

# Encyclopedia of Information Science and Technology

Second Edition

Mehdi Khosrow-Pour

*Information Resources Management Association, USA*

Information Science  
**REFERENCE**

**INFORMATION SCIENCE REFERENCE**

Hershey • New York

Director of Editorial Content: Kristin Klinger  
Director of Production: Jennifer Neidig  
Managing Editor: Jamie Snavelly  
Assistant Managing Editor: Carole Coulson  
Cover Design: Lisa Tosheff  
Printed at: Yurchak Printing Inc.

Published in the United States of America by  
Information Science Reference (an imprint of IGI Global)  
701 E. Chocolate Avenue, Suite 200  
Hershey PA 17033  
Tel: 717-533-8845  
Fax: 717-533-8661  
E-mail: [cust@igi-global.com](mailto:cust@igi-global.com)  
Web site: <http://www.igi-global.com/reference>

and in the United Kingdom by  
Information Science Reference (an imprint of IGI Global)  
3 Henrietta Street  
Covent Garden  
London WC2E 8LU  
Tel: 44 20 7240 0856  
Fax: 44 20 7379 0609  
Web site: <http://www.eurospanbookstore.com>

Copyright © 2009 by IGI Global. All rights reserved. No part of this publication may be reproduced, stored or distributed in any form or by any means, electronic or mechanical, including photocopying, without written permission from the publisher.

Product or company names used in this set are for identification purposes only. Inclusion of the names of the products or companies does not indicate a claim of ownership by IGI Global of the trademark or registered trademark.

#### Library of Congress Cataloging-in-Publication Data

Encyclopedia of information science and technology / Mehdi Khosrow-Pour, editor. -- 2nd ed.  
p. cm.

Includes bibliographical references and index.

Summary: "This set of books represents a detailed compendium of authoritative, research-based entries that define the contemporary state of knowledge on technology"--Provided by publisher.

ISBN 978-1-60566-026-4 (hardcover) -- ISBN 978-1-60566-027-1 (ebook)

1. Information science--Encyclopedias. 2. Information technology--Encyclopedias. I. Khosrowpour, Mehdi, 1951-

Z1006.E566 2008

004'.03--dc22

2008029068

#### British Cataloguing in Publication Data

A Cataloguing in Publication record for this book is available from the British Library.

All work contributed to this encyclopedia set is original material. The views expressed in this encyclopedia set are those of the authors, but not necessarily of the publisher.

*Note to Librarians: If your institution has purchased a print edition of this publication, please go to <http://www.igi-global.com/agreement> for information on activating the library's complimentary online access.*

# Business Models for Municipal Broadband Networks

B

**Christos Bouras**

*University of Patras and Research Academic Computer Technology Institute, Greece*

**Apostolos Gkamas**

*Research Academic Computer Technology Institute, Greece*

**George Theophilopoulos**

*Research Academic Computer Technology Institute, Greece*

**Thrasylvoulos Tsiatsos**

*Aristotle University of Thessaloniki, Greece*

## INTRODUCTION

This article examines the most effective business model for the optimal exploitation of the currently developing broadband metropolitan area networks in various municipalities around the globe. The proper exploitation strategy of the municipal broadband networks to be deployed could boost the demand for broadband connections and applications. The article describes the relevant, available business models in detail, including ways for broadband infrastructures' expansion, and deals with viability issues, regarding the managing authority which is responsible for the broadband metropolitan networks.

A business model, specifically in the current article, determines the way in which the exploitation of a metropolitan, community-owned, optical network will be effectuated. Municipalities may play a critical role in enabling the deployment of broadband infrastructures by the private sector (Government of Sweden, 2007):

- Placing open conduit under all freeways, overpasses, railway crossings, canals and bridges.
- Allowing over lashing of fiber on existing aerial fiber structures.
- Forcing existing owners of conduit, such as electrical companies, telephone companies, and so forth, to make 100% of their conduit accessible to third parties.
- Coordinate construction of all new conduits, especially by building entrances to minimize the "serial rippers" and make all such conduit open to third parties.

However, the development of such broadband infrastructures raises several questions regarding the business model that shall be used for their exploitation (e.g., what will be the role of the municipality, what will be the degree of government interventionism, how healthy competition is

going to be promoted, how the network's viability is going to be ensured, etc.).

Therefore, this article intends to:

- Record international experience with respect to broadband business models for the exploitation of broadband infrastructures.
- Summarize the available business models and present, through comparative analysis, the advantages and disadvantages of each business model.

The remaining of this article is structured as follows: The next section presents the international experience in developing broadband metropolitan area networks in various municipalities around the globe. Next, the article presents and compares the available business models for the optimal exploitation of the broadband municipal networks, and presents the future trends in the area. Finally, the article is concluded.

## BACKGROUND

In general, broadband metropolitan networks have been developed in municipalities along different parts of the globe. Pioneer countries, such as Canada and Sweden, present examples of how broadband infrastructures can reinforce the local economy and contribute in further development. International experience records various business models (OECD, 2003) on broadband infrastructures exploitation, and a few indicative ones are mentioned in the following paragraphs:

- **Demand aggregation model.** This model regards coordinating efforts, exerted by regional carriers and aiming at the aggregation of the demand for broadband

services. The regional carrier presents the aggregated demand as an attractive clientele basis to the service suppliers, with whom it negotiates the overall purchase of broadband services and the percentage ownership upon the infrastructure.

- **Open access/wholesale provider model.** According to this model, regional carriers and local communities, usually cooperating with an independent infrastructure provider, who offers wholesale prices (a public utility service, in principle), construct the fundamental broadband infrastructures (trenches, conduits, subterranean or aerial cables), incorporating a “public good” rationale, and based on the foreseen general needs, as is the case of roads and sewerage works.
- **Community-owned network with service provision model.** Regional carriers and local communities, usually cooperating with a local service supplier, or acting as broadband network service suppliers themselves, construct the fundamental broadband infrastructures and provide network wholesale or retail services, investing the resultant profits in the expansion of the infrastructure.

Remarkable efforts in Europe can be recorded in Ireland (www.enet.ie), Sweden (Stokab, www.stokab.se), Austria,

The Netherlands (Kramer, Lopez, & Koonen, 2006) and Spain (LocalRet, <http://www.localret.net/idiomes/english.htm>). In the United States (U.S.), the cases of the State of Utah (UTOPIA, 2003; UTOPIA network, www.utopianet.org) and the city of Philadelphia (Wireless Philadelphia, 2005) are of great interest, concerning the successful application of business models for exploiting broadband metropolitan area networks. Besides from Europe and the U.S., remarkable efforts are tracked in other countries as well, such as Canada (CANARIE, www.canarie.ca) and New Zealand. Table 1 summarizes the features of business models of the most important of the aforementioned cases.

## BUSINESS MODELS FOR MUNICIPAL BROADBAND NETWORKS

### Important Aspects

A business model in our case determines the way in which the exploitation of a metropolitan, community-owned, optical network will be effectuated. Additionally, it determines the role of the municipality, the region and the private sector, the way healthy competition is going to be promoted, the

Table 1. Representative business models and their basic features

Business Models	Irish model	Stokab	LocalRet	UTOPIA	Philadelphia	CANARIE (Canada)
Public carrier						x
Local carrier (municipality, community, etc.)	x	x	x		x	x
Private carrier						x
Consortium			x	x		
Dark fibre network	x	x	x	x		
Last mile connections				x		
Government funding	x		x	x	x	x
Private support					x	x
Collocation facilities	x	x	x			
Leasing to telecommunication providers	x	x	x	x	x	
Supply of services		x				x

degree of involvement of the private sector and so forth. For example, competition is driving fixed and mobile players to invest in new technologies to reduce costs and position themselves in a converged environment (COM, 2006). Another example is that the liberalization of the local loop telecommunication infrastructure allowed the firms involved to behave more competitively and dropped broadband monthly fees to lower prices. Such an example is Sweden (Papacharissi & Zaks, 2006). Moreover, concerning the role of municipality, the analysis of Lehr, Sirbu, and Gillett (2004) shows that the case for a public role is complex and that the optimal policy is likely to depend critically on the type of wireless infrastructure that is being deployed, and the objectives for the system.

The business model aims to ensure the viability of the metropolitan community-owned optical network and to secure the resources for its operation, maintenance and expansion, while, at the same time, it aims to promote competition for offering better and cost effective services to the citizen (Henderson, Gentle, & Ball, 2005).

Figure 1 presents the three basic levels of a relevant business model (Hughes, 2003):

- The first level determines who (a private or public enterprise, etc.) exploits the network’s passive equipment (channels, optical fibres, etc.).
- The second level determines who provides and exploits the active equipment of the network (switches, routers, etc.).
- The third level determines who offers access to the network, the services and the content.

**“Open Access” and “Neutral Operator”**

The attribution of different responsible carriers (municipality, private sector, etc.) to any one of the aforementioned levels of the business model leads to different business model sce-

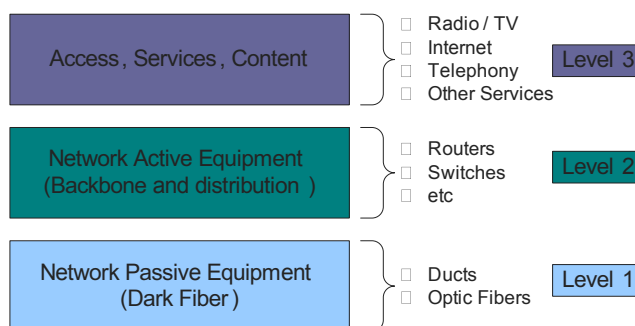
narios indicating how public organizations and providers of infrastructures, equipment and services can cooperate for the consumer’s benefit. Two basic features of the metropolitan optic fibre networks that do not really regard their construction as much as their funding, appropriate management and viability insurance are reflected in the concepts of “open access” and “neutral operator.”

As far as the open access is concerned, the European Commission provides directions and guidelines that must rule the electronic communications between the member states of the EU. In particular, it is stated that the projects to be funded will have to be consistent and conforming to the new institutional framework for electronic communications, as well as to the rules concerning competition (issues of state aid and antitrust). Compliance to the competition rules constitutes an eligibility criterion for funding, while this has to be combined with the obligation for clear open access (Magnago, 2004). Specifically, funding has to be limited exclusively to infrastructure (i.e., installations of optic cables, channels, conduits, pylons, etc.) and equipment that is accessible to any telecommunication carrier and services supplier.

The infrastructure administrator will be liable to preserve the infrastructure character as an installation accessible to all carriers, supplying electronic networks and services, without discrimination. The role of the neutral operator (Monath, Cristian, Cadro, Katsianis, & Varoutas, 2003) is important because it has to:

1. Offer the network infrastructures’ proprietors (on local, regional and national level) the possibility to increase their value and viability within a logical economic frame.
2. Reduce the needs for high initial investments on the part of the service suppliers and, at the same time, significantly increase the availability of economically accessible services on the part of the subscribers.

Figure 1. The basic levels of a business model



3. Be responsible for the observance and evolution of a revenue-sharing schema for all participating sides as well as for the continuous adaptation of the network’s potential in accordance with the growing needs.
4. Act as an administrating entity, in general, ensuring the reliable operation of all cooperating parts (infrastructure proprietors, service suppliers and subscribers).

**Equal Access Business Model**

The target of this business model (Figure 2) is to ensure the equal access to the passive equipment of the network. More particularly:

- One entity is responsible for the first level, which offers cost-based access to the passive equipment of the network.
- In the second level, many providers are active and they offer access to active network equipment in a competitive environment.
- In the third level many providers are active and they offer broadband services to the end users in a competitive environment.

The entity responsible for the first layer constructs the network passive equipment and rents the passive equipment to one ore more networks providers. The network providers offer network services to services and content providers. And finally, services and content providers offer broadband services to the end users.

There are two important variations of this business model (PPPs orchestrated and Public Sector Telco), described in the following paragraphs.

The role of the first layer’s entity is to motivate the competition in the above layers. This entity invests in passive equipment and, due to the nonprofit operation, offers the passive equipment in a cost-basis to the network providers. As a result, the market entry cost for a network provider is relatively low.

**Full Public Control through Public-Private Partnerships (PPP)**

In this business model (Figure 3), the municipal authority is responsible for all parts of the broadband network (passive equipment, active equipment, services). With this approach, the municipal ensures the full control in all levels through the participation in PPPs.

This business model can be used either when the municipal authorities are not ready to allow a temporary monopoly in broadband services or when there is law restrictions. In addition, this business model can be used when the service provides are not willing to invest (e.g., in rural areas).

A benefit of this business model is the simple administration due to the fact that only one organization is involved. The main disadvantage of this business model is the absence of competition. This results in limited options for the end user, as well as lack of pressure for price reduction. Finally, this business model requires the municipal authorities to operate a telecommunication network, an area in which municipal authorities have no experience.

**PPPs Orchestrated**

This is a variation of the equal access business model, which occurs when there is significant existing broadband

*Figure 2. Equal access business model*

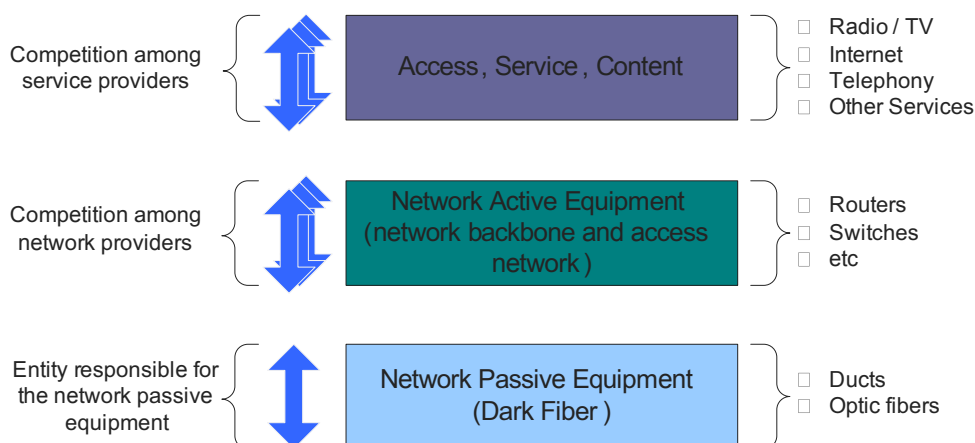
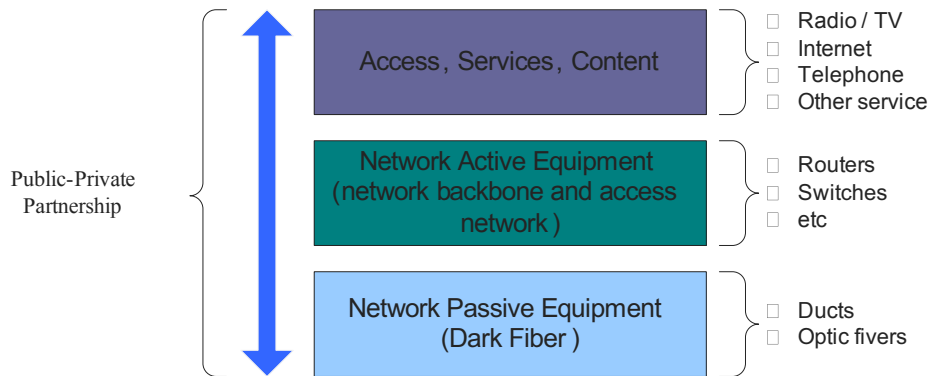


Figure 3. Full public control through PPPs



infrastructure in the area and major investments in new infrastructure is not necessary. In this scenario, the role of the local government may be to act as an orchestrator and, by bringing private organizations together, to ensure that existing assets are used to create a thriving market for broadband services.

This is usually performed by the local administrations and the owners of the existing infrastructure who create a joint venture to manage the passive infrastructure, as if it was a single asset. The active and access services layers are usually managed by one or more service providers on the basis of a partnership agreement with the joint venture.

In this scenario, it is common to have a single private company acting in the second layer (active equipment).

**Public Sector Telco**

This model is another variation of the equal access business model, where the public sector manages the passive and

the active infrastructure, while competition among private companies is acting in the third level (services).

**Sole Private Provider**

According to this model, the operation and the management of the active network equipment and services are offered by a single private service provider. The network’s passive equipment is owned by the public sector (e.g., municipality).

The advantage of this model (Heimgartner, Luke, Villa, & Johnston, 2005) is that the project becomes commercially viable at much lower levels of customer revenue. However, customers are unlikely to be offered as wide of range of services and will not benefit from the impact of competition on pricing. For these reasons the local government will often want to ensure that the monopoly is only offered as a temporary measure over a fixed term, during which time it hopes the sole service provider will generate sufficient numbers of customers to sustain a competitive market. Ob-

Figure 4. PPPs orchestrated

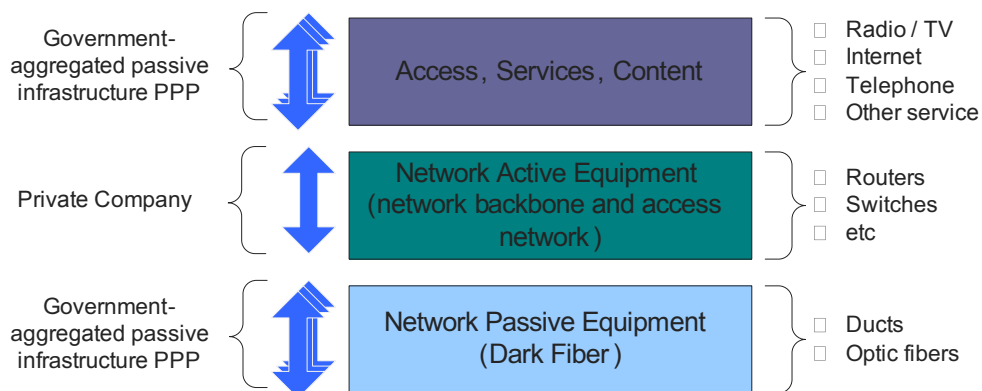


Figure 5. Public sector telco

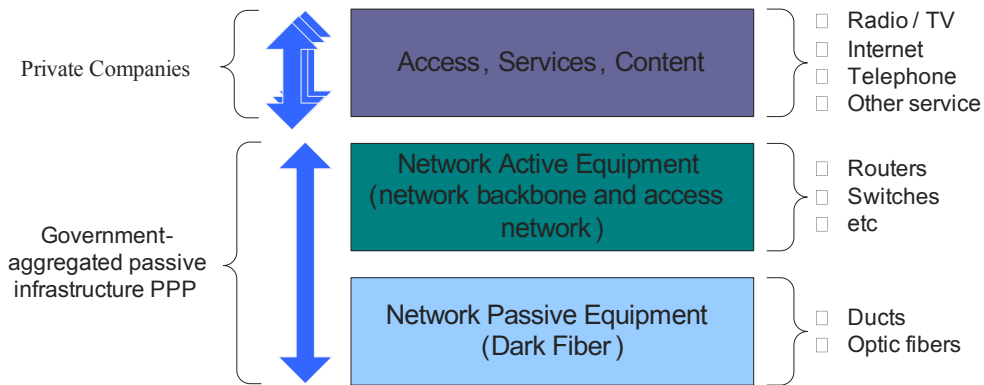
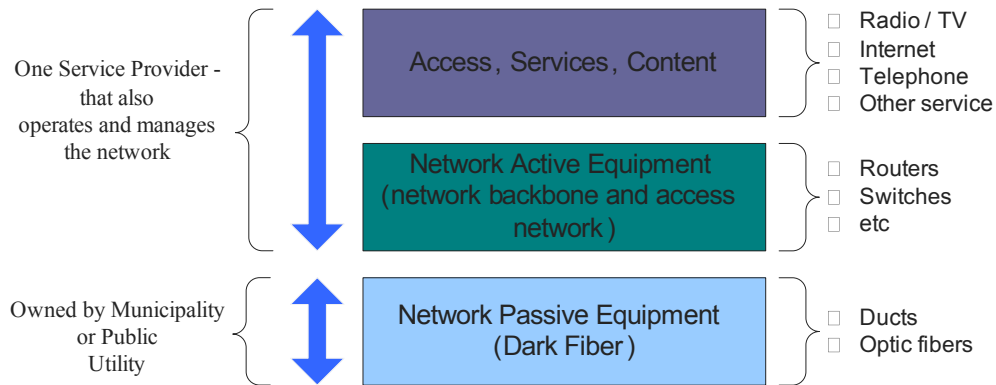


Figure 6. Sole private provider



viously, getting the length of this fixed period right is a key issue. Furthermore, transition to the equal access model at the end of the fixed period will require careful commercial and legal management.

**FUTURE TRENDS**

The neutral operator, in most cases an entity controlled by the municipal authorities, is of critical importance for the business models, because it:

- Secures financial viability of the owners of the infrastructure.
- Reduces the needs for high initial investments from the service providers and, at the same time, it increases considerably the availability of economically accessible services for the citizens.

- Is responsible for fair revenue sharing to all participants in the enterprising scheme.
- Plans and implements networks expansion.

In addition, the service providers should focus on providing economical and competitive services without caring for the development of the broadband infrastructure. Finally, as far as the end users are concerned, the selected business model ensures that they may choose between a number of services with financial and quality criteria. Until now, some research work has been presented concerning lessons learned from broadband development (Frieden, 2005).

All involved parts should bear in mind that once the broadband business model is applied and broadband infrastructures are deployed, quality of service and specific service level agreements (SLA) (Shin, Shin, & Han, 2004) for the provided services should be ensured.



## Business Models for Municipal Broadband Networks

Table 2. Comparison of local and regional models for broadband deployment

Model	Description	Advantages	Disadvantages
<b>Equal Access</b>	The municipal authorities develop and manage Level 1 (passive infrastructure). Both Level 2 and Level 3 are subject to competition.	<ul style="list-style-type: none"> <li>Public intervention at the lowest level of the business model (which, however, represents 70% of the cost of a new fixed network).</li> <li>Market entry cost for a network provider is relatively low, due to leasing of the passive infrastructures on a cost basis.</li> </ul>	<ul style="list-style-type: none"> <li>Entry barriers for network operators remain sizeable</li> <li>Financial risk for the municipal authorities</li> </ul>
<b>Full Public control</b>	All three levels are created and managed by the municipal authorities.	<ul style="list-style-type: none"> <li>Complete solution</li> <li>Easier management of the whole "operation"</li> </ul>	<ul style="list-style-type: none"> <li>Negative impact on competition in services and networks</li> <li>Financial risk for the municipal authorities</li> <li>Municipal authorities needs great technical and commercial expertise</li> </ul>
<b>PPPs orchestrated</b>	Variation of the equal access business model. PPPs act in level 1, usually a single private company acts in level 2, while competition (many companies) acts in level 3.	Service providers may have a chance to enter the market, as part of the PPPs acting in level 3.	<ul style="list-style-type: none"> <li>Significant existing broadband infrastructure in the area is assumed</li> <li>No competition in network active equipment (level 2)</li> <li>Governmental interference both in levels 1 and 3</li> </ul>
<b>Public Sector Telco</b>	Variation of the equal access business model, where the public sector acts in levels 1 and 2.	Simpler management of the network (both active and passive equipment), since it is performed by a single entity.	<ul style="list-style-type: none"> <li>Municipal authorities needs great technical and commercial expertise.</li> <li>Negative impact on competition in active network equipment.</li> </ul>
<b>Sole Private Provider</b>	The operation and the management of the active network equipment and services are offered by one private service provider, while a public utility or municipality manages level 1.	Cost-based leasing of passive infrastructures to the private company of levels 2 and 3.	<ul style="list-style-type: none"> <li>Negative impact on competition in services and networks</li> <li>Fewer services to the customers</li> </ul>

## CONCLUSION

This article presents and compares the most important business models for the effective exploitation of the broadband municipal networks. The main objectives of such business models are the following:

- The passive network infrastructure may be used by a large number of service providers.

- The users have the choice of selecting one of the multiple services providers, according to their needs.
- Low operational expenditure (OPEX) and capital expenditure (CAPEX) must be ensured.
- Financial viability of all parts of the infrastructure must be achieved.
- The business model must motivate the competition for the benefit of the end users.

## REFERENCES

- COM. (2006, February 20). *Communications regulation and markets 2005* (11th report). Communication from the Commission to the Council, The European Parliament, The European Economic and Social Committee and the Committee of the Regions. European Electronic Commission of The European Communities Brussels.
- Frieden, R. (2005). *Lessons from broadband development in Canada, Japan, Korea and the United States*. doi:10.1016/j.telpol.2005.06.002, 2005. Elsevier.
- Government of Sweden. (2007). *The government and the government offices of Sweden, broadband for growth, innovation and competitiveness*. Retrieved May 28, 2008, from [http://www.sweden.gov.se/download/9a39e612.pdf?major=1&minor=76048&cn=attachmentPublDuplicator\\_0\\_attachment](http://www.sweden.gov.se/download/9a39e612.pdf?major=1&minor=76048&cn=attachmentPublDuplicator_0_attachment)
- Heimgartner, A., Luke, M., Villa, N., & Johnston, P. (2005). *2010 broadband city: A roadmap for local government executives*. Cisco IBSG. Retrieved May 28, 2008, from <http://www.cisco.com/web/about/ac79/docs/wp/2010/broadband/Broadband-City.pdf>
- Henderson, A., Gentle, I., & Ball, E. (2005). WTO principles and telecommunications in developing nations: Challenges and consequences of accession. *Telecommunications Policy*, 29(2-3), 205-221.
- Hughes, G. (2003). Local & regional models for broadband deployment. In *Proceedings of eEurope: Broadband Local & Regional Best Practices Workshop*. Retrieved May 28, 2008, from [http://europa.eu.int/information\\_society/eeurope/2005/doc/all\\_about/broadband/bb\\_regional/g\\_hughes.ppt](http://europa.eu.int/information_society/eeurope/2005/doc/all_about/broadband/bb_regional/g_hughes.ppt)
- Kramer, R. D., Lopez, A., & Koonen, A. M. (2006, September 4-6). Municipal broadband access networks in the Netherlands—three successful cases, and how New Europe may benefit. In *Proceedings of the 1st International Conference on Access Networks*, Athens, Greece, (Vol. 267). New York: ACM. Retrieved May 28, 2008, from <http://doi.acm.org/10.1145/1189355.1189367>
- Lehr, W., Sirbu, M., & Gillett, S. (2004, April 13-14). Municipal wireless broadband: Policy and business implications of emerging access technologies. *Competition in networking: Wireless and wireline*. London Business School.
- Magnago, A. (2004). Open access—business models and operational costs. In *Proceedings of the Broadband Europe 2004*.
- Monath, T., Cristian, N., Cadro, P., Katsianis, D., & Varoutas, D. (2003). Economics of fixed broadband access network strategies. *Communications Magazine, IEEE*, 41(9), 132-139.
- OECD. (2003). *Policies for broadband development*. Recent OECD work on Broadband Committee for Information, Computer and Communications Policy, DSTI/ICCP(2003)13/FINAL/ADD/. Retrieved May 28, 2008, from [www.oecd.org](http://www.oecd.org)
- Papacharissi, Z., & Zaks, A. (2006). Is broadband the future? An analysis of broadband technology potential and diffusion. *Telecommunications Policy*, 30(2006), 64-75, 70.
- Shin, S.-C., Shin, S.-Y., & Han, S.-Y. (2004). Network performance monitoring system for SLA: Implementation and practices. In *Proceedings of the 6th International Conference on Advanced Communication Technology, 2004*, (Vol. 2, pp. 661-664, ISBN: 89-5519-119-7, Digital Object Identifier: 10.1109/ICACT.2004.1292952).
- UTOPIA. (2003, November 26). *Utah's public-private fibre-to-the-premises initiative*. Utah Telecommunication Open Infrastructure Agency (UTOPIA) (White paper).
- Wireless Philadelphia. (2005, February 9). *Wireless Philadelphia business plan*. Wireless Philadelphia Executive Committee. Retrieved May 28, 2008, from <http://www.phila.gov/wireless/pdfs/Wireless-Phila-Business-Plan-040305-1245pm.pdf>

## KEY TERMS

**Broadband:** Broadband describes high-speed, high-capacity data communication making use of a wide range of technologies that often have diverse characteristics and seem appropriate for certain network scenarios and situations. There is no specific (international) definition or unique standard for broadband and the range of service speeds varies typically from 128 Kbps (or 200 Kbps according to the Federal Communications Commission—FCC—of United States) to 100 Mbps for broadband access. For the purpose of this article, we consider as broadband connection every connection which supports speeds greater than 200 Kbps.

**Broadband Business Model:** A business model determining the way in which the exploitation of a metropolitan, community-owned, optical network will be effectuated.

**Broadband Network Passive Infrastructure:** It is the physical infrastructure that is used to provide the broadband connectivity and may consist of fiber optic or copper cable.

**Broadband Network Active Infrastructure:** It consists of the elements used to transmit, forward and route informa-

## ***Business Models for Municipal Broadband Networks***

tion data packets over fiber optic or copper cables. The main elements are switches and routers.

**Broadband Services:** They are the actual services offered to customers. Examples are: high speed Internet access (usually 10Mbit/s or higher); video telephony; video on demand; gaming portals; e-government and e-health services; Virtual Private Network services; video conferencing; Web hosting; data storage; video surveillance and so forth.

**CAPEX:** Acronym of the words Capital Expense. In the broadband networks it is the network implementation cost.

**OPEX:** Acronym of the words Operation Expense. In the broadband networks it is the operation and maintenance cost.