

Regulation of broadband telecommunication in Germany



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Summary

The European Union Commission wants all businesses in EU to have access to broadband by 2010, a move that could ensure the state stays competitive in the global economy. Broadband access means much more than faster Web surfing and quicker music downloads. It could save lives by allowing health-care providers to rapidly exchange medical records over long distances. It could enable more efficient distance learning so schools could offer more online classes. It can make possible more virtual enterprises and "distance-working", in which employees save time and trip costs by using their computers to work from home.

Wireless broadband - transmitted and received from satellites, radio towers or cell phone carriers - appears to be a key to opening up the state's most rural locales to high-speed Internet service. Of course it's not as fast as a wired connection from a cable-television provider or fibre-optic lines, which stream data through light, but getting a wire into every German household is impossible.

Broadband Wireless Internet Access technology and systems mean that the incumbent monopoly providers who control the existing telecommunications infrastructure, (wireline) rights of way, and dominate the thinking of lawmakers and regulators no longer have a monopoly on electronic communications. It is obvious that for the enterprises it is not very profitable to create the access points in rural areas. To provide service beyond the cities and suburbs these companies need help of government or some special organizations responsible for broadband access providing.

There are some different ways to make this broadband entrepreneurship in the sparsely populated areas more attractive for the potential providers. The first of them is the reducing of the operational costs. That, in turn, can also be done in two separate ways, one of which is the applying of new technologies, so-called intensive method, and the other is to attract the capital of the third party (government, organizations, and companies) to cover all the foregoing costs, so-called extensive method. The second possibility that is the attracting of investments into broadband providing in rural areas is very popular among governments of many countries. That allows telecommunications companies to provide only the "last mile" of connectivity at a more affordable rate to homes and businesses in less populous regions.

The last but not the least task of the government is promotion of internet utility and broadband services for the population. That can be done by means of creation of the different organizations that can facilitate the development of broadband internet implementation in diverse areas of human activity, such as medicine, education, business and others.

A special separate committee can be created in the government, for example, forming a Wireless Broadband Access Task Force. On the one hand in this case the companies will always know where an every encouragement will be given to them, on the other hand the support from the local authorities' side will get a distinct form and all their obligations and responsibilities will be clear and obvious that is always good for the controlling purposes.

Generally spectrum management reform should be supported believing that the current system is outdated and inadequate to meet the growing demand. But based on the overwhelming success of the 802.11 standard, the availability of unlicensed spectrum will lead to the development of more innovative and cost effective technology. This is also consistent with the goal of achieving ubiquitous and affordable broadband access for all our campuses and communities. At the same time the EU-activities in the spectrum politic can be in general acclaimed. But in the same way as in other politic fields the magic word liberalization should be used very carefully in this regard. The confusion in the USA that was observed in the 2G-mobile networks should be a warning example in the connection, how the liberalization should not look like.

Nowadays Germany is the largest broadband market in Europe, but it is still occupied by DSL-Monoculture. Due to the government interference that becomes significantly harder in the last year the competitors were able to expand their market share noticeable. However, in the last year the Telecom has got more customers than all other competitors together. In international comparison despite all the efforts Germany cannot gain the leading places and thereby is not able to join the important industry nations in the EU.

The government can support the small local providers with competitive protection by guarantying of suspension of probable wired network construction by Telecom in the areas where the wireless internet access was provided. It can reduce the risk of their bankruptcy and enhance the chance for getting financing. Since the money transferred to the DTAG are the state amounts, may be it would be better to invest them into construction of the own last mile infrastructure.

To fight its way on the DSL-dominated broadband market provider should create the added value for the customers. The cooperation scenarios between WiMAX-licence-owners and other TC-providers will play an important role in Germany. The models of cooperation vary from the pure distribution partnership to the regional business joint-venture companies. The branch experts report also about the numerous firms from other areas that have interest to sale the mobile internet in certain regions. Especially regional energy suppliers are interested in this area.

The broadband internet can be provided only by helping of the local authorities. Therefore the task of the vision for the local is a promotion of internet utility and broadband services for the population. That can be done by means of creation of the different organizations that can facilitate the development of broadband internet implementation in diverse areas of human activity, such as medicine, education, business and others.

If the local authorities want to provide the further development of their federal county, they should find the resources for the broadband access affordability for everybody, but of course, it must not be done solely from the local budget, there some other effective sources of financing. The investments from the state authorities' side can also have an implicit character. Private investment paired with local government incentives is the most expeditious way to get broadband deployed.

Introduction:

It is not a secret that Germany especially in its rural areas has fallen behind numerous countries in wireless broadband uptake. The reason for this situation is not geographical or demographical state of the country, but the absence of appropriate policy rudder on broadband networking. This study is grappling with how to convert and augment our legacy communications systems to provide access to high-speed, wireless broadband networking for all.

Numerous competing companies are installing wired and wireless Internet services in both new and old venues. Many municipalities are installing their own advanced networks in a bid to support better access to education, health care, government services, commerce, and employment for their citizens and to remain competitive as communities in a "flattening" world. Telephone and cable TV companies now support a "starter" level of broadband Internet to the home and are investing heavily in upgrades to support much greater capacities in an all-digital, Internet Protocol format.

On 26.09.06 the Präsidentenkammer of Bundesnetzagentur considered to sell the frequency range from 3400 to 3600 MHz at the auction in an effort to promote and extend the adoption of true broadband networking by addressing thorny issues of competition, regulation, taxation, and subsidy in the light of new technologies. But till now it doesn't bring some obvious results, moreover there are opinions that it has made the competitive ability of small firms even worse.

Since there are some opinions that the legislation imperfection in the broadband regulation is even more important problem than the sparse population in rural areas, the detailed analysis of this problem was made in the separate study. Here the current situation on the German wireless broadband access market is presented, as well as the existing problems in this area and the ways of their solving, basing on the experience of the other countries and for all on the experience of the Nordic countries, where the wireless broadband access has already become a reality in the last years.

The study is organized in the follow way: The very first section is devoted to the description of the broadband access significance for the country and the wireless broadband access in particular. The following 7 sections describe the certain aspects of broadband access regulation. Each section consists of the analysis of steps that should be done by the authorities of the all levels to create the favourable ground for the broadband connection development on the base of the existing broadband policies in the other countries. It also describes what was already done in Germany and what should be done in the future regarding to the first part.

The so-called broadband access that is available via cable modems or the somewhat slower digital subscriber line (DSL) is technically inferior to that routinely provided to students residing on campus. Thus, higher education has an important stake in the national effort to widely deploy a state-of-the-art broadband public network which overcomes these deficiencies. Many of its own educational goals cannot be realized without affordable and ubiquitous access to such a network.

1. Meaning of wireless broadband access availability for the development of the country

Broadband access means much more than faster Web surfing and quicker music downloads. It could save lives by allowing health-care providers to rapidly exchange medical records over long distances. It could enable more efficient distance learning so schools could offer more online classes. It can make possible more virtual enterprises and "distance-working", in which employees save time and trip costs by using their computers to work from home.

Wireless broadband - transmitted and received from satellites, radio towers or cell phone carriers - appears to be a key to opening up the state's most rural locales to high-speed Internet service. Of course it's not as fast as a wired connection from a cable-television provider or fibre-optic lines, which stream data through light, but getting a wire into every German household would be the utopia if it could be done. It should be recognized that it is just a very expensive dream.

However, the broadband access availability can allow businesses to set up shop in rural areas and pay network-transmission rates that are competitive with prices in the other part of Germany and the government should assist communities with planning and deploying the most cost-effective high-speed technology that can traverse urban and rural terrain.

The European Union Commission wants all businesses in EU to have access to broadband by 2010, a move that could ensure the state stays competitive in the global economy. Of course, while wireless may be appropriate in one region, a wired connection will need to be used in another. Many businesses or offices may require the faster speeds of fibre that a wireless signal currently cannot provide. But, for example, current wireless technology can excellent meet the needs of doctors who want to practice telemedicine or for some other needs. That's why the Bundesnetzagentur consider options on deploying wireless services in the state.

Broadband Wireless Internet Access (BWIA) completely changes the paradigm of wired/wireline Broadband Internet Access. BWIA technology and systems mean that the incumbent monopoly providers who control the existing telecommunications infrastructure, (wireline) rights of way, and dominate the thinking of lawmakers and regulators no longer have a monopoly on electronic communications.

While the Internet profoundly changes things all of the wonderful capabilities of the Internet doesn't do a person any good unless they 1) can get Broadband Internet Access at all (and a large part of the world cannot, at present), and 2) they can afford that access, and 3) it's unfiltered - the service provider doesn't decide what you can and cannot do with your connection to the Internet¹.

For more than ten years now the BWIA makes possible in providing individuals and businesses better, cheaper, and often the only access to the

wonders of the Internet to enhancing humanity's chances for growing as an intelligent species and helping the humans of the world understand and communicate better with each other.

There are a big number of examples for successful implementation of wireless techniques all over the world. The Europe is not exclusion, especially with its rural areas in Baltic region. For example, one of Finland's largest cities Oulu has built out a metropolitan mesh network to provide high-speed voice, video and data access to its citizens. This is a good example of an innovative public and private partnership that can be established to enable large-scale wireless access networks and bring entire cities online.

Mesh networks are made up of individual mesh nodes, which have the ability to automatically form connections with other nodes within range, and reroute traffic if a node drops offline. This makes the networks self-organising.

Oulu is the largest city in Northern Finland with a population of 130,000. It already has substantial but mostly indoor wireless access, with 675 access points in total — of which 60 presently provide outdoor coverage. Outdoor nodes currently include 11 mobile-access points placed on buses, a ferry and even a mobile library. According to city authorities, 5,656 different devices accessed the network during January 2007. It is run by a consortium of seven organisations including the University of Oulu and Oulu Polytechnic.

The UK as well has its own wireless cities initiative, which is being run in conjunction with BT and Motorola. The project has made parts of 12 UK cities go wireless by the end of March 2007. The cities taking part so far are Birmingham, Cardiff, Edinburgh, Leeds, Liverpool and Westminster. Cardiff and Westminster represent extensions of the scheme, as smaller Wi-Fi networks already exist in both places.

Another interesting solution is that buses equipped with Wi-Fi are being used to deliver web content to remote rural villages in the developing world. For example, in rural India and parts of Rwanda, Cambodia and Paraguay, the vehicles offer web content to computers with no internet connection. The buses and a fleet of motorcycles update their pages in cities before visiting the hard-to-reach communities. As well as offering popular pages, the United Villages project also allows users to request specific information. A small box, with an antenna, onboard the buses and motorcycles communicates with the rural computers.

The wireless access is very important for the local business as well. Thus in many parts of the developing world it is too expensive to lay the fibres and copper cable to deliver a standard internet connection. Wireless technologies also do not reach many remote places.

The founder of the United Villages initiative Amir Alexander Hasson said the company had been set up to give those people in these areas a slice of the web for a fee.²

As well as this regular content users can make special requests. For example, if there was no information about something on the village computer, a fee could be paid to get hold of such information. The bus would then go back to the city and communicate with an internet server. The box on the bus would be updated with the requested information and, a few

hours later, the bus would arrive back at the village to zap the needed information pages to the computer. The Wi-Fi vehicles also deliver and collect e-mails from the villagers.

Thus the broadband internet communication is in demand all over the world. That's why the standardization of wireless communication is progressing almost so fast as the year rhythm is changing: in 2001 it was 802.16, in 2002 the standard was extended with 802.16c for frequencies range of 66 GHz, in 2003 follows 802.16a, then in 2004 the 802.16d that united the previous versions and in 2005 the powerful standard was ratified with 802.16e, with which the wired as well as mobile infrastructures can be realized. The development rapidly goes further to much more higher speeds. The work team of 802.16m is already working on Wimax-Version that should provide the transmission rate up to 1 GBit/s for cable and about 100 MBit/s for mobile applications.

The next chapter contains brief description of the main modern types of wireless communication media regarding their advantages and disadvantages and the possible areas of their application.

2. Description of the main types of broadband connection devices

The popularity of **WLANs** is a testament primarily to their convenience, cost efficiency, and ease of integration with other networks and network components. The majority of computers sold to consumers today come pre-equipped with all necessary wireless LAN technology.

The benefits of wireless LANs include:

- *Convenience:* The wireless nature of such networks allows users to access network resources from nearly any convenient location within their primary networking environment (home or office). With the increasing saturation of laptop-style computers, this is particularly relevant.
- *Mobility:* With the emergence of public wireless networks, users can access the internet even outside their normal work environment. Most chain coffee shops, for example, offer their customers a wireless connection to the internet at little or no cost.
- *Productivity:* Users connected to a wireless network can maintain a nearly constant affiliation with their desired network as they move from place to place. For a business, this implies that an employee can potentially be more productive as his or her work can be accomplished from any convenient location.
- *Deployment:* Initial setup of an infrastructure-based wireless network requires little more than a single access point. Wired networks, on the other hand, have the additional cost and complexity of actual physical cables being run to numerous locations (which can even be impossible for hard-to-reach locations within a building).
- *Expandability:* Wireless networks can serve a suddenly-increased number of clients with the existing equipment. In a wired network, additional clients would require additional wiring.

- *Cost:* Wireless networking hardware is at worst a modest increase from wired counterparts. This potentially increased cost is almost always more than outweighed by the savings in cost and labour associated to running physical cables.

Wireless LAN technology, while replete with the conveniences and advantages described above, has its share of downfalls. For a given networking situation, wireless LANs may not be desirable for a number of reasons. Most of these have to do with the inherent limitations of the technology.

- *Security:* Wireless LAN transceivers are designed to serve computers throughout a structure with uninterrupted service using radio frequencies. Because of space and cost, the antennas typically present on wireless networking cards in the end computers are generally relatively poor. In fact, there are even computer users dedicated to locating and sometimes even hacking into wireless networks. To combat this consideration, wireless networks users usually choose to utilize various encryption technologies available such as WPA. Some of the older encryption methods, such as WEP are known to have weaknesses that a dedicated adversary can compromise.
- *Range:* The typical range of a common 802.11g network with standard equipment is on the order of tens of meters. While sufficient for a typical home, it will be insufficient in a larger structure. To obtain additional range, repeaters or additional access points will have to be purchased. Costs for these items can add up quickly.
- *Reliability:* Like any radio frequency transmission, wireless networking signals are subject to a wide variety of interference, as well as complex propagation effects that are beyond the control of the network administrator. In the case of typical networks, modulation is achieved by complicated forms of phase-shift keying (PSK) or quadrature amplitude modulation (QAM), making interference and propagation effects all the more disturbing. As a result, important network resources such as servers are rarely connected wirelessly.
- *Speed:* The speed on most wireless networks (typically 1-108 Mbit/s) is reasonably slow compared to the slowest common wired networks (100 Mbit/s up to several Gbit/s), although the maximum ADSL throughput (usually 8 Mbit/s or less) offered by telecommunications companies to general-purpose customers is already far slower than the slowest wireless network to which it is typically connected. That is to say, in most environments, a wireless network running at its slowest speed is still faster than the internet connection serving it in the first place. However, in specialized environments, the throughput of a wired network might be necessary. Newer standards such as 802.11n are addressing this limitation and will support peak throughputs in the range of 100-200 Mbit/s.⁴

At the moment a lot of IT-enterprises are heavily pushing research and development in **WiMax**. WiMax — especially mobile WiMax, or 802.16e — is widely seen as the next step for wireless technologies, but the mobile standard is yet to be ratified. However, the likes of Intel and Motorola are

already investing heavily in mobile chipsets to take advantage of the technology when it gains more momentum.

The WiMax technology provides a truly pervasive, high-speed mobile data services and has a lot of advantages, otherwise it was not considered as a future for wireless technologies. WiMAX is a standards-based technology enabling the delivery of last mile wireless broadband access as an alternative to wired broadband like cable and DSL. WiMAX provides fixed, nomadic, portable and, soon, mobile wireless broadband connectivity without the need for direct line-of-sight with a base station. In a typical cell radius deployment of three to ten kilometres, WiMAX Forum Certified™ systems can be expected to deliver capacity of up to 40 Mbps per channel, for fixed and portable access applications.

This is enough bandwidth to simultaneously support hundreds of businesses with T-1 speed connectivity and thousands of residences with DSL speed connectivity. Mobile network deployments are expected to provide up to 15 Mbps of capacity within a typical cell radius deployment of up to three kilometres. It is expected that WiMAX technology will be incorporated in notebook computers and PDAs by 2007, allowing for urban areas and cities to become “metro zones” for portable outdoor broadband wireless access.

Local phone and cable providers are already exploring WiMax as a low-cost way to extend their residential broadband service to rural areas. One possibility is that municipalities will deploy WiMax as an Internet utility service for residents in much the same way that cities once provided gas and electric service a century ago.

But at the same time the WiMax has some disadvantages.

- *Deployment.* Although the WiMax is often portrayed as a “super-Wi-Fi” technology that creates citywide hot zones, most users won’t access WiMax via cards in their notebooks as they do with 802.11b. WiMax is really an infrastructure technology, like DSL or cable modem service. When WiMax products become certified, they’ll serve the same purpose as a router, providing the backbone access to a location. Individual users will connect to the WiMax modem via a wired Ethernet or Wi-Fi connection. The prospect of mobile users connecting to WiMax hot zones directly is still years away, however, and some analysts urge customers not to hold their collective breath.
- *Standardization.* When vendors first delivered hardware based on the IEEE 802.11d standard, different products often weren’t compatible -- a fatal flaw for a network technology. So an industry consortium, the WiMax Forum, develops interoperability standards and certifies compliance by licensing the WiMax label, giving customers assurance that labelled devices would work together.⁵

There are some data for the year 2006, which shows that 52% of the deployments still used proprietary equipment, 36% applied the 802.16-2004 standard, and 12% applied wave 1 802.16-2005 standard. United States, Spain and Australia were the top 3 countries in number of subscribers. In Q1 2007, they accounted for 0.5 million BWA/WiMAX subscribers. APAC accounted for 38% of deployments, Europe 33%, North America 17%, and CALA 13%.

WiMAX service revenues in 2006 totalled US\$322 million, with recorded ARPUs of US\$40.76 and US\$145.54 for residential and business subscribers, respectively. The split by subscriber type operators was 58% residential and 42% business. APAC operators offer higher speeds compared to other regions, yet APAC has the lowest ARPU at US\$30.45 for residential. The price difference between WiMAX and DSL tends to be narrow, which tends to negate price as a factor for potential customers.⁵

The next possibility for the modern broadband access providing is a satellite connection. However, wireless broadband may be experiencing rapid uptake, but research has found high-speed satellite remains stagnant despite government incentives. According to reports from analyst Market Clarity, Positioning Satellite, and Setting the Scene for Wireless, 33 ISPs out of a total of 556 offer satellite broadband while 129 provide wireless broadband, that is mostly because while satellite can reach remote areas, not all services offer uploading.

Not all satellite services are two-way, so a terrestrial service is needed to send e-mail, which undermines the reason for getting satellite. There is also a problem with latency and propagation delays; there is a set speed that electromagnetic radiation can travel using geospatial orbit, so conversation can be affected using VoIP, whereas a terrestrial line is faster so it doesn't have those problems.

Also, the cost of satellite dishes can be expensive, up to 10 times the cost of an ADSL modem, which is where government subsidies Broadband Connect come in handy. The take-up of satellite broadband would be higher if the subsidies brought its cost closer to city ADSL prices.

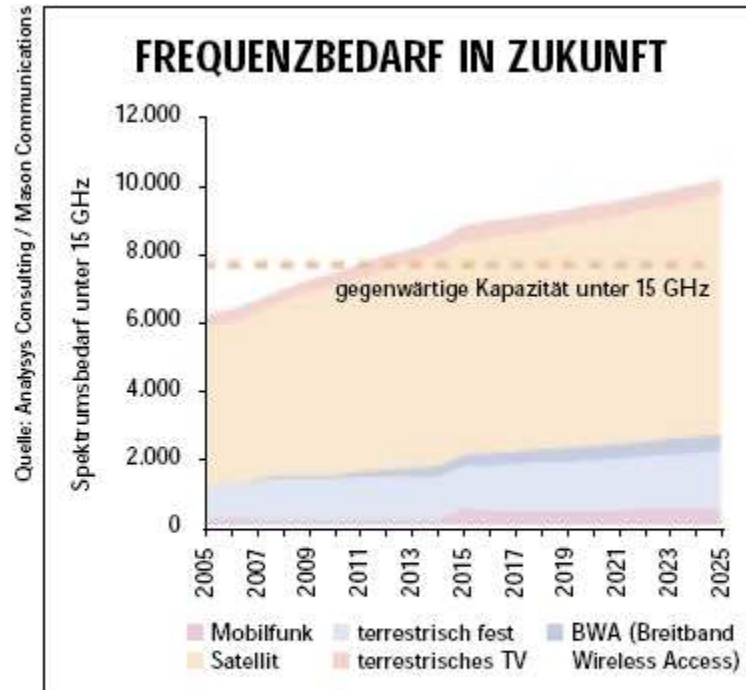
According to these data, more than 83 percent of wireless ISPs offer regional services, and there are 56 percent more wireless broadband infrastructure owners regionally than in cities. In metropolitan areas, ISPs have wholesale wireless service options to choose from, which save them the expense and effort of deploying their own infrastructure, whereas in rural locations an ISP may have no choice but to deploy its own fixed wireless services.⁶

As a summarizing conclusion should be noted, that the carrier should thoroughly plan what technology he wants to implement. The important parameter hereby is the business model and the addressed target groups as it is shown in the following examples:

- broadband internet access in the regions without DSL-Providing (OPAL-areas, power attenuation)
- new products on the base of not-bundled services (Internet access and VoIP without participant connection wire), for instance for one-person households
- portable access points to the firm networks (VPN) for instance for mobile employees
- value-added services on the base of broadband access and portability of the connections (for example, Telematic, Telemetry, Security)

Thus there are many different alternatives of Wi-Fi implementation. Beside the WiMAX Telecom the DBD (Deutsche Breitbanddienste) decided to implement the mobile cells according to the stationary WiMAX-Standard.

DBD and other Carriers such as Televersa or TelDaFax provide at the moment already 50 WiMax-networks in Germany (often actually as pre-WiMax solution).



Analysys und Mason haben für Großbritannien eine Studie erarbeitet, in der versucht wurde, den künftigen Frequenzbedarf für den Bereich unter 15 GHz zu ermitteln. Er wird demnach weiter wachsen. Das Diagramm stellt einen urbanen Anwendungsfall dar

Picture 1 Frequency usage trends

Professional application, such as implementation of WiMax connections in firm networks (VPN) or Telematic services will become more important. For the provider the successful business will mean the intensive studying of target group needs and taking care of implying from them the technical requirements during the choice of infrastructure and network planning. Due to the Hybrid-Networks implementation (for instance, WiMAX and WLAN or WiMAX and DVB-H) the additional applications will appear with the course of time.

3. Role of the government in the broadband regulation

Broadband is important, not just for rural Germany, but for every part of Germany. It's similar to what interstates when two-lane or four-lane highways are used. It's as important as when the authorities first brought electricity to the commonwealth. But broadband access exists in many forms, and the answer on the question: "wired or wireless?" is different for every town, city and county. German political and business leaders should learn as much as they can about high-speed Internet access - who has it, who doesn't and how to make it affordable for all state residents.

Once the answer to that question will be found, German localities that are underserved with high-speed Internet service for everybody may finally jump into the 22nd century. The large telecommunication companies, like Telecoms, have typically concentrated on more densely populated regions because operational costs in rural areas are high and there are fewer potential subscribers. Thus, it is obvious that for the enterprises it is not very profitable to create the access points in rural areas. To provide service beyond the cities and suburbs these companies need help of government or some special organizations responsible for broadband access providing.

There are some different ways to make this broadband entrepreneurship in the sparsely populated areas more attractive for the potential providers. The first of them is the reducing of the operational costs. That, in turn, can also be done in two separate ways, one of which is the applying of new technologies, so-called intensive method, and the other is to attract the capital of the third party (government, organizations, and companies) to cover all the foregoing costs, so-called extensive method. The more detailed description of both these possibilities follows.

Applying of new technologies that allows significant reducing the costs is the most effective way of further development of the broadband connections in rural areas. Thus, for example, the implementation of WiMax technology devices that are newly standardised is much more cheaper as the installation of optical fibre. But this technology is still very new on the market and providers haven't got enough experience to deal with it properly.

Most of the barriers to implementation of new technologies, both external and internal, are seen to be of a local nature. However, the federal government could be of significant assistance in promoting the development of lower cost WiMAN and WiMAX technologies with increased bandwidth capacity for those entities interested in extending services out into the community. Unlicensed, lower frequency, higher speed bands (900 MHz band and below) are needed for outside, non-line-of-sight WMAN applications. Even for campus installations, the availability of only 3 non-overlapping channels make deployments difficult. A larger channel range would be helpful. This problem is described in more details in the next chapter.

The second possibility that is the attracting of investments into broadband providing in rural areas is very popular among governments of many countries. For example, in USA since 1998, \$312.9 million has been invested into Virginia's broadband infrastructure. That figure is rising, and much of the funding, \$242 million, has come from a Federal Communications Commission (state institute similar to the Bundesnetzagentur) program called E-Rate. That program ensures that eligible U.S. schools and libraries have affordable high-speed access, in part by subsidizing operating costs.¹

In the Europe there are also a lot of examples where the broadband access providing becomes the part of federal government program. That takes place in Estonia, Lithuania and Latvia and some other developing European countries that want to fasten their development. The 53 million Euros which were got during the WiMax auction in Germany can be successfully spent to the further development of broadband in the country.

There are some other possibilities to get investments from the third side. In the USA, for example, in Virginia of the total 312.9 mil\$, \$67.6 million came from the 1998 national tobacco settlement and is designed to help rural areas of the state recover from declines in tobacco income brought by anti-smoking measures.¹ The tobacco-settlement money helps pay for fibre-optic backbones across Southside and Southwest Virginia, joined to a hub in Northern Virginia. That allows telecommunications companies to provide only the "last mile" of connectivity at a more affordable rate to homes and businesses in less populous regions. It can be very interesting and useful solution for the problem of funds for some European countries and for Germany in particular.

The last but not the least task of the government is promotion of internet utility and broadband services for the population. That can be done by means of creation of the different organizations that can facilitate the development of broadband internet implementation in diverse areas of human activity, such as medicine, education, business and others.

Also a special separate committee can be created in the government, for example, forming a Wireless Broadband Access Task Force. The country is very interested in the continuing development of wireless broadband access both in their cities and in surrounding them rural areas. Wireless technologies hold great promise to help fulfil the national goal of affordable and ubiquitous broadband access throughout the Germany. This goal can be seen as critical to the mission of providing a quality learning environment both on campus and through distance learning that is very interesting for us as for the University of Applied Sciences.

But educational reasons for a public broadband network are only part of a larger and more complicated picture involving users, providers, and governments at every level. College and university leaders, working through different associations, foresee that many sectors of our society will benefit from a widely deployed and affordable broadband network and seek to collaborate with the appropriate individuals and organizations in promoting its development and deployment.

Achieving a new sense of national purpose in deploying broadband Internet services to all German people will require the efforts of many individuals and organizations. To fulfil its intended aims, this work must be guided by several basic principles, including:

a) Affordable Broadband Access

Affordable access to advanced communications services and capabilities by individuals, households, businesses large and small, non-profit organizations and public service agencies is a matter of the highest public interest. Planning and deployment of a network that meets these collective needs must be accomplished in a way that engages both the public and the private sectors and builds on the strengths of each.

The Internet, whose public access is barely more than a decade old, initially occupied a new and special niche in the panoply of technology-based communications. But its technical architecture (cutting across the vertical orientation of older systems), implementation in semiconductors and fibre optics (embodying revolutionary cost and performance

advantages), and its increasing commercial use (forging an increased reliance by the general public), set a basic change from "niche" status to that of core transport protocol.

In the ancient time the environment was appreciated as a dangerous, the progress was very slow; the main task of the people and their authorities was to preserve the existing way of life that means that the society was static. Then the society transformed into dynamic one and this transformation was very advantageous process that has created the ground for further development of the society. The psychologists suppose that it is connected with obtaining by the people their rights, for example, right for freedom and other basic human rights. And now when we are living in the informational society it is a question of life and death to make the informational access to each man, to each household the next basic human right.

b) A New Regulatory Structure

Progress in the deployment of public broadband services requires new and streamlined regulatory structure based on sound economic and social concepts, recognition of the advantages inherent in new network technology and a new network structure, and a willingness to undertake the difficult transition away from current, obsolete telecommunications facilities and the regulations which govern their use.

The success of free market economies, which now dominate the world, has led to a re-examination of governmental roles in regulating private sector business behaviour. Initiatives to liberalize regulatory structures and open business sectors to competition based on product and service innovation are widespread. At the same time, there has been a major shift toward an economic structure based on information technology rather than industrial manufacturing technology.

These twin forces have brought into question much of the telecommunications regulatory structure erected to ensure social benefits of an earlier time. In particular, studies have concluded that the lengthy duration of proceedings in regulatory hearings and decisions is a significant inhibitor of technology-based innovation. Likewise, the rigidity of regulatory accounting rules creates disincentives to the introduction of services based on new technology that may not initially fully recover their costs.

As the economy is remade by new technologies, so must the regulatory structures designed to ensure social benefits be remade. In particular, they must be alert to situations in which the timely elimination of obsolete services is not inhibited by perpetuation of subsidies that no longer serve the purpose for which they were enacted. An excellent example of this hazard is the current situation regarding analogue voice telephony services provided over wire line facilities in the USA. Many billions of dollars of telecom investment in such facilities have been subsidized over the years with the laudable goal of achieving universal telephone access at affordable rates. As a result, the United States has more than 200 million wireline access telephones, a majority of which are based on analogue technology at the end-user sites.

Although this technology is obsolete, and there are multiple lower-cost and higher-performance replacements available, the subsidy regime and related user taxes associated with the original goals continue. Recently, it was published a paper recommending a wholesale diversion of subsidy funds to the support of a widely deployed broadband infrastructure that maintains universality of access while providing Internet-based voice, data and video services.

Regardless of which alternatives for regulatory reform are adopted, the revised goals must embody principles of affordable access to the full range of services that are now enabled by the Internet. The goals must also provide incentives for continued technological innovation and efficiency in the implementation of a new universal service structure.

c) Federal Support

The federal government must renew its leading role in funding and sponsoring network and computational research, now collectively known as cyberinfrastructure. This work - much of it, conducted within the university community through basic research, prototyping, and proof-of-concept deployment activities - is an essential part of the "food chain," which leads to commercial products and services and the substantial economic benefits flowing therefrom.

Articulating and fulfilling the vision for broadband access requires many activities, of which those in higher education are only a part. The highest priority can be placed on the following five action areas:

I. Creation of a National Broadband Network Vision

Here it means to analyse vision for the future of the Internet where it will be transformed, through private investment and entrepreneurship, from a federally sponsored academic enterprise to one which widely served society and the economy. Today the society faces the reality of an Internet beset by a variety of troubles whose progress has been slowed by lack of a unified view toward the future. Unfettered capitalism has brought it not only a punctured Internet "bubble" but also a network that no longer commands the respect of scholars and the public at large.

To achieve its promise as a powerful instrument for economic and social betterment, the Internet must continue to be closely linked to communications and computing research endeavours. Many important architectural and operational issues confronting us in the current network environment require sustained research and proof-of-concept funding. Working from these principles, the possible National Broadband Internet Vision can include following major objectives:

- a national commitment, including industry and all levels of government, to deploy technologies that meet the bandwidth standard above to 80 percent of German homes and businesses, for example, by 2008 and to all homes and businesses by 2012;
- network access based on the IP transport layer standard that is open to all providers of higher-layer services and applications on an affordable and non-discriminatory basis;

- network access that is standardized for the delivery of essential residential and business public services, including police, fire, health, civil defence, and national disaster.
- an open, secure, reliable network that continues to be based on freely available, interoperable, international technical standards;
- network access prices that are reasonable, non-discriminatory, and universally available on a nationwide basis;
- network access bandwidth at a minimum of several megabits per second (in both upstream and downstream directions) that is easily and transparently scalable to hundreds of megabits;

In addition to these basic principles and objectives, there is a big number of important broadband policy goals, including new approaches to universal service, local government provision of broadband access, and renewed federal research support for broadband technologies. The government must lead the national broadband effort with new and forward-looking telecommunications legislation that builds on the successes of the Internet.

II. New Telecommunications Legislation

The nearly century old structure of telecommunications regulation is also at risk. Formulations that assigned costs and benefits in an analogue world are no longer relevant. Vertical industry separations confirmed in legislation have been undermined by the horizontal layering of Internet infrastructure and services. Social subsidy goals can no longer be served when the revenues to support them disappear. Thus we come to a major crossroads in the legislative history of telecommunications. It appears to have done little to prepare industry, consumers, and regulators for the Internet. Many observers are calling for a completely fresh look at the nation's regulatory structure for telecommunications.

III. Local Government Provision of Broadband Network Access

Many communities across Germany, sometimes in partnership with their colleges and universities, have undertaken to provide Internet access to their residents and businesses. The investments from the state authorities' side can also have an implicit character. Private investment paired with local government incentives is the most expeditious way to get broadband deployed.

For example, the sponsoring a bill to let private companies partner with local governments can help to set up wireless broadband at schools, businesses and homes. Instead of erecting costly transmission towers, Internet service providers could take advantage of tall buildings and water tanks already built with tax money. The installation of optical fibre can be made automatic legislatively, that means that during the annual regular technical check-ups or reparations carrying out by public utility corporations the optical fibre can be installed and the costs can partially be paid by the local authorities.

IV. New Approaches to Universal Service

That is a new and streamlined regulatory structure based on sound economic and social concepts, recognition of the advantages inherent in

new network technology, and a willingness to undertake the difficult transition away from current, obsolete telecommunications facilities. Consistent with this approach, universal service should be revised from a program supporting subsidized legacy services to one promoting an accelerated migration from narrowband legacy voice to broadband Internet transport services.

Incentives and subsidies contained in a reformed universal service program should assist all citizens in obtaining quality and affordable broadband access to the Internet at the earliest possible date.

V. Federal Funding of Cyber infrastructure

The reports of federal advisory committees and other studies outside government have repeatedly underlined the importance of Internet technology, and especially advanced forms of the technology, such as broadband access, which support a wide range of applications as a major component of economic growth and the enhancement of job opportunities. It will be the essential contributions of federal research sponsors to the design, development, and deployment of the Internet.

4. Frequency range allocation

As a rule in the most countries the frequency spectrum can not be used free according to the needs of users. In Germany the Bundesnetzagentur takes care of "necessary and sufficient allocation of the frequency resource"¹¹. Since in the frequency regulation area, as well as in the other politic areas, the level of European Government becomes more and more active, the looks are turned towards Brussels. The EU-Commission presented the new strategy for the flexible frequency usage just in the end of February. It foresees the concrete measurements for reducing the access and usage restrictions for this resource, which is decisive for the wireless communication. In this connection the new ideas would appear and potential blocks and barriers for the innovation activity, business growth and the choice possibility for users would be removed.

The EU-commissioner Vivian Reding says «We want to give the new chances for the branch by means of reducing the rest of restrictive general conditions; these chances will strengthen the competition and improve the choice possibility of users.»¹¹

The total turnover of these radio-based communication services amounts in 2006 about from 240 to 260 milliards Euro. The actual regulations in the frequency area are always insufficient to follow the steady convergence of mobile, TV and Internet services, all of which use the wireless communication. The establishment of market-oriented frequency management can lead together with flexible frequency usage rights to the additional profit that according to the estimations can amount from 8 to 9 milliards Euro per year.

The auction where 56 millions € were obtained related to the four frequency packets (paired 21 MHz) in 3,5GHz range that was available in 28 regions. These frequencies should be mainly applied for the new mobile technology WiMax. For two frequency packets the related spectrum is not

fully available, because it is still locally being used for WLL (Wireless Local Loop). Since not all frequency packets can be sold on the auction completely across the country, the Bundesnetzagentur looks for the possibility to bring the rest licenses to the people.

“With three new nationwide broadband providers this providing in the rural areas will be significantly improved” supposes the president of Bundesnetzagentur, Mathias Kurth. This situation promises the excellent opportunities for vendors as well. According to the Steria Mummert Consulting’s estimations the turnover only of WiMax hardware in Europe will grow to the near one milliard euro. The Asia-Pacific region is seen as the WiMax-market of future. According to the study of market analytic IN-Stat in 2009 45% of participants (3,8 mil) will be from that region.⁸

Amazingly no large provider-companies took part in the frequency auction. Among the licence-owners in Germany are:

- Clearwire has got the frequency packet A for the any and all regions. This wireless provider has been active only on the USA market up to last time, but now it wish to strengthen its position in the Europe. In the last year Motorola and Intel joined Clearwire.
- Inquam Broadband in Germany with head-office in Köln is a joint venture company of the founded in 2005 WiMax-vendor Next-Wave Wireless and the group of finance investors and Omnia Holdings Limited. Inquam wants to build the Europe-wide broadband wireless networks. The enterprise has got the frequency packet B for all 28 regions.
- DBD (Deutsche Breitbanddienste) that is known as Maxxonair in the cities and as DSLonnair in rural areas is mainly financed by VC-Arm of Intel. The enterprise bought 27 of 28 possible licences of the frequency packet C, as well as the licence for the region 14 (Saarland/Pfalz) from the frequency packet D. DBD has been providing the wireless broadband in some regions already.
- The regional licences went to the MGM Productions Group S.R.L from Italy (region 27, packet D) and to the Televersa Online (region 25 and 28, packet D).

Thus, five from sex interested-in enterprises bought the licences for about 56 millions Euro; with this amount the auction net result remains under the set up by the Bundesnetzagentur bottom price - 60 millions euro. The most part of the successful providers has not revealed their strategies of network implementation yet.

Now, after the finishing of the auction the winner can begin the network construction. It will be clear whether licence-owners will make their own offers or will sell their rights of use to the third party as it’s possible according to the licence conditions. The licence conditions should be followed in any case: till the end 2009 the winners must cover 15% from the total number of communities in related being provided area, then till the end 2011 – 25%.

The mobile WiMax is a broadband radio solution for point-to-multipoint connections. The Wi-Fi-interfaces use the OFDM (Orthogonal Frequency Division Multiplexing) and OFDMA (Orthogonal Frequency Division Multiple Access) techniques. And with SOFDMA (Scalable OFDMA) the 802.16e-

Standard was extended to support the scalable channel width from 1.25 to 20MHz. At the moment the MTG-Gruppe (Mobile Task Group) of WiMax Forums works on the profiles for necessary functions and possible options as a background for the certification of the Wi-Fi-interfaces.

In published in 2006 by WiMax Forum Release 1 of Mobile-Wimax-Profile the channels of 5, 7, 8,75 and 10 MHz width for the licensable frequency spectrum 2,3, 2,5 and 3,5 GHz will be defined. In this year the new Release 1.x will be added and in 2008 the Release 2 on the base of 80.16m is planned.⁸ For mobile application the frequency bands 2,3 and 2,5 suit better than the 3,5 GHz band. But the frequencies sold in Germany in December 2006 on the auction lye in the 3,5 GHz-band. And according to the existing frequency usage plan the sold frequencies can be used only for the fixed WiMax. The Bundesnetzagentur (BNetzA) have an intention to use it also for mobile applications, but for this purpose the corresponding changes in dedication area should take place.

The cooperation scenario between the WiMax-licence owners and other TK-providers (Regional- und City-Carrier, MVNOs, DSL-Providers or Internet Service Providers) will play an important role in Germany. Hereby there is a very wide palette of different cooperation models from the pure distribution partnership to the regional carrier-joint-ventures. From the regulating point of view the issue of sublicenses is also possible. Whether the providers will use this opportunity we will see later. The interest to the cooperation from the both sides is really big, but since the interfaces are very complicated by interconnection and the contributions of partners into the added value determine the profitability, the thorough planning and formalization of the partnership is crucial for the mutual success and the relation persistence. For these purposes it is strongly recommended to involve an extern moderator to balance the opposing interests.

WiMax relates to the IEEE802.16-Family, here the both most important standards are 802.16-2004 for so-called „fixed Wimax“ and 802.16e-2005 for „mobile Wimax“, by the last one the mobile cells can be changed. The development of the 802.16-standard has not been finished yet. The license conditions specify only applying for the fixed-standard. On the other hand the license-owner can convey their rights of use or hand them over temporarily. It could be interesting only for local providers; however the license-owners are also interested in, because till end 2009 they must cover 15% from the total number of communities in related being provided area.⁸

Still absolutely unclear is in what part of general broadband-picture this new technology will be seen. In ideal case this mobile technology would displace the DSL from the leading broadband position worldwide and in Germany and do not let the other wireless technologies, such as 3G, to progress at all. But just few of the observers believe in such scenario. The main advantages of WiMax are high transmitting distance and good latency time (reaction time). The prevailing opinion is, however, that mainly rural areas that at the moment have got no cost-effective broadband access at all will gain from WiMax.

The availability of unlicensed spectrum combined with inexpensive and innovative products made WLANs financially feasible. The responses indicate that the uncertainty of future spectrum availability does have a

dampening effect on plans for implementing new services. The continued focus by the EU-Commission on making more unlicensed spectrum available, allowing flexible use of current licensed spectrum, and facilitating the development of new technologies such as cognitive radios and mesh networks should help alleviate these concerns.

The distribution potential of WiMax is huge: according to the estimation of Steria Mummert Consulting till 2011 the new radio standard should occupy the market volume of circa one milliard euro in Germany. Thus this standard will obtain the same meaning as the WLAN today, says Harald Boveland, Telecommunications expert of enterprise consulting agency Steria Mummert Consulting.¹⁰ Due to the auction the three enterprises have got the permission to the nationwide WiMax-providing. Thereby more than 8 millions households – first of all in the rural areas – will be pleased to get their broadband internet connections.

Whether the WiMax will really be a gold mine for the IT-Branch extremely depends on how many the offers will cost and whether their added value will be valuable for users. At the moment DSL-customers are not ready to pay more than ca. 40 euro for the broadband internet connection. Moreover, by Internet-surfing the flat rate tends to become more and more popular. Solid, stable networks are the basic conditions for fast surfing and are decisive for this tariff form. The increased security risk of radio technique belongs to the basic conditions as well, because it can scare many customers away. Thus the investments into the high security standard are the liability of provider to persuade the customers to use this particular type of connection. The new technology does not promise automatically that the customers will rush for it fascinated. The well-thought-out business model that at the same time is price-effective and meets the customer's requirements is necessary to make the WiMax-solution so prosperous as it can be potentially.

From the past it is already known that political decisions are not always made for the prosperity of users. In the most European countries the 2,5 GHz frequencies are reserved for the extension to the IMT-2000/UMTS-Services. The resent recommendation of the European Commission according to which the radio frequencies can be technologically neutral applied gives the hope to the fast re-dedication. After the quicker than expected decision of ITU-R made in the end of Mai 2007 to extend the IMT-2000 to the new terrestrial radio interface „OFDMA TDD WMAN“ (that is a specific subset of WiMax), it can positive affect the decision of the regulating authorities, because the WiMax is now officially likened with UMTS.

The further obstacle for the Mobile WiMax implementation is the lack of end devices. Although on the Congress Trade Fair „Wimax World Europe“ that took place in Vienna in the end of Mai Intel has released its plans for the corresponding Chipsets lay-out, it said as well that the end devices with embedded chipset will be available not earlier the middle of 2008. Moreover, the WiMax Forum is still working on the certification procedures for the 802.16e with more than 500 test cases. Thus the first certified devices will be available only in the second half of 2007.

The requirements to the security for the future version are significantly complicated as well. The service providers should define the user localization, determine his usage of mobile end devices in the network and

correlate corresponding data for the account services. For the access authorization the providers set up the well-trying AAA-method (Authentication, Authorisation and Accounting). Although the mobile WiMax supports the functions Handover and Roaming the required specifications and accounting models should be worked out in further studies. Kenneth Ashworth, the Director of WiSOA (Wimax Spectrum Owners Alliance – the worldwide union of WiMax network carriers) said on the trade fair in Vienna that WiSOA is working on the bearing Roaming-Model in close collaboration with WiMax Forum.

The more the WiMax-technology sets itself as a base for the wireless Internet on the market the more comparisons with other competing solutions are discussed. Why should be done the contraposition to the WLAN, CDMAEVDO, UMTS-LTE and UMB? The different radio technologies exist or will be developed and all of them take the certain position on the market that means each of them has its own advantages and disadvantages. To make just one example, the data of the vast and current up-to-dated marketing research by Maravedis can be used. The analytics calculated that the average costs for the frequency spectrum pro Hertz by 3G are 353 times as much as by WiMax. In Germany the relation of auction results for country-wide frequencies of WiMax to UMTS equals to the 1:1000⁷. According to the Maravedis these too low costs for BWA/WiMax-licenses lead to the 1028 WiMax licence-owners in total, thereby 276 of them at the same time own the licenses for BWA and 3G. Till 2012, Maravedis forecasts, over 25 mil WiMax-able terminals will be created.

The keystone for expected success of the WiMax on the market lies first of all by the vendors of chips, end devices, systems and intelligent antennas. At the same time the license-owners want to implement their business models in a cost-effective way. Thus nowadays the country-wide networks are built in the USA by Sprint that has invested over 3 mlrd.\$ in its 4G-networks or by Clearwire that is financially supported by Intel and which has bought the 2,5-GHz frequency spectrum of AT&T for 300 mil.\$.

Development of the technology for the mobile application (according to the IEEE 802.12.e standard) will be significantly inspired with the decision of Sprint/Nextel in the USA that build a mobile radio network of 4th generation on the base of this technology. For this purpose the contract on the amount of 3 Mrd. \$ with Motorola and other vendors was made. To the end 2008 Sprint/Nextel already wants to gain 100.000 new customers for this still being built network. Whether it will be realized is of course dubious, but anyway the success of 802.16.e cannot be restrained. The chosen WiMax technology does not only create the ground for mobile application, but also promises the higher efficiency of the network and lower costs for the end device modems. For the carrier it is problematic that the both standards “d” and “e” are not compatible with each other. It means the re-building of the infrastructure or the migration when the networks will be built according to the 802.16.e standard.

In Austria, Croatia and Slovakia the WiMax Telecom is now building the networks; in Pakistan - Wateen Telecom and the Deutsche Breitbanddienste in Germany, which is also a significant affiliated branch of Intel. Intel wants to continue the story of Centrino's success but now for WiMax. Since middle

2008 the laptops, notebooks and many other end devices should be equipped with WiMax-chips and thus the users can in the following with triple connectivity (WLAN, Wimax und 2G/3G) communicate in even more mobile way. Following the Intel activities the Taiwanese government declared the WiMax-technology as the base for their next production offensive after the intensive recherche of research institute ITRI.

Accordingly to the Dow Jones report the Microsoft will file an application for allowance of a terminal based on the OFDM-technology. The large network vendors, such as Alcatel-Lucent, Motorola, NSN, Nokia, Nortel and Samsung, also offer complete solutions. Motorola, which was able to gain over 3.500 installations with its special Canopy-System, was awarded with a special reward for its network terminal device series CPEI 200/300 during the Wimax World Europe. Andy McKinnon, Principal Wimax EMEA by Motorola has said in this regard, that with WiMax the carriers can maintain fixed as well as mobile connections with the same equipment. Moreover, beside the broadband access WiMax enables an additional offer of new services and applications and thus it is a key-technology for triple-play technique.

The WiMax technology with its efficient basic costs offers a large potential for the broadband internet access providing especially in the rural areas Due to the very good price-power relation the WiMax-technology suits as TK-infrastructure in the best way especially for the communities with less then 100 households. So, for example, after the thorough testing of licensed and unlicensed WiMax solutions the regional carrier Neckarcom, the EnBW enterprise with head-office in Stuttgart, has chosen Motorola as a provider for its infrastructure in Ulm area. This solution operates in 3,5 GHz-band, the required frequencies were got by Inquam. The good connection quality over 800 communities and the wishes of supervisor to get a covering TK-providing were the reasons for building of a Wimax-Pilot-Network in Ulm that was put into commercial operation in June. The fast internet-connection and Voice over IP-function were offered to the customers. It is planned the further extension to the other communities.⁷

The Austria best-practice shows that the WiMax business can be successfully carried out. WiMAX Telecom GmbH from Vienna has been active on the Austrian market since a year and durin this time it has sold 7.000 connections with 120 microcells. The target of enterprise is first of all the area that is not provided with DSL-connection and it sells the stationary connections according to the standard IEEE 802.16.d. Thereby user needs an exterior antenna, the installation of which can be compared with the cost for installation of satellite antenna. The application of the infrastructure for the mobile usage according to the IEEE 802.16.e standard is also planned.

From the side of infrastructure providers the mobile standard is especially required. Although the relevant technologies are already "ready for market" until today there is not enough practical experience regarding to the network performance, service availability and latency time of transfer that are essential for very important service of VoIP. Generally it is suspected that the importance of the mobility for the market is overvalued. Depending on the business model and especially by using of WiMax as an substitute solution for the DSL based on the fixed network the stationary

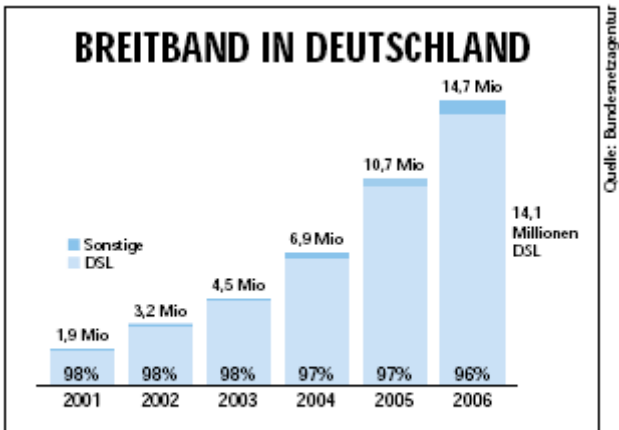
design is also enough for the first time. Furthermore the needed for the mobile implementation end device modems in form of Chip-Sets in Notebooks and Smartphones are still absent and are expected to appear only in 2008.

There is a technical alternative to the sold on the auction frequency range between 3.400 and 3.600 MHz for the establishment of WiMax-networks. For the unlicensed diapason is according the Quant the new wireless technology available that uses the WiMax-chipsets as specified in WiMax-Standard IEEE 802.16-2004 and owns a DFS-able radio-part (Dynamic Frequency Selection). But this technique is also very new and need to be studied in a thorough way.

In conclusion I'd like to say that generally I support spectrum management reform believing that the current system is outdated and inadequate to meet the growing demand. But based on the overwhelming success of the 802.11 standard, I believe that the availability of unlicensed spectrum with improved quality will lead to the development of more innovative and cost effective technology. This is also consistent with the goal of achieving ubiquitous and affordable broadband access for all our campuses and communities. At the same time the EU-activities in the spectrum politic can be in general acclaimed. But in the same way as in other politic fields the magic word liberalization should be used very carefully in this regard. The confusion in the USA that was observed in the 2G-mobile networks should be a warning example in the connection, how the liberalization should not look like.

5. Antimonopoly policy on the broadband access market

Nowadays Germany is the largest broadband market in Europe, but it is still occupied by DSL-Monoculture. The following chart shows the share of DSL-connections among the whole amount of broadband connections in Germany.



Das rasante Breitbandwachstum hierzulande in den letzten Jahren wurde beinahe vollständig von DSL getragen

Picture 2 Broadband in Germany

Monopoly commission warns about the regulation refusal, in this way the Bundesnetzagentur wants to provide significant progress in the broadband

market. Matthias Kurth, president of Bundesnetzagentur (BNetzA), means, that despite the noticeable growth indicators in future communication market, that is the broadband internet access, today available numbers are by the exact considering even sobered. Due to the government interference that becomes significantly harder in the last year the competitors were able to expand their market share noticeable. However, in the last year the Telecom has got more customers than all other competitors together.

In international comparison despite all the efforts Germany cannot gain the leading places and thereby is not able to join the important industry nations in the EU. "Due to the better competitive situation and alternative network access possibilities the usage and the competitive offers grow abroad more quickly than inside the country. Thus the discussion about the regulation setback in the German broadband market for the good of dominating on the market enterprises seems to be rash" Jürgen Grützner, the managing director of association of telecommunication and value-added services providers e.V. (VATM), means.

The special warning expert notice of the monopoly commission is of a current interest as well. The compliance with the European law is open to question when the telecommunication enterprises would lock out the new markets explicitly from any government or submit the certain market independently from its novelty character to the existing regulations.

"Germany needs more and not less competition. This can be impressively proved by the published EU comparative numbers. If in year 2004 Germany was able to land a bit before the EU-25-average by the broadband providing during the market analysis (anyway already behind the 15 largest EU-countries), in 2005 it has already landed under the EU-25-average" says Jürgen Grützner.

The main reason is the weak competition. This is also proved by the competition intensity analysis. Here Germany was on the sixteenth place in the EU and therefore it has improved its position in comparison to the year 2004 only at three places. The analysis also shows that the reason for the bad indicators is not just the absence of the alternative infrastructure in Germany, but also exactly comparatively weak competition in DSL-market itself.

"The contentment cannot be enhanced considering these facts. Conversely they should be the enforced stimulus to use at last still notable idle chances of competition for the good of Germany. This is very important especially for the alternative broadband technologies by the covering of still numerous existing providing gaps. Exactly in cities where the local competition and good broadband providing exists to give the state protection to the Telecom, would not require the further investments in the network construction, but would reduce them. When the competitors in the urban centres will lose their economical ground it will be even harder to promote the network construction in rural areas" means Jürgen Grützner.

Considering these facts the competition and broadband providing for the whole country can be guaranteed only by means of efficient regulation and not by promising of competitive protection for the largest German Telecommunication enterprises for the 50 Mbit/s-network constructions for TV, Music and Video downloads in some selected cities and regions.

Originally, one of the reasons for these efforts was the lack of interest in providing such access by incumbent telephone companies. As the Internet and its service opportunities have become attractive to them, telephone companies have come to view public network facilities as unfair competition with their own services, which have now expanded to include network access offerings such as DSL.

In 2004, the Supreme Court ruled, in a case from Missouri, that states have an inherent right to control the activities of their legal subdivisions (for example, counties and cities) and to prevent them from offering Internet access services. Telephone companies have been successful in a number of states in obtaining prohibitions on network access being provided by public or non-profit entities.

Affordable broadband Internet access is becoming an essential public service, whether provided publicly or privately. This is the case with other utility services such as water, sewer, and electricity. Internet access should be treated in a similar manner. Thus, the test should not be based on provider status within the public sector or the private sector, but on whether a truly affordable, high-quality broadband access is being made available to all residents and businesses.

Successful models of public-private partnership to achieve essential service goals, such as rural electric cooperatives, have existed for many years. A more recent model is community deployment of Wi-Fi "hotspots." These grass roots and community-based efforts should be promoted and supported as one mechanism for achieving the Broadband America vision. Legislation seeking to define a preferred role for one kind of provider or another should be discouraged.

In a phrase, Broadband Wireless Internet Access technology and systems level the playing field of telecommunications. BWIA technology has evolved enough, is good enough, is affordable enough that individuals can now build their own networks when that's necessary or desirable - in their buildings, in their neighbourhoods, in their communities and there's not much the incumbent telecommunications companies can do to stop them. BWIA makes it possible for individuals, small groups, not-for-profit organizations, and entrepreneurial companies like Wireless Internet Service Providers, local governments, and even entirely new carriers to all offer Broadband Internet Access, all in full-blown competition with each other. In the end, competition keeps companies "honest".

Now, when the frequency auction is over, people are strung-up which business model and services will be created and offered by certain providers. While DBD has already operated in some regions with WLL-frequencies from the bankrupt assets of successful WLL-providers "Star 21", the Clearwire and Inquam Broadband until today have business activities and mobile networks only outside of Germany. From the three license-owners operating in Germany it is expected that they will promote the rapid network construction and will come on the market with WiMax-providing at latest by the end 2007. By MGM production is absolutely unclear what objects it pursues and what business model should be realized by means of WiMax in Oberbayern.

The fact that no one of the largest Telecommunication-providers took part in the auction can be estimated as an advantage for the market and the competition situation. This fact can significantly reduce the risk that WiMAX will be implemented just as a "gap patcher" in regions that are not provided with DSL-access till now. Because the winners of three country-wide licences are known as the experts for radio access networks, it can be reckoned with the quick network-rollout in the high-populated areas. Furthermore, the innovative solutions will also come on the market, as for example DBD has already declared they want to create the bundle from cost free internet access when the Telephony will be also provided via WiMAX-connection.

The other interesting aspect is the readiness of providers for cooperation. As the experts for broadband radio access they are interested in using of cooperation for accelerating the market processing and the implementation of innovative solutions. But at least Clearwire refused the way of cooperation in other European markets (Ireland, Denmark and Belgium) where their own networks were constructed. Thus in this regard it is interesting to see how the certain providers present themselves. The competition environment in internet access area is expected to be (at last) with WiMAX wider and brighter.

However, the actual frequency auction for wireless broadband access brought just a bit more than minimum price offer that amounts totally 60 millions euro. Whether it is a niche technology is still a question. The overall pessimistic estimation of market gives some newcomers the chances to get the frequencies at low limit for the network construction.

The impetuous broadband growth in Germany during the last years is almost fully provided by the DSL. Of course, the advantage of DSL is absolute obvious. By this access technology the already existing copper infrastructure can be used at the last mile. This significant advantage gave a noticeable start impulse to the digital subscriber line, especially to the cable-TV-provider. In many countries the severe competition for DSL by the broadband providing does not get ahead. At the end of 2006 the share of DSL in German broadband market amounts 96% according to the Bundesnetzagentur. It disaccords with the worldwide situation, because as the market researcher Point-Topic says the DSL share on the world market in the third quarter 2006 with 173 millions participants amounts "just" 65,6% (the total number of participants is 273 millions).¹³

Since the copper infrastructure on the last mile in Germany is in hand of ex-monopolist Deutsche Telecom (staying under the regulation regime), the discussions consider the moderate compensation for the usage of this infrastructure especially in this network segment by the alternative competitors. Thereby they usually forget that with their compensations to the Deutsche Telecom for TAL (participator's connection-wire), line sharing and bit traffic not only make no support for the infrastructure competition, but in contrast even strengthen its status quo.

In this case the government can even support the small local providers with competitive protection by guarantying of suspension of probable wired network construction by Telecom in the areas where the wireless internet

access was provided. It can reduce the risk of their bankruptcy and enhance the chance for getting financing.

Since the money transferred to the DTAG are the state amounts, may be it would be better to invest them into construction of the own last mile infrastructure, as in Germany, for example, Netcologne in Köln demonstrated. However, the chances for the improvement of infrastructure competition are not so bad. There are, for instance, the first evidences that the mobile communication at last transfer noticeable traffic with data services based on the broadband technologies (3G) and get the related turnover. And in general the wireless access becomes more and more popular. The network access via Wireless LAN slowly increases in Europe accordingly the data of I-Pass. This was shown by Wi-Fi Hotspot Index which characterised the usage of WLAN-hotspots via I-Pass-customers.

Furthermore the number of WLAN-connections in Europe in the second half of 2006 is increased on 74% in comparison to the first one. This means the growing interest of people who are in business trip to use the WLAN-technology as a safe and effective way of connection. And with WiMAX the other wireless technology is on start. The theme optic fibre (FTTx) as well comes again in view at least internationally. For example, the TC-provider Verizon with FIOS has started a gigantic FTTH-project (Fibre To The Home) in the USA (see: <http://www.verizonfios.com/>). The enterprise wants according to its statements to use more than 20 milliards dollars of investments for this purpose.

Due to such projects the FTTx-growth in the regions Asia-Pacific and North-America is according to Point-Topic at 20% per quarter and is already in advance of broadband cable. Worldwide as the Point-Topic says more than 27 millions FTTx-participants are available.¹³ Even if with the new VDSL-Network (Very High Bitrate DSL) the Deutsche Telecom will bring the optic fibre closer to the customers its development in Germany and Europe is, generally speaking, already over. In Germany especially in East Germany firms are very careful with the optic fibre implementation after the sober results of construction in the nineties years, when there was a rash construction of networks and then even the demounting of copper and DSL networks.

The experts are united in their certainty that no one customer will change over to WiMAX just because the Technique is interesting. To fight its way on the DSL-dominated broadband market provider should create the added value for the customers. The DBD want to achieve it among others with its telephony-service offering. Thus the enterprise offers in Wuppertal and Dessau also the telephony over the WiMAX for private users. According to their information the quality of speaking is on the ISDN-level.

The cooperation scenarios between WiMAX-licence-owners and other TC-providers will play an important role in Germany. The models of cooperation vary from the pure distribution partnership to the regional business joint-venture companies. The branch experts report also about the numerous firms from other areas that have interest to sale the mobile internet in certain regions. Especially regional energy suppliers are interested in this area.¹⁴

The major telephone and cable TV companies still have an effective duopoly in last-mile connections to homes and offices in most communities and will try to use this power to dictate the policies and business practices of the new broadband Internet. This could substantially change the nature of the Internet to the detriment of both the consumers and the providers of Internet-based content and services. There are the claims of providers of telephone-based DSL Internet that they cannot afford the investment required to upgrade their services to carry high-definition TV unless they can wall off part of their capacity to make sure that competing services do not interfere with their own programming. Taking this a step further, they claim the right to charge higher rates to content providers willing to pay for better service, in effect biasing the performance of the Internet to support the business plans of the highest bidder. Very large content providers such as Google, Yahoo!, and ESPN could, in this scenario, pay the Internet service providers (ISPs) to provide faster and better access to their own products and indeed might feel compelled to do so in a competitive market.

Introducing such a performance bias violates time-honored design assumptions of the Internet. It takes away the customers' right to choose content and services, on an equal basis, from all that are available at a given time. It inhibits innovation by locking the large providers into positions of strength. Whether inventor of a new Internet product could afford, in advance of sales, to buy good performance from the ISPs to compete with already established producers is a big question. Such performance biases would also balkanize the Internet into zones controlled by different ISPs, which might behave differently with respect to similar or even identical products. This would erect unpredictable and steep barriers to new Internet applications, which must assume a certain uniformity to succeed.

The Internet could not have grown as rapidly as it did, or have supported all of its attendant innovations, if such biases had been present at the start. As it considers the larger issue of telecommunications reform, in the USA, for example, Congress is presently holding hearings on the network neutrality issue.¹⁶ The higher education community has weighed in on the side of neutrality, and against bias, as a means of protecting the free flow of information on the Internet, of defending our access to lesser-used and less-commercial content, and of avoiding the need to outbid entertainment channels to offer quality access to distance learning.

Although the technical path to a solution might seem clear, the result is far from certain, since powerful profit motives underlie the calls for bias. There is real cause to worry that the end, indeed, may be just around the corner.

6. Interconnections between companies and local authorities

Creation of a public broadband network is a large and complicate picture involving users, providers, and governments at every level. Of course, many sectors of our society will benefit from a widely deployed and affordable broadband network and collaboration with the appropriate individuals and organizations will promote its development and deployment.

The Internet is perhaps the best single example of public-private partnership in discovering, developing and deploying new technology. Much of the original research was sponsored by the federal government and conducted at the universities. But the global Internet of today could not have been constructed without massive private investment and a conscious policy within the federal research agencies of working with industry to commercialize promising new technology.

The astonishingly rapid emergence of the centrality of internet, with minimal federal support when compared with the aforementioned subsidy regime for the antiquated wireline communication infrastructure, provides perhaps the most compelling hints of what might be accomplished for the good of the nation with appropriately robust support and adaptive regulatory policy. A layered model approach to residual requirements for regulation in an Internet-dominated world can be used for the creating of the new regulatory structure.

As it was already said in the third chapter the achieving a new sense of national purpose in deploying broadband Internet services to all German people will require the efforts of many individuals and organizations, which must be guided by several basic principles, which are highlighted here regarding the local authorities and companies.

a. Affordable Broadband Access

It has been an established fact of law and public policy in the developed countries for nearly a hundred years that communications services must be made available in a manner that serves the public interest as well as the private business interests of the companies that provide them. Telegraph, telephone, radio, and television have all fallen under some degree of governmental regulation in order to achieve this goal.

Even in the early stages of its existence, the Internet has demonstrated a remarkable capacity to empower individuals, groups, and communities to participate more effectively in society. Schools, colleges, and universities are struggling to assimilate this new wave of technological innovation, which will have as revolutionary an impact on the conduct of education on other sectors of the economy.

In the workplace, networked computers have intruded into nearly every job, and computer-related skills are essential to getting and holding a good job. It is already apparent that lack of access to the Internet contributes to the widening economic gap between the most skilled and the least skilled workers in the global economy, thus contributing to what is called the "digital divide." In short, the Internet is rapidly approaching the status of an essential public service, whether provided publicly or privately, and deserves the same attention to equal access and affordability that has long prevailed in other areas such as telephones, roads, and television.

The work on the realising of this principle by companies and authorities can be divided into two main areas, including:

- **Creation of a broadband network vision**

The challenge of such a vision is great; perhaps no technology has held out so much promise while at the same time displaying so prominently its shortcomings. Preserving the freedom of the Internet and its spontaneous

creativity, while at the same time maturing it to a system through which essential social and economic goals are achieved, will be difficult. Melding aspiration with realistic expectation will not come easily. Nevertheless, the future of the Internet requires no less commitment from us today in addressing its latter day growing pains than did its original research and implementation efforts 20 years ago.

For the companies this vision goes without saying. To be successful in our hard-competitive world means to have a clear vision of what you are doing and its utility and necessity for the people, who will pay for these broadband services. But for the local authorities it is not exactly the same. I have already heard the opinions of some politicians that they do not see the real necessity of creation of such infrastructure. This vision is invited to change their minds in order to create the solid base for the further development of the county, because people can not successfully promote the things they are not interested in.

In this regard there is one more problem: the people gladly buy something that they have already tried and liked. However, while the large telecommunication companies like Telecoms can afford themselves the trial internet connection for about 300 hours to attract the new customers, the small companies, especially those providing the wireless access in the rural areas are not able to do something like this because of high basic and operational costs that they should undertake on their own in this case. The risk will be too high and they get no credit in the bank if they don't make the contracts with potential users before the implementation of wireless network. But the people are afraid of making these contracts before they ever see the advantages of broadband access.

And here the problem can also be solved only by helping of the local authorities. Therefore the second task of the vision for the local government that is inseparable from the first one is a promotion of internet utility and broadband services for the population. That can be done by means of creation of the different organizations that can facilitate the development of broadband internet implementation in diverse areas of human activity, such as medicine, education, business and others.

For example, since 2005 on the island Rügen an e-health application AGnES exists for providing the community medicine nursing for seniors. Supported by a telemedical technique the specially-educated nurses make all the needed procedures and measurements by a patient and send these data via broadband connection to their consulting physician, who in the turn makes the final diagnosis and prescribes a medicine. The seniors, nurses and the physician are very content. There are some other examples of successful and very necessary broadband applications in other European countries, like Finland for instance. When the people will know about these advantages and will see the local authorities support behind these small firms, which want to provide the internet connections needed for implementation of all these services and applications to their households, they will be much more active in making such a contract.

As another interesting example the next situation can be shown. On one of the campuses wired access was considered as the primary method of connecting to the Internet. Wireless access provided additional convenience

and mobility, but did not appear to significantly increase the overall number of Internet users. The institution installed them defensively, in an effort to stop the proliferation of rogue access points. Installation projects first target areas where students congregate, such as conference rooms and common areas. Academic and administrative buildings are then added, often as individual departments request the service and are able to fund the installation. And an increase in wireless use over time for all participants took place. Thus the problem is just to start.

- **The funding of broadband infrastructure**

The need to add IT policy to the definition of IT infrastructure is in alignment with the Gartner Group's commentary in "The New Face of Infrastructure," which stated: "Most enterprises approach infrastructure from an asset-based perspective. This is a response to decentralized organizational constructs, where achieving enterprise-level synergies was subordinate to the expectation that business units succeed or fail independently, as well as to the nature of infrastructure as a collection of shared resources. Enterprises identified what asset types were shared and therefore controlled centrally, and which were not. The objective was to define infrastructure as narrowly as possible to minimize non-operating-department intrusion of business units."¹⁹

The commentary describes the three most important domains as the physical infrastructure, the IT infrastructure, and the social infrastructure and notes these three domains are converging. It suggests taking a more holistic view of infrastructure: "This entails accepting a slightly more blurred but substantially more meaningful definition of infrastructure as the organization's connective tissue, a restatement that frees organizations to approach infrastructure more holistically, incorporating not only hard assets, but human, process, and organizational elements."

As the definition of infrastructure has blurred, so too has the definition of IT infrastructure. Over the last decade, it has become clear that functional IT infrastructure and systems are composed of more than hardware and software.

Budgeting methods that did not adequately account for the full human resources costs to analyze, design, integrate, support, and manage new hardware and software systems mostly underestimated the costs involved. If we accept a more blurred definition of IT infrastructure that incorporates not only the hard IT assets but also the human, process, and organizational elements, then IT policy development clearly deserves a greater level of attention—and on an ongoing basis.

Today, the combination of accessible communications bandwidth, coupled with powerful computational and information resources, has produced a medium of unprecedented power. The synergy possible from the synthesis of powerful networks, computers, and databases sets aggressive national goals for fresh investment in these technologies.

The reports of Bundesnetzagentur and other studies outside government have repeatedly underlined the importance of Internet technology, and especially advanced forms of the technology, such as broadband access, which support a wide range of applications as a major component of economic growth and the enhancement of job opportunities. It will be the

essential contributions of federal research sponsors to the design, development, and deployment of the Internet.

For companies this statement means the possible solution for the financing problem, because providing of such public service becomes in this case the prior task not only for the company but also for the whole country. Thus, the main part of the operational costs for the creating of the related infrastructure should be undertaken by government in general and by local authorities in particular.

For the local authorities this statement has more obligatory nature, because they should find the sources for financing of such a broadband infrastructure. If the local authorities want to provide the further development of their federal county, they should find the resources for the broadband access affordability for everybody, but of course, it must not be done solely from the local budget, there some other effective sources of financing. The investments from the state authorities' side can also have an implicit character. Private investment paired with local government incentives is the most expeditious way to get broadband deployed.

For example, it was already mentioned in the third chapter that sponsoring a bill to let private companies partner with local governments can help to set up wireless broadband at schools, businesses and homes. Instead of erecting costly transmission towers, Internet service providers could take advantage of tall buildings and water tanks already built with tax money. The installation of optical fibre can be made automatic legislatively, that means that during the annual regular technical check-ups or reparations carrying out by public utility corporations the optical fibre can be installed and the costs can partially be paid by the local authorities.

Please note, that this topic is much more complicated and should be better made as a separate case study, dedicated to the problems of financing.

b. A new regulatory structure

The country is very interested in the continuing development of wireless broadband access both in their cities and in surrounding them rural areas. Wireless technologies hold great promise to help fulfil the national goal of affordable and ubiquitous broadband access throughout the Germany. Progress in the deployment of public broadband services requires a new and streamlined regulatory structure based on sound economic and social concepts, recognition of the advantages inherent in new network technology and a new network structure, and a willingness to undertake the difficult transition away from current, obsolete telecommunications facilities and the regulations which govern their use.

The existing regulatory structure does not meet all the requirements that are necessary for the successful development of the broadband infrastructure, especially when the wireless broadband access connections are concerned. For example, the small companies steadily complain that beside the general obstacles such as licensing of the available frequency spectrum for WiMax or monopolistic behaviour of the large telecommunication companies, which were analysed in previous chapters, they also have a problem of communication failure with local authorities.

They explain that they try to communicate with civil officers as with cooperation partners, but meet the wall of incomprehension and indifference to their needs.

At the same time the local authorities also say that they in their turn try to find the common ground with the representatives of small companies, but fail. It seems to be ridiculous but actually is very sadly. The small companies depend on the local authorities in many ways, for instance, the lengthy duration of proceedings in regulatory hearings and decisions is a significant inhibitor of technology-based innovation. Likewise, the rigidity of regulatory accounting rules creates disincentives to the introduction of services based on new technology that may not initially fully recover their costs.

As the economy is remade by new technologies, so must the regulatory structures designed to ensure social benefits be remade. In particular, they must be alert to situations in which the timely elimination of obsolete services is not inhibited by perpetuation of subsidies that no longer serve the purpose for which they were enacted.

In this regard a special subcommittee can be created to the local government, for example, the forming of a Wireless Broadband Access Task Force that will be specified to deal with providing wireless access firms and companies can be a possible solution for this communication problem. On the one hand in this case the companies will always know where an every encouragement will be given to them, on the other hand the support from the local authorities' side will get a distinct form and all their obligations and responsibilities will be clear and obvious that is always good for the controlling purposes.

The Bundesnetzagentur implicitly has used elements of layered regulation. Early on, the conflict between "vertical" and "horizontal" regulatory schemes in the same system caused little difficulty because Internet traffic, in both revenue and costs, was trivial compared to that of traditional telecommunications. Today, the conflict is substantial and growing rapidly, particularly as a result of the widespread adoption of Voice over Internet Protocol (VoIP).

But voice is only one of myriad applications that can be supported seamlessly and with greatly enhanced functionality over a robust Internet transport infrastructure. The advantages of converting from the existing vertical regulatory arrangement to a layered model include: (a) the model matches, rather than conflicts with, the reality of the manner in which services are implemented and delivered over the Internet; (b) competitive abuse by dominant providers in any service layer is more easily identified and remedied; and (c) innovation in future technology and services is promoted by affirming a federal commitment to apply minimal regulatory constraints only to those layers of the Internet where demonstrably anticompetitive market behaviour occurs.

It is obvious that the fundamentals of the layered model are an essential ingredient of an updated and forward-looking legislative approach to promoting and shaping the future of Internet services. This goal can be also seen as critical to the mission of providing a quality learning environment both on campus and through distance learning that is very interesting for us as for the University of Applied Sciences.

7. Broadband-supporting Organizations and Institutions

The so-called broadband access that is available via cable modems or the somewhat slower digital subscriber line (DSL) is technically inferior to that routinely provided to students residing on campus. Thus, higher education has an important stake in the national effort to widely deploy a state-of-the-art broadband public network which overcomes these deficiencies. Many of its own educational goals cannot be realized without affordable and ubiquitous access to such a network.

Big pipes, cheap hardware, and clever applications provide colleges and universities unprecedented opportunities for building new services, new products, and new ways of doing business - and also expose them to unprecedented new challenges. With continuing developments in information technology (IT), the desire for academic freedom and for the open exchange of ideas and information is increasingly testing not only the operational reliability of the institutional electronic infrastructure but also the legal and ethical base of the institutional policy infrastructure.

How can colleges and universities protect personal privacy in the workplace when the private sector agrees that doing so is dangerous? What is the role of an institution in regulating "cyberslacking" (surfing so much that employees don't get their jobs done)? How can institutions encourage students' academic imperatives to experiment with new technological ideas when those ideas may negatively affect infrastructure? Campuses can expect to face such challenges with greater and greater frequency.

The answer, of course, lies in building IT policy now, shaping process and infrastructure. This requires:

- *identifying a core group of people who will bring needed expertise and experience to the table when grappling with a new challenge;*

As a catalyst for efforts to accelerate the planning and deployment of a public broadband network with a sound economic base and with advanced technology that enables e-learning as well as meeting many other vital social and personal needs an association of information technology executives in higher education should be formed that will be specified as a special working group on broadband access technology.

Despite enormous progress in deploying Internet technology and services over the past 15 year, many of the goals for use of the public Internet in education and research, particularly for support of e-learning, remain unrealized. The purpose of this association is to examine the present situation and outline steps that would, if widely embraced, contribute to a revitalization of vision and expectation and lay the basis for creation of an advanced communications infrastructure for Germans that fully supports the needs of the academic community and its educational mission.

This association will surely have a broad impact on academic, service, and professional development aspects within higher education. There are a lot of very interesting questions, for instance, how will universities handle residential phones, with or without implementing VoIP and should residences install in-building wireless to support not only 802.11 but cellular voice and data networks? SMS has the power not only to deliver messages between friends, but possibly assignments from professors, and emergency

notifications. More and more cross-over between data and telephony units can be seen as these technologies more converge.¹⁷

Influenced by operational areas of such an association, institutions have been in the forefront of rethinking the way students relate to technology. Its service areas have long engaged in discussions on the overall use of space, create smart lounges, and update residence cluster models. They are often the first to spot important security threats (and breaches) to the campus network, and they support equal access to computing services through residential computer labs.

Because every entering class of students brings ever more portable technologies and because campus information technology applications create new challenges for collaborative technologies and network usage the services are often at the intersection of academe, residential life, and technology. As such, they are in a unique position to concurrently support the well-being of both the institution's network infrastructure and its students.

The prototypes of such association already exist, but not as a united association for the whole Germany, just as separate organizations, on the base of which the German association of information technology executives in higher education can be created. For instance, in the framework of one of the initialised projects (Wireless LAN) of the Federal Ministry for Education and Research (BMBF), each state are assisted in one or two demonstrative projects about the initiation of a wireless network infrastructure at German universities as a part of education. On the basis of experience at the University of Rostock or some other universities, interested universities and professional institutions will receive support on behalf of the BMBF with the introduction, structuring and the operation of a WLAN-infrastructure at their universities. A part of our informative and counselling function will be to make available, for example, test results (with devices of different manufacturers) as well as assistance with the installation of a WLAN.

- *understanding the institution's cultural values and guiding principles well enough to be able to articulate them as institutional policy;*

The task—articulating an institution's cultural values—is remarkably difficult to do. But it serves as a framework that helps keep challenges manageable. Ideally, such institutional policy not only imparts rights and responsibilities but also communicates an institution's expectations and thus serves as a set of principles that can help provide answers to more operational questions on a day-to-day level. For example, how can an institution determine an appropriate level of privacy in the workplace if administrators don't understand how privacy is valued on campus? These cultural values are fundamental to the ability to make decisions that are "right" for an institution. They should infuse the entire IT policy definition and interpretation process.

At the beginning it should be mentioned that university itself is a certain community with its own rules and standards. In this regard understanding the student perspective is crucial. The students clearly highlight a need for community and sense of freedom because it affects on their ability to be successful in many social aspects of their life. The residential network once viewed as a technical service, and treated as such, has changed to a social service with rules, expectations, and community living standards. The

university should aim to provide a service that can be used to meet any need, social or technical.

The residential network contributes in many ways to the total education of students, including their socialization. After all, while people are at home they relax by communicating with others (via telephone, e-mail, and instant chats); they learn by reading, researching, and doing coursework (much of which is now done online); and they entertain themselves (often online).

- *making policy a part of day-to-day practice—just another part of the IT infrastructure of the institution.*

Applying these principles to real-life situations is equally challenging and requires diverse experience and expertise from people who can together reason out a conclusion in a specific situation. Policy staff, technologists, and campus counsel need to work with administrators, faculty, other employees, and students in such a process. Ideally, an IT policy analyst would take the lead in building these processes and infrastructure and in ensuring that a core group is identified to quickly meet new challenges, bringing in subject experts as appropriate.

Finally, developing IT policy is a significant undertaking and needs resources dedicated to the entire process, from the definition of requirements through the application of policy to real-life cases. Institutions that do not make this policy a part of the day-to-day IT infrastructure will find it difficult to meet the challenges they will face—potentially under high pressure and media scrutiny.

But can computer policy law provide a standard policy for another institution to adopt? The answer, since 1996, has been “no”, for two general reasons. First, at least as important as the policy itself is the process used to develop the policy. To succeed, a policy must have buy-in: all participants must understand the policy and accept it, an outcome that requires input and participation from the beginning. This can take time, it took years, but short-circuiting the process is almost always a bad idea.

The second reason that computer policy law rejects one-size-fits-all policies is that one size does not fit all. Every institution of higher education is unique. To be effective, technology policies must take into account a wide range of distinctive campus features: the campus culture and climate; the existing judicial system, including expectations for on- and off-campus jurisdiction; whether students live on-campus and, if so, the nature of dormitory networking; requirements of state and local laws, including open-records laws. Thus the computer policy law database allows campuses to review and compare a wide variety of policies representing a range of institutions and a range of choices.

The use of computers and networks has increased explosively, both quantitatively and qualitatively. Students now arrive on campus with computing experience and expectations, not to mention the computers themselves. Campus policies at variance with that experience and expectations meet resistance. With technology an integral part of student life the technology policy can no longer be addressed by technology sanctions. On many campuses, losing computer access is equivalent to expulsion. Yet at the same time, with the proliferation of wide area wireless networking, students become less dependent on campus resources their Internet

connections.

Still, regardless of the source of connectivity, incidents of abuse arising from members of a campus community will likely lead to public relations problems for the school and therefore remain a subject for policy. The technology itself keeps changing. Low-cost, easily configurable wireless access points are available now. And each of technology advances raises important policy issues. The law is not keeping up.

A little more than twenty-five years ago, in 1974, Sony Corporation amazed consumers with an affordable videocassette recorder. Producers of television shows and movies objected, complaining that massive copyright infringement would occur if these new devices caught on. It took ten years for the Supreme Court to finally decide that VCRs were legal.¹⁷ Today's court system does not work any more quickly. Moving from the judicial to the legislative branch, we are faced with an increasing number of new laws governing online privacy, intellectual property, protection of minors, service-provider liability, and commerce; the meaning, the impact, and even the constitutionality of these new laws may not be clear for the foreseeable future. In such an environment, policies must be written carefully and flexibly to avoid the need to make major revisions with each new law and each new court decision.

There seems no end in sight to the need for work. With this in mind, and in recognition of computer policy law past success and future importance not only the University Association of Broadband Access Technology, but also the Computer Policy and Law Program should be created.

Several lessons may help in the formation of effective IT policy:

- technology evolves more quickly than law and business practices, and policy lags behind all of them. This isn't necessarily a bad thing, however. Good policy usually requires time to gain experience and wisdom.
- policy appears to require continuous interpretation, particularly given the highly mobile and transient population of higher education institutions.
- many real-life questions often generate a "gut-level" reaction. Ask any ten people whether WiMax is "right" or "wrong," and the interesting thing is not the spectrum of answers given but how fervently most people believe in whatever answer they gave. To overcome these natural emotional (and personal) reactions when developing IT policy, colleges and universities must use a reasoning process that involves many perspectives.
- too often IT staff is put into the awkward position of being gatekeepers, holders of the keys to some desired action (whether it be the ability to look at an employee's e-mail or the ability to send out "mass e-mail" to the entire campus community). Without a solid policy footing, suddenly the IT staff has to decide what's appropriate and what isn't, and often these decisions are made in a vacuum.
- although new technology does not usually create new problems, it often sharpens an existing problem (such as copyright infringement) to the point of crisis. Many of these problems are not technology problems and are not solvable with IT policy. Instead, technologists

must work with campus policy staff to update existing policy in light of new technology. (Cyberslacking, for example, is a management problem rather than an IT issue.)

So, how can an institution of higher education develop a systematic approach to IT policy, even with limited resources? Regardless of size, the first step is to identify who needs to participate and who will be responsible for which aspects of IT policy formation, interpretation, and implementation.¹⁹ An IT policy program can minimize legal exposure, deepen the campus cultural values, and in the longer run, prevent much wear and tear.

8. Net Neutrality

Despite early participation in the development and expansion of the original Internet, over time the higher education community acquiesced in the commercialization of the Internet. Only now it is beginning to understand what will happen to the original vision of the Internet when that monopoly guarantee is fully removed and deregulation rules without limit.

There is no single definition of net neutrality: the phrase means different things to different communities, companies, and individuals. The simple definition used by Common Cause states: "Network neutrality is the principle that Internet users should be able to access any web content they choose and use any applications they choose, without restrictions or limitations imposed by their Internet service provider." But such simplicity can itself beget confusion. What does the phrase "Internet users" really mean: does it refer only to individual end-users or also to corporate users like eBay, Google, Sony, and other service and content providers?

How are "restrictions or limitations" to be interpreted? Do these refer to bandwidth shaping? To mass e-mail and spam? Is pricing considered a restriction on accessibility? And aren't Acceptable Use Policies (AUPs) full of restrictions and limitations on users? On further examination, net neutrality soon seems related to everything involving the Internet: privacy, security, freedom to communicate, innovation, and above all, who controls the Internet. Since the meaning of net neutrality shifts depending on who gives the definition, a quick introduction to the basic players and the vocabulary may help.

The participants can be loosely grouped into those who, for the most part, are against the articulation and enforcement of net neutrality principles (who are referred to below as Deregulators) and those who, largely, are in favour of enforceable net neutrality principles (who prefer to be called Openists, rather than the more obvious Regulators). Among the Deregulators are the incumbent telecommunications companies, or "telcos"; the cable companies and their; and equipment vendors. On the other side, the Openists include CLECs (Competitive Local Exchange Carriers) and their associations; content providers (Amazon.com, Disney, eBay, Google, Microsoft, Yahoo!); VoIP (Voice over Internet Protocol) companies (Skype, Vonage); and higher education organizations. Public interest groups are also active in favouring the formalization of net neutrality principles.

A specialized vocabulary—a mixture of law, economics, information technology, marketing, and telecommunications jargon - informs and frequently confuses the net neutrality debate. General concepts like access, attachments, blocking and impeding, quality of service are intermixed with the economic meanings of terms like duopoly, oligarchy, innovation, and Schumpeterian creative destruction. This mixture is then topped off with telecommunications acronyms and with paired concepts like dumb/smart pipes, edge/core networks, and bundled/unbundled services. Debaters frequently talk past each other, often deliberately so, using the same words but with their preferred meanings.

Several academic and think tank pieces were published in 2004,³ and the debate broadened in 2005 as newspaper and trade journal articles on net neutrality began to appear monthly. At the same time the lack of any consensus on net neutrality soon came to be viewed as a major obstacle to comprehensive telecommunications legislation.

Limited deregulation following decades of monopoly and quasi-monopoly policies and practices has resulted in telecommunications environment in which the telcos and cable companies maintain a duopoly and minimize competition through mergers and acquisitions. For example, the remaining telcos now have their own cellular and fibre networks, and some have partnered with broadband satellite companies. Given that the remaining competition is between the three major modes of broadband service (cable, fibre, and satellite), the problem of intermodal collusion is increasingly important. In economic terms, duopolists and oligarchists, those controlling the limited modes of production and delivery, have had a history of fixing prices and stabilizing market share by jointly discouraging competition. This can happen naturally, without any direct communication or criminal intent. Within such a small group as two or three competitors, there may be more incentives *not* to compete than to compete, and new competitors faced with high market-entry costs have recourse only through time-consuming antitrust litigation. What this means for consumers is fewer provider choices and more product choices made for them by the dominant players.

The Openists argue that the duopolists “still don’t get it” with respect to the cooperative nature of the Internet and its historical end-to-end structure designed to give endusers both the freedom to choose and the freedom to innovate. Instead, having turned end-to-end on its head by vertically integrating their companies, the telcos and cable companies argue that they are now free not only to assert their exclusive ownership over the limited number of consolidated networks but also to enforce end-to-end control over all products and services flowing through those networks. This is the familiar heavy-handed, “we know best” approach that rings hollow since a dozen or more countries now offer greater bandwidth at lower prices to a larger percentage of their citizens.

Today’s telcos seem to have little obligation to - and even less interest in - universal service. Instead, in pursuit of the best return on investment so that their proprietary broadband networks can be deployed quickly, the incumbent telcos are concentrating on who can pay and how much their services saturate the market at the highest prices it will bear. The Deregulators want to continue to deregulate because they believe there is no problem that their free market approach will not solve and that any abuses can be resolved after-the-fact through antitrust litigation. For the Deregulators, a compromise on net neutrality would be to self-police - that is, to endorse a set of net neutrality principles in the form of a pledge that could be enforced by simple peer pressure and consumer choice.

From the Openists’ viewpoint, the net neutrality debate and the threat of regulation through legislation must continue until strong net neutrality principles are codified and common carrier obligations reestablished. At the same time, Openists intend to pursue self-help in the form of community and municipal broadband networks and the use of unlicensed spectrum.

Reaching a national consensus on net neutrality soon is highly unlikely, given the two fundamentally different visions of the future: the Deregulators' belief in a world of bandwidth scarcity, which justifies their tiered-pricing approach to services; and the Openists' belief that a world of bandwidth surplus is upon us if we would but build it. Although it is also unlikely that the current administration will support a strong legislative-enforcement mechanism for net neutrality principles, there is no reason to despair.

Over time, monopolies tend to dig their own graves, and their demise, though long and painful for those living under their sway, eventually arrives. The Internet was created at least in part because monopoly and failure to innovate, and Linux was created because of Microsoft's market domination.²⁰ Flawed telecommunications policies may cause the greatest short-term damage to the nation's ability to innovate and to its global competitiveness, but it is this same urge to innovate that should prevail over the long run.

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