propagation of WiFi and wireless connectivity in Estonia in commercial and municipal settings is in large part due to the efforts of one man: Veljo Haamer, creator of WiFi.ee—a non-profit, non-governmental organization. WiFi.ee catalogues all of the wireless hotspots and wireless development in Estonia, and Haamer is largely responsible for WiFi outreach and the spread of WiFi in

Estonia to this point. Mr. Haamer travels around the country explaining the benefits of WiFi to business owners and politicians, explaining what I call the four basic principles behind Estonia's WiFi movement. Generally speaking, I believe these to be true not only in Estonia, but around the world as well.

First of all, **Internet access is important for all members of society to have.** As I have discussed above, WiFi is a means to connect many people to the Internet at once and is already quite widespread throughout Estonia and throughout the world; these are two reasons as to why the technology is appealing. Whether or not another technology will emerge as a replacement for WiFi remains to be seen, though it is hard to deny the fact that BWA technologies will at least amplify WiFi's impact in the world. Regardless, the actual technology in play is *FAR* less important than the spread of connectivity, as I mentioned above. Whether or not end users pay for connectivity or not is yet to be seen, but regardless, all people should be outfitted with at least basic connectivity.

Following this train of thought, **Internet access cannot be prohibitively expensive for potential users.** The reason this is important to remember is that the benefits of being connected to the Internet increase exponentially as more users are connected, *particularly* across an entire country. Free Internet access for end-users is ideal, but nothing in the world is entirely free; someone or some group must pay along the way. Under the current setup in Estonia with regard to free or cheap WiFi in commercial and public hotspots, this statement most certainly applies.

One possible way to ensure that Internet access is accessible for even the poorest citizens would be for the government to provide low-speed, broadband wireless connections (i.e. a maximum speed of, say, 150kbit/second) to all citizens, free of charge throughout society. This way, all citizens will have the ability to be outfitted with access to an increasingly important but remarkably basic utility, and will

not abuse the free connectivity with which they are provided. If users want higher rates of data transfer (and believe me, *some certainly will*), they can pay for it on a subscription or per-use basis.

Witnessing the growth of the Internet over the past 10 years, it is clear that **our dependency on the Internet and our access to it will only increase as time passes**. Wireless communications have fostered and will continue to foster this development, as they are capable of connecting people to the Internet and to one another faster than any other technology in the history of the world. We must keep this in mind and further utilize wireless technologies to connect the remaining non-connected people—of course, only if they want to be connected. If people do not choose to be connected, that is perfectly fine, however, this should be a choice individuals make, not one that is made for them due to a lack of resources.

Wireless visionaries like Haamer have made it clear that **Internet connectivity today is what electricity was 100 years ago**. To some, this may seem to be a bit of an overstatement, though I believe it to be true, as do virtually all of the wireless experts with whom I have consulted in Estonia and around the world. The truth is that we are still in the relative infancy of the Internet, and as I said above, the Internet and our methods of connectivity will only increase in importance in our lives. Moving forward, it's important to do everything we can to improve and enhance connectivity in cities and surrounding areas so that all citizens can gain access to this valuable resource. Whether this is done by implementing WiMAX, 3G, WiFi, or any other technology is less important than focusing on the necessity of providing at the very least, minimal speed broadband connections at affordable prices, if not heavily subsidized or free of charge.

Looking forward, it seems important that we think of the provision of wireless Internet access as an extension of programs like *Tiger Leap*. As *Tiger Leap* aimed to give all Estonians computer literacy, the implementation of wireless technologies and the ability to be connected to both the Internet as a

whole and to smaller, Estonia-specific (or municipality-specific) networks will extend this literacy and will help society personally, commercially and governmentally. Continuous access to the Internet will (and is already) giving people a new way to conduct business and improve their overall quality of life. And as the lives of individual Estonians slowly improve, so too will the general state of Estonia. It is important to remember that the Internet, and in many cases, the wireless technologies that give people access to the Internet, are the means to various ends, rather than the ends themselves.

With this being said, the various ends that will be reached in the coming years due to an increased focus on the provision of Internet access to all citizens will be increased use and ease of use of e-services like e-Banking, e-Taxes and e-Voting, not to mention a bevy of additional e-services that the next generation of computer users and programmers will undoubtedly design and implement. It is important that we view the provision of connectivity as both a short term and a long-term investment, and act as such.

Thus, it is my recommendation for the e-Governance Academy to support Estonia in future efforts to enable citizens with at least basic connectivity. Regardless of the exact technologies in play, it is crucial that it remains possible for different technologies to enter the marketplace and work together. Just as is the case with GSM mobile phone coverage, the potential to be connected to the Internet should exist everywhere, all over the country, in both urban and rural settings. Citizens won't care *how* they are connected to the Internet, but just that they are, so this should be eGA's main goal rather than worrying about one specific technology. Sure, the specific technologies are important and we must understand the strengths and weaknesses of each respective technology, but at the end of the day all each technology does is enable connectivity. It is my hope that Estonia and the rest of the world can increase this connectivity, which will allow us all to do more with our lives and become citizens of a truly global society.