Handbook of Research on Global Diffusion of Broadband Data Transmission

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Chapter XIII
Metropolitan Broadband Networks:
Design and Implementation Aspects, and Business Models

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ABSTRACT

This chapter presents the design principles that cover the implementation of broadband infrastructure in the region of Western Greece, by examining all the necessary parameters that arise while implementing such a critical developmental project. The broadband infrastructure that is deployed is either based on optical fiber (on big municipalities) or on wireless systems (OFDM based and WiFi cells). Furthermore, we present as two case studies all issues of the designing of the Metropolitan Area Network of Patras, the third largest city of Greece and the Wireless Access Network of Messatida. The major target of the broadband networks is to interconnect the buildings of the public sector in the city and also deploy infrastructure (fibers or wireless systems) that will create conditions of competition in providing both access and content services to the advantage of the end consumer. The usage of the broadband infrastructure by service providers will be based on the open availability of the infrastructure in a cost-effective way. Finally, we present the main characteristics of a proposed business plan that ensures financial viability of the broadband infrastructure and guarantees the administration, growth, and exploitation of infrastructure.

INTRODUCTION

This chapter presents the design principles that cover the implementation of broadband infrastructure in the region of Western Greece, by examining all the necessary parameters and studying all the issues that arise while implementing such a critical developmental project. In particular, we present the main principles that should be followed while developing such metropolitan area networks. Regarding the design guidelines, in this chapter we cover issues such as architecture of the broadband network, topology selection, requirements of the passive and active equipment, and requirements of the fiber and ducting infrastructure. Furthermore, we present as a case study critical issues regarding the design of the metropolitan area network of Patras, the third largest city of Greece. The main target of the MAN of Patras is to interconnect the buildings of the public sector in the city. The organizations that are going to be connected in the MAN are organizations of the sectors of public administration, education, health, culture, and so forth. The usage of the broadband infrastructure by service providers will be based on the open availability of the fiber optics infrastructure in a cost-effective way. Finally, we present the main characteristics of a proposed business plan that ensures financial viability of the broadband infrastructure and guarantees the administration, growth, and exploitation of the infrastructure.

Several related projects that implement neutral broadband infrastructure in cities are running across the world. For example, Ireland, Sweden, and New Zealand run such programs, where the local authorities design and fund the major part of the projects aiming to increase the broadband penetration with benefits to the end users (UTOPIA, 2006; CityLink, 2006; Localret, 2006).

This chapter is structured as follows. We next describe broadband infrastructure in Europe and in Greece, then present the general guidelines for the design of municipal broadband networks. Following this, the methodology of work regarding the designing of the MANs is offered, and the overall architecture and topology of the MAN of Patras is briefly described. Additionally, the same section describes the architecture of smaller wireless networks that are implemented in smaller municipalities where the optical MANs are not profitable and presents a typical case study that is Messatida municipality. A presentation follows of the main characteristics of a business plan that ensures the financial viability of broadband infrastructure. Finally some concluding remarks and planned next steps are presented.

BROADBAND STATUS IN GREECE

The importance of broadband infrastructure worldwide is confirmed by the activities of certain advanced countries in order for the appropriate broadband infrastructure to be developed and adopted so as to contribute to economic growth and to tackle any possible cases of "technological exclusion" of citizens (Firth & Mellor, 2005).

The importance of broadband networks for the development of a country may also be confirmed by the intensiveness of the activities of many countries that set as their main strategic objective the implementation of such infrastructures. In addition, the development of such networks has also been adopted in the common European policy for the implementation of the Information Society. In eEurope 2005 as well as in i2010, broadband access is an important priority of the European Union (EC, 2002; Europa, 2004).

In the current situation, the proper infrastructure in Greece is owned only by the former public telecommunications provider (OTE), while the alternative providers seem only to have plans in expanding their network infrastructure within the big cities of Greece. The business plans of the alternative telecommunications companies and network carriers do not include the expansion of their network throughout Greece, since they are afraid that non-urban areas do not appear to have any business interest. Broadband access, as defined by the "Strategic Text on Broadband Access" of the relevant task force, requires the proper broadband infrastructure and the competition between the Internet service providers. Since broadband infrastructure is now being developed, the penetration of broadband usage has not been increased. Although these findings are pessimistic regarding the growth of broadband, the action line of the operational program "Information Society" appear to be a significant hope for the near future.

Unfortunately, the broadband penetration level has been very low in Greece. Greece has been the last country among the EU of 15, and remained last, in providing broadband access among the 25 countries of the EU (see Figure 1) (Europa, 2006). This is caused by the fact that there is no investment by the private sector, therefore there is no competition in the broadband market in the region.

The main issues that occur during this research for the current state of broadband in Western Greece could be divided in two main categories: (a) the clients' side, as far as broadband demand is concerned; and (b) the providers' side, as far as broadband supply is concerned. Regarding the end users, the major issues are the following:

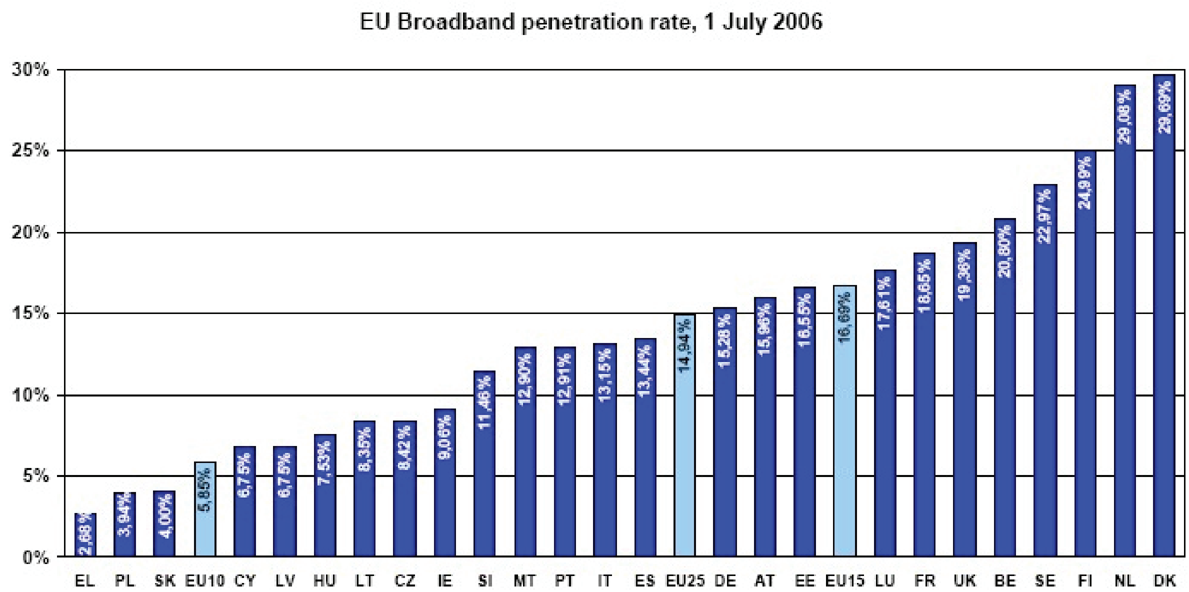
- High cost of broadband access regarding home usage
- Lack of broadband services that will take advantage of the infrastructure

The telecommunications companies have raised a number of issues that discourage them from investing in broadband infrastructure and services. Synoptically these issues are:

- Lack of the regulatory framework that adjusts and defines the market of broadband services, in order to ensure market and competition's functioning
- Difficulties in developing local loop unbundling (LLU)
- Lack of preparation in supporting the demand of broadband services by the former public telecommunications carrier (OTE)

Since the start of 2005, the xDSL penetration has been rising. The current access network (copper cables) is being updated by installing xDSL technologies such as ADSL mainly and HDSL. According to OTE, 10,929 ADSL ports were installed in the region of Western Greece by the end of 2005 (and 270,000 throughout the country). In addition, wireless hotspots have been installed in public places, such as ports, entertainment parks,

Figure 1. Broadband penetration rates in EU25



and so forth, through a project of the Information Society.

Another measure that is expected to boost ADSL use in the major cities of the country is the provision of ADSL Internet access at a diminished cost to university students. This measure was announced by the Greek government in June 2005, and it will begin at the start of the next academic year.

Taking into consideration the current state in the region of Western Greece where the telecommunications market still depends on the core fiber optics networks of the dominant provider (OTE) and all the above mentioned issues, it can be said that it is important for the Greek government authorities to update the telecommunication law of the country. This could secure the viability of the public and private telecommunication companies, and simultaneously the viability of the community-owned networks. To this end, the Greek government authorities, taking into consideration the issues mentioned in this section and the variability of the Greek telecommunications market, passed the new telecommunications law. This law aims to secure the telecommunications market and competition in Greece, and as a consequence, better services will be provided to the citizens. The new law provides the telecommunications firms with the conditions to enable the reduction of prices. The specific clauses clearly describe the functioning of the Regulatory Authority (EETT) in terms of independence and efficiency. The issues concerning the rights-of-way are also being defined (e.g., the rights-of-way of fiber optic through urban planning resources of different proprietors such as municipalities, individuals, institutions, and organizations), collocation issues, and the demarcation between public and private networks.

ISSUES ON DESIGNING BROADBAND INFRASTRUCTURE

This section presents the main principles that should be followed while designing such metropolitan area networks. In Western Greece (our case) the networks belong to cities, where in most of the cases the municipalities do not have the proper know-how of designing such networks. Therefore, a specialized technical consultant (the Research Academic Computer Technology Institute) has been selected in order to provide its know-how. In particular, the consultant works on conducting the studies of the networks' design and architecture, supervising the technical part of the construction of the networks and also designing the business plan that will be applied and will ensure the network's viability. The business plan proposes the scheme that will be responsible for the operation of the networks, according to the criteria and the guidelines of the EU (EC, 2002; Europa, 2004).

The expected result of these projects is the creation of broadband infrastructure in Greece, which in turn will create conditions of competition in Greece in advance of the end user. A common strategic design and implementation in a regional level is highly desirable. At the first stage, the main target of these networks, as metropolitan area networks, is to interconnect the buildings of the public sector of the cities in which they will be developed. The organizations that are going to be connected are those belonging on the education, health, and culture sectors, and so forth. During the second stage, this infrastructure will be available on network and content providers in a cost-effective way. The latter will create conditions of competition in broadband infrastructure and services that will benefit end users. The plan for deployment of the infrastructure encourages the public exploitation through the leasing of pairs of fiber optics. This fact provides revenue in a cost-effective way in order to cover all operating and maintenance costs.

The projects mainly consist of manholes, ducts, channels, fiber optics, points of interconnection, together with the installation of the passive and active equipment in order to provide the basic broadband access in the public sector buildings. In particular, a broadband infrastructure based on optic fibers will be installed across the cities, and several public collocation points will be created. The projects also fund some additional access infrastructure from public sector buildings to the collocation and aggregation points. This access infrastructure along with a small part of the cities' broadband infrastructure will be used to provide network connectivity to the public sector. The remaining broadband infrastructure (optic fibers and collocation points) will be available for the content and service providers to use, and it will provide broadband services to the citizens.

The major characteristics of the mentioned broadband infrastructure according to the European Commission (EC, 2003) should be the following:

1. **Open access:** The funded projects must be consistent with the new regulatory framework of electronic telecommunications and the rules of competition (public funding and antitrust). The appliance of these rules is a commitment in order to have clearly defined open access. In particular, the construction of the networks, as already mentioned, should be limited in the construction of infrastructure and equipment that will be open to any telecommunication carrier and service provider (ED, 2003; Magnago, 2004).
2. **Neutral operator:** The main principles in the deployment of the broadband infrastructure assign the network operator the obligation to retain the neutral character of the infrastructure. The network should be an open access installation to all the organizations that provide electronic networks and services with absolutely no discriminations against them (Economides, 1996).
3. **Infrastructure owner:** The municipality constructs the broadband infrastructure and obviously has specific benefits from these networks. Therefore, it is also responsible for planning the expansion of the current infrastructure in a controlled and rational way. Also its role is to solve all issues of the installed infrastructure and declare the rules of usage of the infrastructure by the providers.

METROPOLITAN AREA NETWORKS

This section is dedicated to describing the methodology that we followed in order to design the MAN of Patras. Furthermore, it presents the main characteristics of the MAN of Patras in terms of topology, architecture, and technology selection.

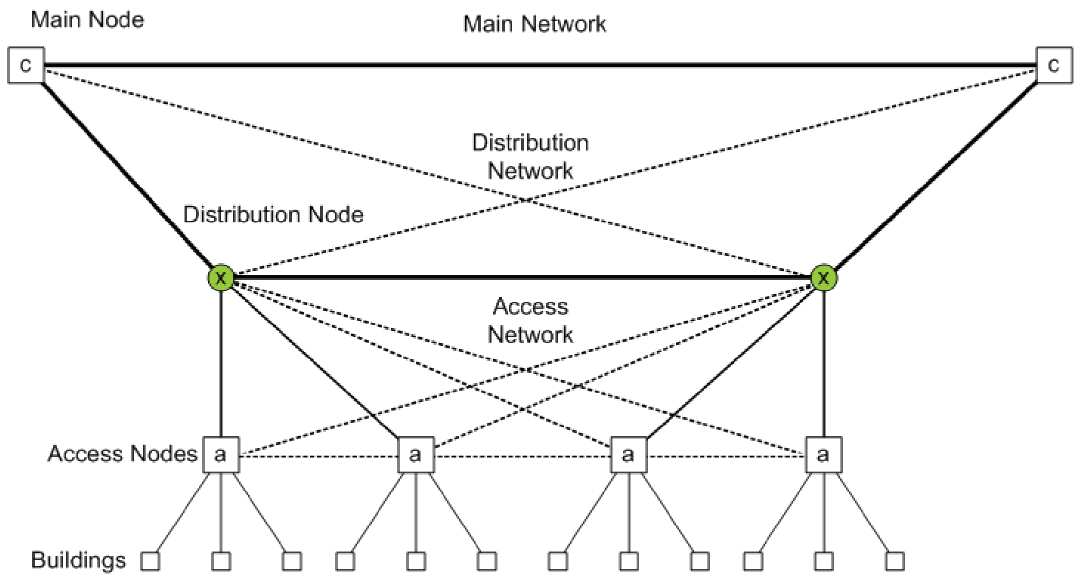
Designing Aspects

The overall architecture of the MAN is shown in Figure 2 (ITU, 2006). The topology is based on a three-level model: main network, distribution network, and access network. In turn, there are three types of nodes in the system: main nodes, distribution nodes, and access nodes.

The main network consists of a number of main nodes that are connected directly between each other. In the main network, there must be some direct redundancy between main nodes which are close together. This means that it must be possible from one main node to reach the main nodes next to it without passing through the active equipment of another node. The optical cables should be laid without a break between the main nodes, so as to achieve high operational dependability. The main network's optical cables that connect different main nodes are to be separately ducted. The number of fibers between the main nodes in the main network in a municipality ought to be not less than 72 per optical cable. This number results as follows: Each distribution node usually collects traffic from approximately eight access nodes, as designed in the technical studies for the development of the networks. Each access node gathers two pairs of fibers (one uplink and one backup), thus each optical cable should have at least 4 x 8 = 32 fibers, plus 32 for alternative routes in the distribution network. The available cables usually provide 48, 72, and 96 fibers, so 72 is the lower acceptable optical cable. If main nodes in different municipalities are long distances apart, with a smaller number of distribution nodes, the number of fibers may possibly be smaller if this is justified by great differences of fiber cost.

As far as the distribution network is concerned, it consists of the distribution nodes. A distribution node shall connect to a main node and shall be planned to have a redundant connection to another main node. The optical cables should be laid without a break from each main node to any

Figure 2. General architecture



distribution node. Alternatively, an optical cable loop is laid with two or three distribution nodes where the need for each distribution node is hived off. Over long distances this will be a cheaper but more vulnerable option. The number of fibers in the distribution network is affected by the following parameters:

- Number of access nodes connecting with each distribution node
- Number of operators needing connections in the distribution network
- Leasing of dark fiber to other actors

The number of fibers to each distribution node ought not to be less than 72 per optical cable, as already described.

The access network consists of the access nodes. A number of buildings are connected to an access node through a fiber cable with at least four fibers (two pairs of fibers, one uplink and one backup).

Regarding the fiber infrastructure, the additional optical cable will be installed, in order to handle situations of possible or anticipated penetration in the area, a large number of Internet operators active in the area, the positioning of active equipment, and the degree of redundancy in the networks. As a general rule, if existing ducting is to be used, a careful assessment must be made of the best way to use it. If the number of existing optical pipes is small, an optical cable with many fibers will have to be laid so as to make maximum use of the ducting.

For the part of the network that will provide connectivity to the public sector's buildings, the ethernet technology has been selected (Metro Ethernet Forum, 2006). Ethernet switches are used on access nodes and aggregate the traffic from the buildings. Each building has a 100 Mbps or 1 Gbps connectivity through Base-LX SFPs. The distribution nodes do not have any active equipment, only passive. The main nodes have gigabit ethernet switches with advanced features. Those switches connect the ethernet switches of access nodes as well as the buildings that have dedicated fiber connections. This choice has been done due to the fact that the public sector's buildings should use various service providers. In particular, the traffic from the connected schools in the MAN should be forwarded to the Greek School Network, the traffic from universities on Greek Research and Technology Network, and so forth. Therefore, the designing approach is to configure the equipment in such a way that will provide Transparent LAN services, connecting the building to their service provider transparently and "friendly" (Kompella & Rekhter, 2005). The latter means that the approach will eliminate the limitations that add to the network and service providers.

Methodology of Work

In order to handle the project work and secure the correctness and quality of the design, a specific methodology was followed. In particular the steps were the following:

- Several visits on municipalities took place, in order to finalize the location of the building, the points that the building will connect to the network, and the final mapping out of the ducts
- Design the network according to the three distinct levels (access, distribution, and main network)
- Design the requirements of the network's nodes and the equipment (passive and active)
- Write the first version of the analytical design study of the network
- Write the specific requirements of the network's components according to each municipality's needs
- Perform indicative cost accounting of the requirements and the overall design in order to ensure that it is compliant to the allocated budget
- Finally, optimize the network design and equipment requirements

The above mentioned methodology was used efficiently for eight different municipality networks in Western Greece. The case of MAN of Patras was the largest one and therefore the most complex.

The MAN of Patras

The city of Patras is the largest municipality in the region of Western Greece, the third largest city of Greece (its metropolitan area has a population of more than 200,000), an important commercial center, and a busy port—the second largest in Greece. Patras' MAN connects 210 public buildings in the city, among them three university institutes, six research centers, four hospitals, and 120 schools (primary and secondary).

Immediately benefiting from this network will be all the employees of institutions of education, research, health, and public administration in the region of Patras, while in effect all the citizens of a wider region of the city of Patras will profit. Additionally, all major Greek content and service providers can use (cost effectively) this infrastructure to provide broadband services to the citizens. Their interest is quite large as the local 'Patras' market is very attractive.

The MAN of Patras consists of five rings, while the total length of the ducts is 48 Km (see Figure 3). The used fiber cables (various types, 24/36/48/72 fibers) are approximately 230 Km. Among the rings, a star topology is used for the connections of the buildings to the access nodes. Additionally, 100% redundancy has been designed for the distribution and main network. More specifically the Patras MAN will consist of:

- Four (4) main nodes
- Eight (8) distribution nodes
- Twenty-two (22) access nodes
- Nine (9) wireless access nodes

Regarding the cost of the total investment, the Patras infrastructure cost approaches the value of 3 M€ which is absolutely comparable to the cost of the telecommunication services of the public sector of municipality of Patras. As shown in Table 1, this cost is approximately 2.2 M€ according to recent research for the municipality of Patras conducted by the Research Academic Computer Technology Institute. Consequently, the depreciation of the cost of the whole investment in the municipality of Patras will take no more than two years.

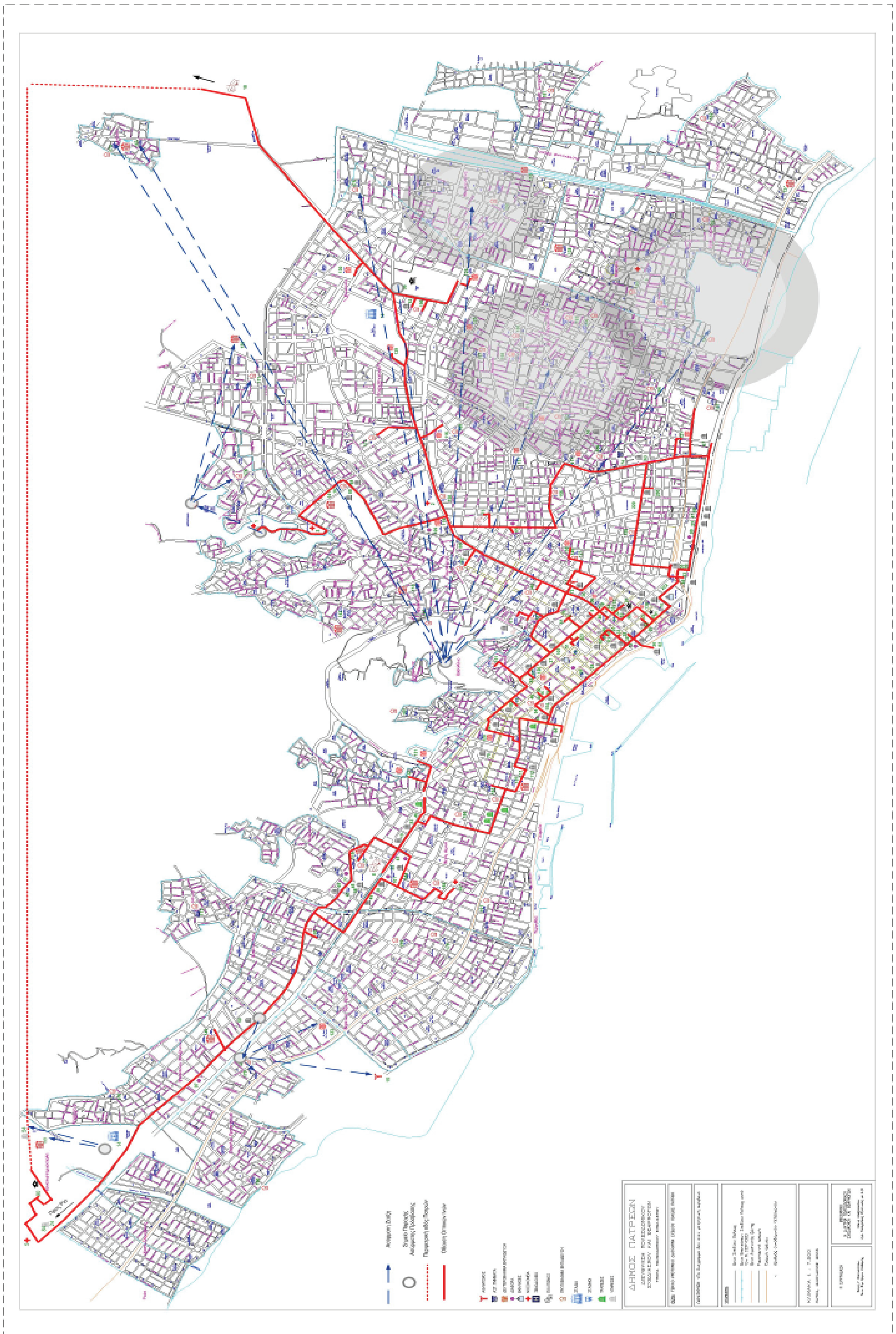


Figure 3: The general ducting schema in Patras MAN

Table 1. Telecommunications fees in the municipality of Patras (in K€)

	ORGANIZATION		SUM
Education–Research	Universities	2	880.41
	Technical Universities	1	73.37
	Research Institutes	6	117.39
	Elementary Schools	76	102.72
	High Schools	44	108.58
	Public occupational centers	2	5.57
	Hospitals	4	622.16
Government	Region	1	158.48
	Prefecture	1	70.43
	Municipalities	2	76.30
	Libraries	1	3.22
	Sum	**140**	**2218.6**

Wireless Municipal Networks

Additionally, the Information Society program funds similar smaller projects that are suitable for small municipalities (less than 10,000 citizens) that mainly are underpopulated. These projects have the same goals as the optical metropolitan area networks, but due to the local geography (difficult morphology), the underpopulation of these areas, and the small needs of the public sector, the deployment of optical infrastructure is unprofitable. Therefore, these special projects are carried out and are based on wireless technology.

The main design goal is the existence of backhaul connections based on multi-carrier OFDM that can succeed with large transmit rates over long distances and also support non-line-of-site (NLOS) connectivity. These systems are accompanied by WiFi products that are used in the densely populated areas in order to connect various sites of public sector (local authorities, schools, hospitals, etc.). Following this approach, small wireless networks can be implemented, investing a reasonable amount of money.

Those networks are designed in a three-level hierarchy (see Figure 4), where there are:

- Access nodes that provide connectivity through WiFi systems, or in special cases through multi-carrier OFDM (mainly WiMAX)
- Retransmission nodes that are used to connect main and access nodes when their immediate connection is not feasible
- Main nodes that aggregate the traffic from all connected sites and provide inter-municipal routing. Main nodes also support the interconnection with the global Internet through the appropriate providers in a federated way

Except for the basic connectivity between sites, those networks aim to provide inter-municipal VoIP calls for all public sector sites and connectivity with other federated networks that are higher in the hierarchy (for example, school networks, national administrative networks). Additionally, the expansion of those networks is a continuous goal that can be succeeded either with wireless or optical connections. Finally, these networks will comprise the basis for the e-government and all the e-services of the new digital world that the European countries try to establish.

In the region of Western Greece, 19 small municipalities are going to implement such wireless metropolitan networks, aiming to limit their operational costs and increase the quality of the services provided to the citizens.

The Wireless Access Network of Messatida

This section presents a case of a municipal wireless access network—the case of Messatida. Messatida, in the western part of Peloponnesus and very close to Patras city. The population of the city is 11,873, and its area is 66.4 square kilometers.

The proposed municipal wireless access network covers the wider region of Messatida and constitutes a network that could be easily implemented

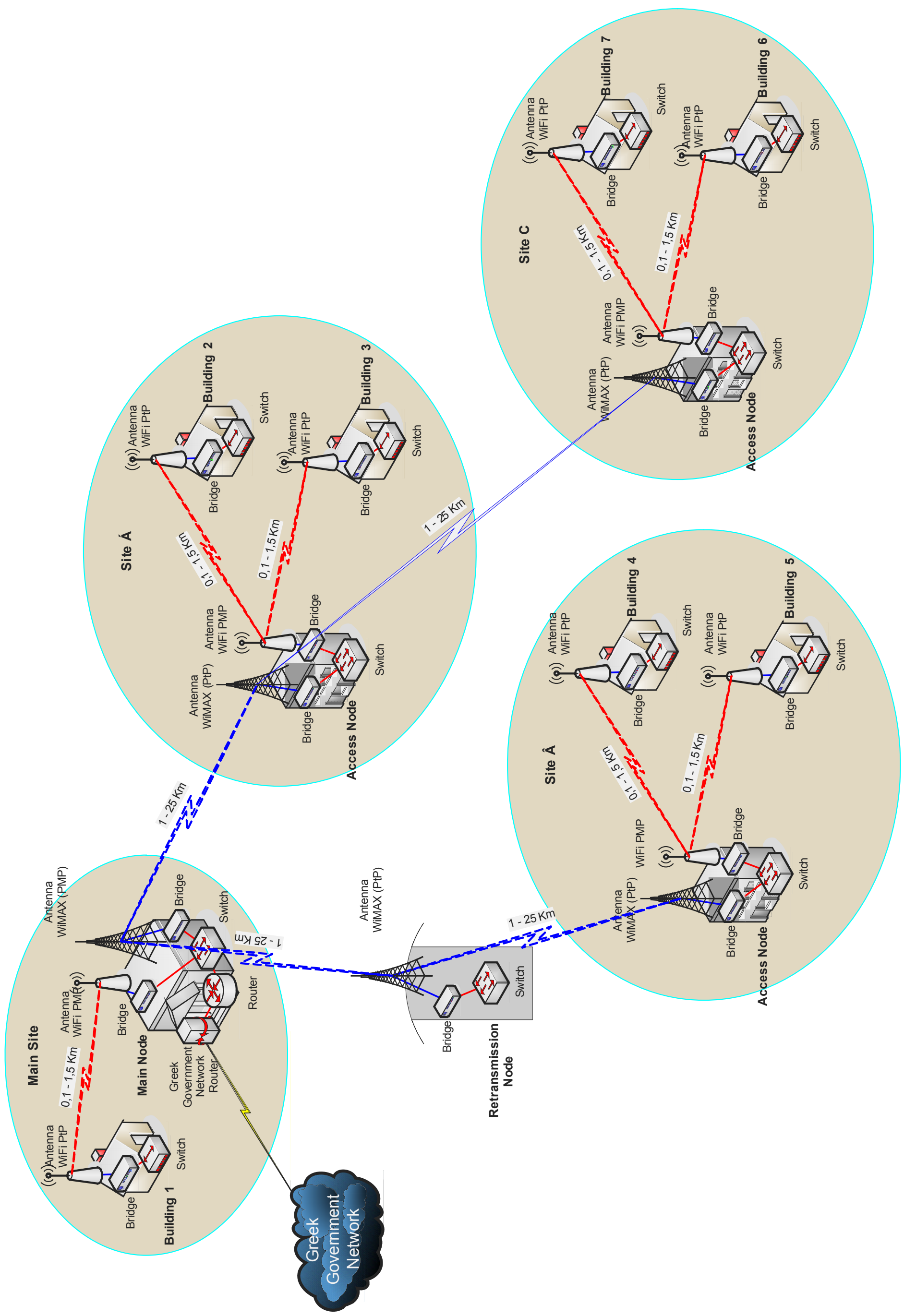


Figure 4: The architecture of wireless broadband networks

since the covered distances are relatively small. This network will benefit institutions of education, research, health, and public administration in the municipality of Messatida, and all citizens of the wider region of the city of Messatida will have access to this broadband network.

The municipal wireless access network of Messatida consists of the backhaul network and the access network. The backhaul network consists of point-to-point and point-to-multipoint high capacity links (one and four respectively), with high-power transceivers able to cover long distances with a cost-effective way. The selected technology could be either WiMAX or any technology that supports multicarrier OFDM.

The whole wireless network of Messatida has one main node, six access nodes, and uses one retransmission node that is necessary due to the morphology. The total number of connected buildings is 22. As far as the access network is concerned, it consists of large-scale cell deployments implemented with point-to-multipoint WiMAX/multi-carrier OFDM technology, as well as WiFi hotspots where the cell radius is small enough. In particular, two access connections are implemented using WiMAX and six using WiFi systems.

Interconnection at a National Level

A major issue for the viability and exploitation of those networks is the interconnection between them in order to make a full connected broadband country. It is a key point for future years, but also a big challenge due to the morphology of Greece.

In a first stage, the interconnection of all the optical MANs and the wireless municipal networks from each "provider" of the public sector (school networks, Greek research and education networks, the Greek government network) independently is an obvious solution. In this case, each provider will establish links that will route its traffic from the main node of each municipal network. But this solution must be temporary, as it is not scalable and cost effective due to the fact that each provider leases lines (or buys access lines from OTE) that are expensive and technology specific.

The outer goal should be the interconnection of those networks (not even for the needs of the public sector) through broadband infrastructure that will either be deployed or will be leased for a long time (at least 20 years). The solution for the deployment of interconnection infrastructure could be an easy solution, if we take advantage of existing projects for construction of highways and other roads. In this case, the deployment of optical infrastructure during the construction is worldwide a very cheap solution. Additionally, for solitary areas where the optical deployment is not feasible, alternative solutions such as wireless backhaul connections based on OFDM technology or satellite links can be studied.

This prospect will offer global connectivity through infrastructure compliant to specific technology standards and neutrality. Over this infrastructure, each provider will offer its services to its clients. The latter also applies for public sector needs.

Generally, it is a key point to study carefully this prospect of global national connectivity that will add value to these municipal broadband networks and will also expand their usage and viability.

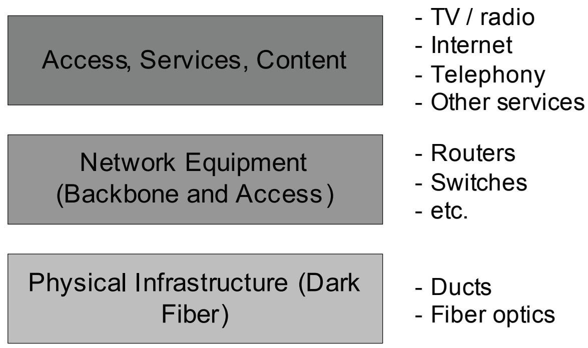
BUSINESS MODEL

In order to secure the financial viability of the broadband infrastructure of Western Greece, it has to be supported by a business plan. Such business models have been proposed by several researchers and are used on other broadband municipal networks.

A business model defines the way a metropolitan public network should be exploited. It defines the role of the municipality or the public authorities, the handling of competition issues, the involvement of private companies, and so forth. Its intention is to provide the citizens with a viable metropolitan fiber optic network, including the proper resources for the maintenance and the expansion of the network (Monath, Kristian, Cadro, Katsianis, & Varoutas, 2003; Ecomomides, 1996). The main goal is the provision of better and less expensive services to the public (Henderson, Gentle, & Ball, 2005). Figure 5 presents the three basic levels of a business model:

- The first level refers to the physical infrastructure of the network (ducts, dark fiber, etc.) and to the organization that provides and exploits this broadband network infrastructure
- The second level refers to the active equipment of the network (e.g., routers, switches, etc.)
- The third level refers to who has access to the network, its services, and the provided content

Figure 5. Basic business model's levels



By assigning each of the above mentioned levels to different organizations, consortiums, or companies, different business model cases can be proposed:

1. **Equal Access Model:** In this model the broadband infrastructure is built by the city or state and then it is leased or sold to an operating company or a consortium. The operating company adds the active equipment to the network and sells access to the operating broadband network to any service provider. The service providers pay the operating company a monthly fee per customer, while independent content providers are able to sell their content to the public or to business customers. This process is done through the operating company's portal, which is responsible for keeping billing records and having a direct billing relationship with the customer.
   The role of the public authorities (municipality or government) in this model is to stimulate competition at the level of content and services. The government in this model has already invested in passive infrastructure, thus the cost for a service or content provider to enter the market is much lower. Through the operating company the government ensures an equal confrontation of all the service and content providers. In this model the roles and responsibilities of all the involved organizations must be clearly defined, because it may lead to complex structures and processes (Chlamtac, Gumaste, & Szabo, 2005).
   The equal access model is followed by a number of international and EU countries. Examples of this model can be found in The Netherlands (Enschede) with the Dutch/German Internet Exchange (NDIX), in Canada (Alberta) with Axia, and in the United States (Grant County) with the Zipp Network. Variations of this model can also be found in the case of the city of Amsterdam, where the physical infrastructure already existed, and in Spain (region of Catalonia) and Italy (Infratel), where local government also set up the active infrastructure of the network.
2. **Sole Private Provider Model:** This model is applicable for cases where no service and content providers preexist, and the broadband market has not created a critical mass of customers that would be able to generate sufficient revenue to a large number of involved companies. In this model the operating company is also the service provider. In this way, the development of broadband infrastructure can become more easily a viable project, but the customers experience a less wide range of services at a price that does not benefit the competition of companies. For this reason, the monopoly of the operating company should be maintained temporarily, in order to lead to an equal access model in a fixed period of time. This model requires a lower manage-

ment complexity and is also more attractive to service providers as it becomes commercially viable much more quickly (Chlamtac et al., 2005). Examples of this model can be found in Sweden (Stokab–Stockholm) and The Netherlands with the Fiber Pilot program in Almere.

3. **Full Public Control Model:** In this model all the layers are managed by one or more public organizations, including the development of passive and active infrastructure and the provision of services. The private sector can also get involved in a variation of this model, by the creation of public-owned companies with private capital investment. This model is suitable in cases where the involvement of an operating company is not feasible and no service providers are activated. Most of the time, this is the case of rural or remote communities, with no prior broadband infrastructure (Chlamtac et al., 2005).

   The main problem of this model, like the previous one, is that no competition is evolved between service and content providers. Moreover, the lack of technical expertise of the local government most of the time has as an effect of less innovation in the deployment of the network and its provided services. Finally, the cost of the total investment in building the network and providing the services is quite high for the local government.

   Examples of this model can be found in Italy with Terrecablate in Siena and Acantho in the region of Emilia-Romagna, and in Austria with the Wienstrom in Vienna.

Proposed Business Model

The selection of the proper business model is essential for the viability and the success of the project. Regarding the metropolitan area networks, the use of the equal access business model based on a national level is the one that seems to fit most in the case of Greece. In this business model, the public sector is only the owner of the passive infrastructure (level one in the model presented in Figure 5) while in the upper two levels (Figure 5), competition is delivered between both telecommunications carriers that operate the networks and content and service providers.

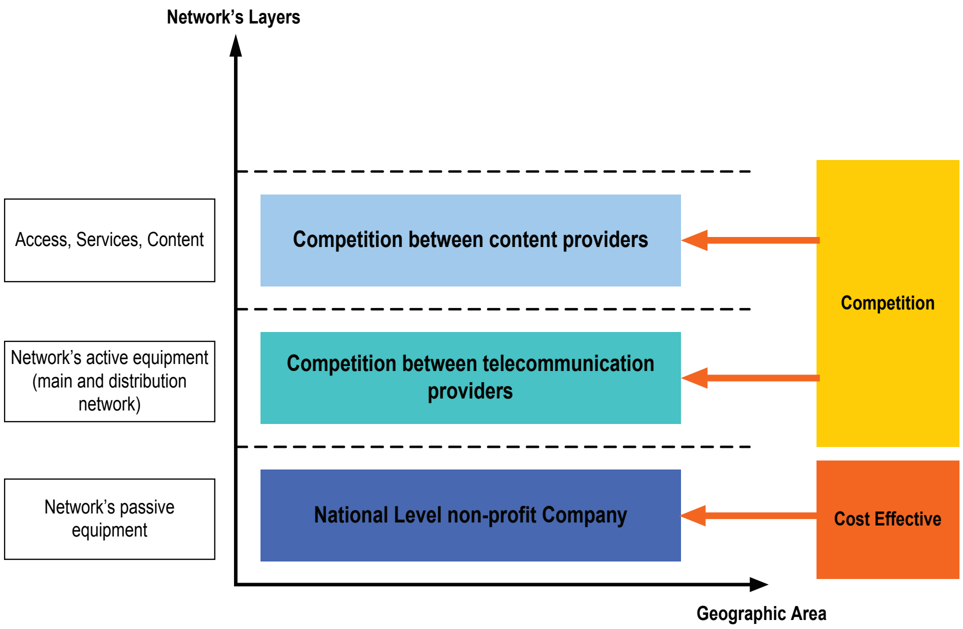
The public sector's organization (which will operate on level one) will provide the fiber optics infrastructure, in a cost-effective way, to the telecommunication companies. The mission of this organization will be to establish competition conditions between the providers, and maintain and expand the network, where this will be necessary. In particular, it should have certain responsibilities, such as the information of the citizens, the recording of the needs during the use of the network infrastructures, in order to be able to maintain the networks and conduct the studies for their expansion. The requested revenue for the expansion of the network will come by the leasing of the existing infrastructure to telecommunication and service providers. Thus, the service and content providers will focus on their role by providing their competitive services in a cost-efficient way. The consumer will be able to choose from among the competition a great variety of different services.

All in all, this model has some certain advantages regarding the design and the deployment of an overall broadband network in Greece. In this way, the service and content providers will provide their services at a low cost and in a continuously developing way. The service providers will also gain from this situation, as they will have access to national infrastructure through one organization and network operating schema. Additionally, there will be competition in the network level between telecommunication companies and competition in the access, services, and content level among the service and content providers (see Figures 5 and 6).

CONCLUSION

This chapter presented the basic design aspects for the broadband municipal infrastructure networks in the region of Western Greece. The proposed broadband networks will cover the needs of the eight major cities within the region of Western Greece and 61 other networks in other regions of Greece.

Figure 6. The application of the proposed business model in network layers



These networks will interconnect the organizations of education, research, health, culture, and the sum of the buildings of public administration via high-speed connections, and will also establish public collocation points and exceeding fiber cables that can be used cost effectively by service and content providers. The projects are in the construction phase, and in the second half of 2008, the network will be up and running. Additionally, the case of the city of Patras, the largest case on the designed MANs, is described. Finally, the chapter discusses the proposed business models for the operation of those broadband networks and the one that we believe better suits the Greek case.

For future work, we already have plans to study and propose an appropriate business model to cover all technical and political aspects for the operation of those broadband infrastructure networks.

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KEY TERMS

Access Network: Part of the network architecture that consists of a number of access nodes.

Business Model: A plan that ensures the financial viability of the broadband infrastructure.

Distribution Network: Part of the network architecture that consists of a number of distribution nodes.

Main Network: Part of the network architecture that consists of a number of main nodes.

Optical Fiber Network: A type of network mainly based on fiber optics technology.

Wireless Access Network: Type of network mainly based on wireless technology.