Regione Toscana

“Allegato B”
Broadband for Rural Tuscany

Project for telecommunication development in the rural areas of Tuscany

Florence 1/02/2006

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1 Introduction

Broadband plays a major role in modernising economies and societies.[1] As an enabling technology, it is at the core of the diffusion of the information society and of the development of information and communication technologies (ICTs). These technologies in turn are key drivers of productivity and growth [2], due to their ability in enabling the delivery of new advanced content, promoting the development of new services and improving delivery of those that already exist. Moreover they allow the re-organisation of working and production processes, bringing significant benefits to businesses, administrations and consumers.

The benefits of broadband are widely recognised. All Member States of the Union are already exploiting these benefits as they have experienced significant increases in deployment and take-up of the european territories. This development, which is largely market driven, is highly encouraged even at the national and regional levels, but there are, nevertheless, obstacles to more its rapid progress.
Some of these obstacles were highlighted in the *e*Europe 2005 Action Plan[3], Programme that foreseens specific actions for the development and use of advanced services running on a secure broadband infrastructure, and which set widespread availability and use of broadband as one main objective to be attained by the end of 2005.

The achievement of that objective is stimulated by public policies that encourages investment in broadband infrastructure, applications and services. Indeed, all EU-15 Member States have now drawn up National Broadband Strategies which propose a series of initiatives to deal with these obstacles and to accelerate the deployment and take-up of broadband.[4] Many of the new Member States are also working on national strategies. Some have already completed them.
These strategies contain a wide array of initiatives both on the supply-side (infrastructure deployment) and on the demand-side (increased usage) of the market. Two key areas of focus include increasing deployment in under-served areas, with public support foreseen in areas where market forces do not deliver the necessary investment, and aggregating demand from public administrations. This is in line with the invitation to Member States from the Telecom Council of March 2004 "*to prepare and implement national broadband strategies, with a view to, inter alia, connecting all public administrations to broadband by 2005 and proposing, where appropriate, digital-divide quick-start projects, using, where appropriate, existing financial instruments such as structural funds, so as to increase broadband coverage of under-served areas*". It also conforms to the priorities highlighted by the Growth Initiative[5] endorsed by Heads of State and Government in December 2003.
Broadband is already available in national and international backbone networks through fibre optic links with very large capacity. However, infrastructure needs to be enhanced to bring high-speed services to residential users and small/medium businesses by upgrading or building infrastructure to each premise. The 'broadband bottleneck' commonly refers to the last-mile connection to the final user.

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[1] 'Broadband' refers to high-speed 'always-on' connections to the Internet that support the delivery of innovative content and services. Compared to traditional narrowband connections, broadband access is immediate and large volumes of data can be almost instantly transmitted, reducing waiting time and improving efficiency for users.
[2] Communication "*Connecting Europe at High Speed: Recent Developments in the Sector of Electronic Communications*", COM(2004) 61.
[3] COM(2002) 263.
[4] Presidency Conclusions of the 2003 Spring European Council, par. 38.
[5] COM(2003) 690.

As stated in the european document "Connecting Europe at high speed-National broadband strategies", reaching the target of spread broadband infrastructure through european regions "*is a complex task - broadband availability is affected by many different policies (town and country planning, research policy, taxation, regulation), implemented by administrations ranging from international organizations through to local administrations, as well as the private sector. Encouraging broadband access is intimately connected to the availability of content - operators will not invest in broadband infrastructure while there is no content to motivate the user to upgrade, while there will be no real push for new applications and content as long as the supporting infrastructure is not adequate*".

With regard to Italy, despite the digital communication market is rapidly growing (due to the average large population density of Italy), some regions are characterized by a concrete risk of "digital divide", mainly due to lack of interest of operators in bringing broadband connectivity in those areas where the density of population and industrial concentration does not allow to exceed the profit threshold. Tuscany region is one of the most evident ones. Currently unserved areas in Tuscany are, infact, located in rural and mountain geographical territory, contexts where, during the last decade, residential settlement and industrial districts have incresingly asked for broadband access.

In those areas, significant barriers exist to the extension of mass-market broadband coverage. The high costs involved in deploying new networks in areas of low population density make it difficult for operators to build sustainable business models to justify investment, particularly given the challenging commercial conditions faced by the ICT sector after the burst of the Internet bubble in 2001. For example, the incumbent operator, Telecom Italia, does not provide ADSL service in local exchanges serving cities having a low density of population (a critical threshold is around 10.000 inhabitants).

This scenario prevents a proper economic and social development of these areas both discouraging enterprise initiatives and leaving residents in a position of reduced social and economic "inclusion", usually termed "digital divide". These problems are exacerbated by uncertainty about the level of demand. In addition, from a pure commercial point of view, broadband remains a relatively nascent market, since it appears that a clear killer application is not evident yet.

The mentioned difficulties thwart the reaching of the purposes defined in the Lisbon Strategy (2005), particularly with refer to the pushing up of the information and communication technologies in the rural areas. As a result, this important part of the tuscany territory will be cut off from the opportunity offered by the knowledge economy, intensifying, in such manner, the gap and the differences between central and peripheral areas.

In order to foster the goals defined by the Lisbon Strategy (purposes confirmed by the Programme "i2010 – A European Information Society for growth and employment"), regional governments were been calling to improve broadband infrastructure, to allow citizens to take advantage of the information society services and possibilities.

As stated before broadband access is, infact, the fundamental resource to enhance and strengthen the internet usage by citizens and enterprises. Specially in rural areas, it enables the development and deployment of advanced services and applications such as e-government, e-health, e-business, e-learning, teleworking, videoconferencing. Moreover, it raises the perception of their usefulness, particularly in the territory where advance services are more needed, for their ability of reducing distances.

The Tuscany Region started the program of intervention, on the broadband issue, in 1997, building the Tuscany Region Data Communication Network ("Rete Telematica Regionale Toscana", www.rtrt.it), an infrastructure that connected the whole public administration of the territory and which is, at the moment, one of the most important reference models in the national framework.
Reached the goal of connecting whole public administration by 2005 (as foreseen in the Programme eEurope 2005), the challenge that Tuscany is now facing is to spread the broadband coverage in the remoteness areas. To meet this purpose, Tuscany Region has been laying specific programs in which it scheduled actions for solving the local broadband gap and connect residential and business users. It adopted, that is, specific measure to faster broadband, enrich regional content, guarantee objective defined at the European level, in a framework of interoperability, security and regional governance.

The fulfillment of that objective would allow the rolling out of the advanced services developed in the Regional program for the information society, titled "e.Toscana" (www.e.toscana.it), and the attainment of the Objective 1 (A Single European Information Space offering affordable and secure high bandwidth communications, rich and diverse content and digital services) and Objective 3 (An Information Society that is inclusive, provides high quality public services and promotes quality of life) of eEurope 2010.

Regional strategies encourage and sustain the primary and important role of the telecom operators in the local market. Those actions are in line with the principles defined by the main Act on the information society issues: the Regional Law, 26 january 2004, No. 1 "Promotion of the electronic administration and of the information and knowledge society throughout the regional system. Rules for the Tuscany Region Data Communication Network". In pursuit of the aims set in that Act, the Tuscany Region financed and realized intervention pointing at improving the "coordinated development of public information systems, sharing and making effective use of public administration information holding", "the adoption of measures, technological standards and development practises that encourage social inclusion", the "qualification and coordination of web services for a balanced socio-economic development of the regional territory", stimulating " the businesses that operate in the information and telecommunication technologies .
At the same time, regional strategies recognise the important role of public policy in guaranteeing and supporting the effective functioning of the market, gathering the demand side and stimulating the supply one.

In this scenario, the focus of this document is on the "digital divide" situation affecting Tuscany. Infact, approximately 82.1%[6] of the Tuscany population has access to a mass-market non-shared[7] broadband solution – either targeted at residential or small business users. Broadband availability is highest in urban and suburban areas. However, broadband availability falls significantly in mountain/hil towns, rural villages and remote areas. This scenario also affects economy of some of these areas of Tuscany, where potentially there could be a florid development if the broadband access service were available. In these areas it is clear that the market will not spontaneously deliver without some form of intervention. However, it would be premature to state that market failure exists in all areas where broadband has not yet reached. In Tuscany almost all areas where some profit is expected have been covered at this time.

[6] Data distributed by Telecom Italia in Sept 2005.
[7] "non-shared" identifies a broadband solution where the access segment is reserved (e.g. ADSL), unlike what happens for satellite access and wireless terrestrial last mile.

Figure 1 – Geographic position of Tuscany within Italy

The scope of this document is to analyze Tuscany broadband coverage situation and provide guidelines for designing public funding aided actions for reducing "digital divide" in Tuscany Region. A task force was established in January 2005, to this purpose, resorting to the competence of CNIT (Inter-universitary Consortium for Telecommunications) to advise the Tuscany local government on the development and implementation of a strategy to isolate areas that follow in category (ii) and (iii) based on a market bidding procedures.

The rest of the document is organized as follows: in section 2 the project description is provided including motivations, the context and the statement of the problem; in section 3 the proposed project implementation plan is outlined (the project has actually already started to build this plan); finally in section 4, the project markers are presented including the monitoring efforts and the actions to be taken to capitalize its results.

2 Project Description

2.1 Background and broadband technologies

The Internet finally appears have defeated the 56 kbps speed limit thanks to the arrival of widely available broadband access. Broadband definition is a still under discussion within several organizations: Organization for Economic Co-operation and Development (OECD) defines broadband any connection that allows 256 kb/s in download and 128 kb/s in upload; ITU-T in its Recommendation T 1.113 defines broadband any access with transmission speed larger than 2 Mb/s [1]. While the incumbent telephone company (Telecom Italia) has been focusing its attention in the high-speed Internet access race primarily upon serving urban and suburban customers, the rural market have been totally ignored by the incumbent telecom operator and largely by small operators.

Broadband connectivity is typically brought in a certain area by a preliminary upgrade of the access segment followed by an adequate increase in capacity of the metro-core segments of providers. The bottleneck is practically always in the access segment and often the metro-core network is under-utilized.

In order to upgrade the access segment various techniques can be deployed classified based on the carriers: wired (copper twisted pairs, optical fibers or combination of them) and wireless (Wireless MAN i.e. WiMax, Wireless LAN i.e. WiFi or HiperLAN, or satellite). All these transport technologies can be used in the access segment combined with proper additional devices in the local exchanges to offer broadband access. But these technologies are not equivalent, the wired access is typically a “true” broadband solution with capability to reach fairly large access speed (especially optical fiber solutions), while the wireless technologies intrinsically are dependent on the number of active users and, anyhow, offer lower transmission speed in a descending order of quality as they are listed above. Nevertheless the wireless access can achieve a significant increase in speed with respect to the 56kbps dial-up access.

The most common and efficient way to bring broadband access in a certain area is to re-use the copper twisted pair and put a DSLAM (Digital Subscriber Access Module) in the local exchange realizing an ADSL (Asymmetric Digital Subscriber Loop) access. Symmetric access can also be designed realizing HDSL (High Speed Digital Subscriber Loop) or VDSL (Very High Speed Digital Subscriber Loop). The incumbent operator is enforced by national regulations to rent, upon demand, the copper local-loop that may be requested by another operator to provide ADSL access. This last operator will terminate the local loop on its own network devices to connect the user to its metro-core network. This procedure is known as ULL (unboundled local loop). Currently ADSL services have a maximum range of about 5.5kms, which means that about 5% of households that are currently connected to an ADSL-enabled exchange are too far away from the exchange to enjoy an ADSL service. An extended reach ADSL product would help to overcome this problem.

Portion or the total access segments can be replaced by optical fibers providing faster connections. This category, generally named FTTx (Fiber To The x) encompasses a variety of solutions: Fiber-to-the-Curb (FTTC), Fiber-to-the-Node (FTTN), Fiber-to.the-Home (FTTH). These solutions deploy a Passive Optical Network (PON) to extend the reach of the twisted pair that is limited or simply replace it up to the closest Point Of Presence (POP) of the provider. This is recently done by many small-medium operators to provide high-quality multimedia services to their user. Sometimes they own the fiber segments so they are not required any more to ask the incumbent for the use of the local loop.

The wireless techniques cannot be declared equivalent to wired techniques, but can be deployed for very sparse communities in the terrestrial version (Wifi, HiperLAN, and in the future also WiMax) or satellite version to alleviate the hunger of bandwidth of certain communities. Although they can offer lower speed in the access and user-dependent, they are less expensive to deploy than fixed networks and faster in the connection set-up. However, the ability to deliver low cost mass-

market wireless solutions to complement equivalent fixed line services such as ADSL depends upon the availability of appropriate spectrum. In addition, sharing of infrastructures on backbones is difficult for wireless especially concerning the last mile. Finally, it is worthwhile to mention that low-cost satellite access is unidirectional requiring a dial-up uplink connection. Bidirectional satellite access exists but they are more expensive both in terms of capacity cost and equipment cost.

2.2 Tuscany situation

Local administration in Tuscany (as in the other Italian regions) is organized on three hierarchical levels: 287 municipalities (the atomic unit is a village with a population approximately at least 500-600 people), 10 provinces (that are aggregation of communities). The territory of Tuscany region is divided in the 10 administrative provinces that characterize the local government of the territory: Firenze (FI), Prato (PO), Pistoia (PT), Lucca (LU), Massa-Carrara (MS), Pisa (PI), Livorno (LI), Arezzo (AR), Grosseto (GR), Siena (SI). Unfortunately, telephone area codes and broadband coverage has a territorial organization that may differ from the administrative organization. In particular enabling technologies and approaches to reduce “digital divide” may be significantly different from operator to operator and may span set of municipalities in terms of atomic granularities.

As Figure 2 illustrates, broadband remains a relatively ‘urban’ phenomenon mainly confined in highly populated areas in geographically flat regions. The map below shows the coverage of mass-market broadband technologies in the Tuscany as it was in year 2004. Solid black lines in Figure 1 separate the ten different provinces labelled with their short acronyms, while cyan lines identify boundaries of communities. In the same figure it is highlighted that the satellite coverage could potentially reach anybody but its performance, albeit beyond the dial-up speeds, is poor compared to ADSL and it maintains a bottleneck in the uplink. The red regions are those covered only by satellite. The yellow regions are served by local exchanges offering ADSL but in very few of them (the green ones) ULL is in operation, i.e. operators different from the incumbent have installed their own DSLAM to offer ADSL access.

In Table 1, we report the population coverage referred to the availability of ADSL access for each of the ten provinces (year 2004). It is worthwhile to notice that the least covered is Grosseto (67.29%) while the most covered is Prato (94.37%). Hence, slightly more than 600.000 people are excluded from high-quality broadband access different from that offered by the satellite. In fact, the high costs associated with the roll-out of new broadband networks and uncertainty about the level of demand are major barriers to market-led broadband deployment in less densely populated areas.

Previous funded projects in year 2004 and 2005 have already contributed to reduce the presence of Digital Divide in selected provinces and communities of Tuscany by creating telecommunication infrastructure whose property remains to the local communities but it is managed by a service providers. Various technologies have been used: optical fibers, terrestrial wireless and bidirectional satellite (www.e.toscana.it/varie/CIPE).

Telecom Italia and other providers stated that further upgrades of exchanges would only be carried out where clear demand indicated commercial viability (i.e. in areas that may exhibit some potential for the future). But still a significant part of the population could remain in a digitally divided state.

Given the above scenario, there are margins to see ADSL and *terrestrial* wireless as an enabling technology to be used in projects aimed at covering selected areas of Tuscany region. Specific co-funding coming from the public sector could support initiatives of private operators according to a well defined business plan.

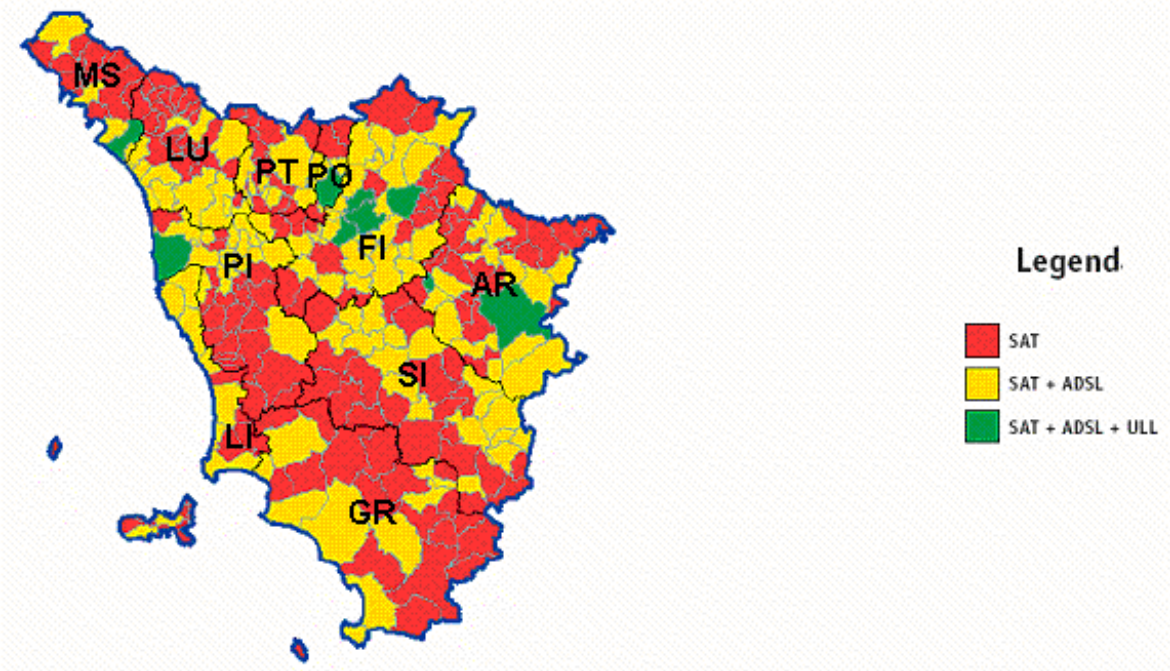

Figure 2: Coverage of Tuscany territory (year 2004)

PROVINCE	TOTAL POPULATION	POPULATION SERVED BY ADSL	PERCENTAGE
AREZZO	323,288	227,678	70.43%
FIRENZE	933,860	819,900	87.80%
GROSSETO	211,086	142,042	67.29%
LIVORNO	326,444	296,171	90.73%
LUCCA	372,244	304,293	81.75%
MASSA-CARRARA	197,652	154,542	78.19%
PISA	384,555	314,671	81.83%
PISTOIA	268,503	218,437	81.35%
PRATO	227,886	215,058	94.37%
SIENA	259,410	186,845	72.03%
TUSCANY	*3,504,928*	*2,879,637*	*82.16%*

Table 1: Province detail of population reached by ADSL (year 2004)

The statistics reported in Table 1 refer to a general population survey. It is important anyhow also to give priority to the coverage of primary institutions such as the municipality headquarters or hospitals etc, before providing for general coverage of the private citizen. In Table 2, we provide a list of all municipalities whose headquarters are not covered by broadband services. Overall, in Tuscany, there are 89 communities headquarters that are not reached by a broadband terrestrial access.

Table 2 : Municipalities headquarters not reached by broadband access (June 30, 2005)

n.	Province	Municipality name	Total population
1	AR	Badia Tedalda	1215
2	AR	Ortignano Raggiolo	852
3	AR	Pieve Santo Stefano	3316
4	AR	Chiusi della Verna	2225
5	AR	Chitignano	955
6	AR	Montemignaio	589
7	AR	Pergine Valdarno	3111
8	AR	Sestino	1454

n.	Province	Municipality name	Total population
9	AR	Castel San Niccolò	2855
10	AR	Caprese Michelangelo	1625
11	AR	Lucignano	3468
12	AR	Marciano della Chiana	2757
13	FI	Palazzuolo sul Senio	1300
14	FI	San Godenzo	1188
15	GR	Roccastrada	9189
16	GR	Isola del Giglio	1401
17	GR	Roccalbegna	1242
18	GR	Cinigiano	2692
19	GR	Pitigliano	4136
20	GR	Semproniano	1332
21	GR	Sorano	3915
22	GR	Castell'Azzara	1826
23	GR	Montieri	1249
24	GR	Campagnatico	2421
25	GR	Seggiano	953
26	LI	Suvereto	2897
27	LI	Capraia Isola	335
28	LU	Montecarlo	4345
29	LU	Molazzana	1187
30	LU	Minucciano	2521
31	LU	Giuncugnano	538
32	LU	Fosciandora	670
34	LU	Coreglia Antelminelli	4805
35	LU	Castiglione di Garfagnana	1877
36	LU	Careggine	642
37	LU	Camporgiano	2393
38	LU	Fabbriche di Vallico	526
39	LU	Villa Collemandina	1399
40	LU	Villa Basilica	1768
41	LU	Vergemoli	400
42	LU	Pescaglia	3718
43	LU	Vagli Sotto	1123
44	LU	Sillano	784
45	LU	San Romano in Garfagnana	1432
46	MS-CR	Fivizzano	9144
47	MS-CR	Bagnone	2022
48	MS-CR	Villafranca in Lunigiana	4594
49	MS-CR	Casola in Lunigiana	1230
50	MS-CR	Tresana	2055
51	MS-CR	Comano	793
52	MS-CR	Filattiera	2471
53	MS-CR	Fosdinovo	4339
54	MS-CR	Podenzana	1818
55	MS-CR	Licciana Nardi	4884
56	MS-CR	Zeri	1382
57	MS-CR	Mulazzo	2564
58	PI	Lorenzana	1144
59	PI	Santa Luce	1465
60	PI	Chianti	1563
61	PI	Monteverdi Marittimo	701
62	PI	Pomarance	6309

n.	Province	Municipality name	Total population
63	PI	Montecatini Val di Cecina	2002
64	PI	Orciano Pisano	628
65	PI	Crespina	3744
66	PI	Riparbella	1326
67	PI	Guardistallo	1026
68	PI	Castelnuovo di Val di Cecina	2489
69	PI	Lajatico	1389
70	PI	Castellina Marittima	1816
71	PI	Palaia	4522
72	PO	Vernio	5526
73	PT	Sambuca Pistoiese	1604
74	PT	Marliana	2914
75	PT	Piteglio	1873
76	PT	Ponte Buggianese	7618
77	PT	Lamporecchio	6788
78	PT	Larciano	6008
79	SI	Murlo	1927
80	SI	Monticiano	1412
81	SI	Casole d'Elsa	2924
82	SI	Trequanda	1417
83	SI	Castiglione d'Orcia	2505
84	SI	Chiusdino	1923
85	SI	San Quirico d'Orcia	2460
86	SI	Radicofani	1220
87	SI	Gaiole in Chianti	2333
88	SI	Radicondoli	978
89	SI	Sovicille	8346
TOTAL			**217.822**

2.3 Business plan requirements

The challenge is to build a sustainable business models for rural broadband. There are currently a number of constraints to the commercial deployment of broadband in rural areas. These include: low economies of density; high equipment and civil infrastructure costs; demand uncertainty; the choice of the proper technology for supporting a local broadband coverage solution.

A first parameter taken into account for funding a certain coverage operation is the density of population of the area. There is a close correlation between broadband coverage and population density as the average cost per user of deploying new technology in less densely populated areas is significantly higher than in urban areas. Economies of density are a primary factor in determining the cost effectiveness and therefore commercial viability of providing new or upgrading existing local access networks in any given area. Unfortunately, almost a third of the Tuscany population lives in areas of relatively low population, making the commercially sustainable provision of broadband access more difficult.

A second parameter is the absolute value of population that a specified coverage operation can handle. For example, in the case of fixed networks, 65-70% of the cost associated with the deployment of new fixed local access networks is related to civil infrastructure (trenches, etc) and new equipment in the local exchange, and they remain a significant cost and a major barrier to the rollout or upgrade of new networks.

These two parameters are jointly considered as a mean to evaluate the efforts of an operator for a proper coverage operation.

By encouraging/allowing operators to share infrastructure it may be possible to reduce investment costs and improve the business case for new network investment. Questions remain about business models, price elasticities, and the future availability of compelling content, services and applications market. Operators are therefore currently concentrating their efforts in building the market in the more accessible urban areas.

Despite the difficulties associated with extending broadband coverage to rural areas we do not believe that it would be either appropriate or desirable to impose any form universal service obligation on the provision of broadband services. However, judicious intervention by the public sector can help to support broadband rollout in rural areas. Significant funds for economic development and regeneration are available, and we believe that is a wise decision to deploy European Structural funds to support projects for an extension of broadband coverage. In fact, public- private partnerships can play a major role in extending coverage and stimulating demand. In Italy, there already are a large number of diverse projects being designed and implemented across many regions and across devolved administrations to explore options for encouraging the wider deployment of broadband.

For some areas of Tuscany, the commercial viability of terrestrial (either wired or wireless) broadband provision may be questionable. Among uncovered areas, we can distinguish three scenarios:

(i) areas where operators are at the threshold of economic convenience and they will eventually bring broadband solutions in the future, but not with high priority. These areas will be named **threshold areas (TA)** in the following

(ii) areas where broadband can be brought with a moderate funding coming from the public sector that can fill the gap between equipment/maintenance expenses and expected revenues to come to an even balance over a reasonable time-span. These areas will be named **under-threshold areas (UTA)**

(iii) areas where any terrestrial broadband solution would be not convenient and the only practical solution is a satellite coverage. These areas will be named **severely under-threshold areas (SUTA).**

3 Project Implementation Plan

3.1 Project Phases

The project is divided into 3 main phases, with an overall duration of approximately four years.

The first phase (already started at the time of writing) is devoted to a series of detailed interviews with TLC operators for the interested areas. The operators are requested to expose the critical elements which prevent them from offering broadband services over the cited areas. The interviews, will also give a general indication of the potential economical gap to reach a spontaneous growth of broadband market in those regions. This phase is described in section 3.2

The second phase consists in the actual bid. A call will be issued and the interested operators will answer committing themselves in a precise business plan. The details are reported in section 3.3.

The third phase is characterized by a project effectiveness monitoring process. This phase consists in the realization of a public verification entity, driven by local administrations and public bodies, whose main task is the surveillance over the diffusion of broadband market in rural and "divided" areas. This phase is described in section 4.

The time plan is reported in the diagram of Fig. 3.

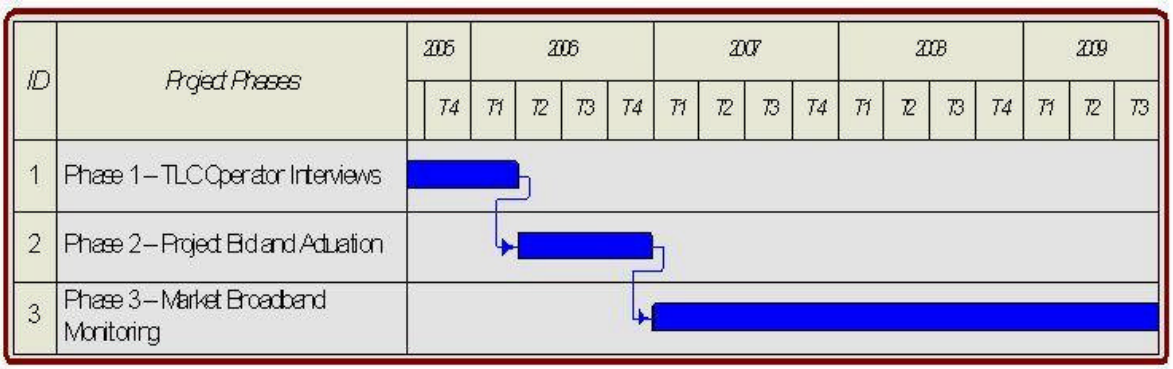

Fig. 3 – GANNT Diagram of the project

3.2 First phase: declarations of interest

In order to derive a reasonable business plan and issue a call that could attract the largest number of operators, a survey of the difficulties of the broadband telecommunication market development has been carried out. Part of the date has been reported in the previous sections and the objective of the proposed call is to reduce by at least 50% the existing digital divide, i.e. to increase by 400.000 units the amount of population reached by broadband services.

To this purpose, besides the raw observation of the existing market, an investigation about the potential interests of telecommunication operators has been conducted in collaboration with CNIT (Inter-universitary Consortium for Telecommunications), a private no-profit Consortium operating in the telecommunication research and development field. This investigation has been carried out by meeting representatives of the operators interested in implementing coverage projects aided by public investments in currently uncovered areas. The information that has been gathered concern

are real “declaration of interest” regarding technologies that could be deployed to cover the marginal areas, business plans and expectations about return of investments along a time span of three to five years.

Eight operators have substantially made declarations of interest (Telecom Italia, Fastweb, Eutelia, Infracom, Multilink, Consiagnet, ePlanet e Momax), and a clear picture of the digital divide in Tuscany has been drawn as well as the potentials of these operators to contribute to the reduction of digital divide. In addition a clear map of the market failure for TAs, UTAs and SUTAs has been depicted. Specifically:

1. SUTAs are those for which the expectation about the revenues are not able to cover the maintenance of the infrastructure itself
2. UTAs are those for which the expectation about the revenues are not able to cover the maintenance of the infrastructure and the annual mortgage related to the cost of the infrastructure;
3. TAs are those for which a balance between costs and revenues is possible but over a time-span that is deemed too long by the operator.

In order to have a significant statistical inference of the above criteria it has been concluded that the right territory granularity to assess broadband coverage is the province and it has been decided to proceed on a province-based call.

3.3 Specifications of the call for public support

The bid will be issued on regional basis, with provincial granularity. The bidding is technology-independent and the specific funding has been tuned based on the province population, the current digital divide and the declaration of interest given by the operators

Table 3: Foreseen market aid for the tuscany territories

Province	Market aid (€)	Newly reached population	% of covered population
AREZZO	1.652.000	37.219	12%
FIRENZE	493.000	17.315	2%
GROSSETO	1.725.000	31.921	15%
LIVORNO	927.000	11.440	4%
LUCCA	348.000	15.621	4%
MASSA CARRARA	1.081.000	18.251	9%
PISA	607.000	22.717	6%
PISTOIA	380.000	22.921	9%
PRATO	144.990	4.169	2%
SIENA	1.309.000	24.599	10%
TOTALE	**8.666.990**	**206.173**	**6%**

The above figures are referred to project implementations over three years to reach a balance between costs and revenues.

The public support has been derived taking into account

1. the potential market in the provinces,
2. the geographical barriers,
3. the potential residential and industrial user population,
4. the economical break-even within three years from the project start.

For each province, a list of cities interested by the support action will be indicated. The competitors will be invited to provide their best service coverage along with a suitable business plan for the development of broadband market in the province area. At the end of the bid process, a single operator will be chosen. The criteria adopted in the selection process are summarized in the following points:

- Maximize the number of potential residential and business users interested by the action
- Maximize the number of low-population-density cities interested by the action
- Prefer long-term scalable technologies
- Allow *wholesale* (business-to-business) redistribution of services
- Minimize the number of *digitally divided* industrial districts

The selection will not prescribe any technology. The provider can propose the most suitable solution for the interested area. Moreover, it will be foreseen a reverse payment mechanism as demand so that, if the broadband services grows, the contribution of the public sector diminishes.

The criteria will be implemented through scoring and the operator with the highest score will be chosen. The scores will be computed by considering the single provincial business plans from each operator. The business plan presented by the operator must show the following relevant parameters:

$T_{\underline{be}}$ = breakeven time [years]

C_1, C_2 = initial investments (network and access devices)
C_M = maintenance costs
C_G = general expenses
C_F = administrative costs
C_{SA} = public support action

R_r = revenues from residential users
R_b = revenues from business users
R_w = revenues from wholesale users

The basic rule for the admissibility of a business plan for the public support action is:

$$C_1+C_2 + C_M + C_G + C_F + C_{SA} = R_r + R_b + R_w \qquad [\text{over } T_{\underline{be}}]$$

Then the scores are attributed to the business plan using scoring tables. As an example a scoring table is reported below:

Table 4: Criteria for the selection of the telecom operator

Evaluated parameter	Max assigned score	Note
$C_1+C_2 + C_M + C_G + C_F + C_{SA}$	+++ for the lowest	prefer financial efficiency
$T_{\underline{be}}$	+++ for the highest	avoid market distortion
$(C_1+C_2)/ T_{\underline{be}}$	++ for the lowest	reduction of annual investment mortage
$C_M/ T_{\underline{be}}$	++ for the lowest	reduction of annual maintenance costs
$C_G/ T_{\underline{be}}$	+ for the lowest	reduction of annual general costs
$C_F/ T_{\underline{be}}$	+ for the lowest	reduction of annual financial

Evaluated parameter	Max assigned score	Note
		costs
C_{SA}/ T_{be}	+++ for the lowest	efficiency for the use of public support resources

In addition there will be a rewarding mechanism of scoring for those operators that cover municipalities with low density of populations. This mechanism is under definition to properly set values of population and density thresholds.

4 Project Markers

4.1 Broadband Development Observatory

Finally, Tuscany Region intends to promote on a long-term perspective a Regional Observatory for the broadband connectivity, herein referred as ORLAB. The main goal of the Observatory is to monitor the development of the broadband connectivity as concerns both the technologies adopted by the various operators and the facilities that can derive from the use of network applications. Furthermore, the Observatory will represent a sort of "meeting point" between the incoming requests from the citizens of the region and the services offered by the Internet Service/Access Provider, which operate in Tuscany.

More in details, the activity of the ORLAB will be focused on:

- Structure and territorial organization of broadband connectivity. For each operator, the ORLAB will attempt i) to assess the technologies employed to interconnect the networks nodes, and ii) to provide the user access.
- Guide lines of a modular pilot system able to collect and share information regarding the broadband connectivity and the benefits derived from its use.
- Evaluation, in term of costs/benefits, of possible actions aimed at reducing the digital divide. This activity includes the definition of models and business plans useful for comparing and evaluating projects, proposed by telecommunication operators, devoted to reduce the digital divide.
- Proposal and implementation of some scalable, pilot projects for conveying broadband network services in Tuscany.
- Design and implementation of a Web portal useful to gather and share data concerning the areas covered by broadband services, the telecommunication companies operating in a specific zone, feedbacks from the users, and so on.

The activities of the ORLAB will be supported by a group of researchers designated by the Inter-University Consortium for Telecommunications (CNIT), which contributed to plan a number of actions aimed at reducing the digital divide in Tuscany, and specifically in its rural zones.

4.2 Project Monitoring

The actions propelled by Tuscany Region will be continuously monitored by a group of observers and/or by the ORLAB. The first objective is to assess the deployment of the access networks as concerns the number and the territorial distribution of citizens and small medium-sized enterprises, which potentially will benefit of the new available broadband services. To this aim, the regional administration will periodically check the deployment plan, proposed by the selected telecommunication companies, and its actual implementation.

Furthermore, the fees paid by users will be subjected to audit in order to evaluate whether the broadband operators will be reasonably able to provide services in the future without any other public financial assistance.

Obviously, the local public administrations (such as, Municipalities, Mountain Communities, Regional Parks, and so on) can play an important role in monitoring the development of the access networks. These institutions could be themselves possible users of broadband services since a lot of transactions and administrative acts nowadays are available through a number of ad hoc network applications exploiting World Wide Web based interfaces. Under this perspective, the previously mentioned administrations can provide useful follow-ups, concerning the perceived and objective quality of the (broadband) services, as well as they can gather information on the areas that progressively will be covered by the access service providers.

The ORLAB will promote the design and the implementation of a Web portal, by which citizens of peripheral and rural zones will be able to leave feedbacks concerning i) the actual availability of broadband service in the areas they live, ii) the fees they pay to their providers, and iii) the (perceived) quality of broadband services offered. The portal could also include some simple tools to allow common users to estimate the average available bandwidth.
Finally, in the case of areas covered by some wireless technology, the effectiveness and reliability of the latter will be more deeply investigated. In fact, although Wireless LANs and MANs are emerging technologies that appear extremely promising to support broadband rollout in rural areas and peripheral suburbs of towns, few homogeneous data are at this moment available as regards the quality of service (in terms of effectiveness and reliability).
The results of the monitoring will be presented within the European Project "Understand" for the benchmarking of the information society (http://www.understand-eu.net), of which Tuscany Region is a partner.

4.3 Market Growth Indicators

The main objective of the project is to provide broadband services to public administrations, citizens, and small-medium-sized enterprises (SMEs) that operate in peripheral and rural areas of Tuscany. Hence, indications of market growing can be fruitfully derived from suitable surveys among persons and organizations interested in exploiting the facilities offered by broadband services.

As concerns public administrations, some examples of indicators are represented by:

- the number of public institutions (such as, Municipalities, Mountain Communities, schools, libraries, first aids, etc) that will be connected to the network infrastructure thanks to the actions propelled by this project;
- an estimate of traffic load (due to data exchange), measured at the active network devices;
- the reduction in complexity and length in dealing with bureaucratic procedures.

With regard to citizens, the number of new users and their distribution over the territory will help to understand the end-user market growth, and the actual deployment of the access network infrastructure, devised by the telecommunication operators in this intervention. Possible statistical survey could come in useful to get information about the most used applications (such as, electronic commerce, entertainment, etc), the average bandwidth available, the quality and reliability of lines employed to access the Internet.

Finally, a group of SMEs can be involved in the project activity in order to check the benefits enjoyed during the lifetime of the project.
Obviously, the telecommunication operators themselves will benefits of this intervention, in terms of both new users (and related fees) and new infrastructures, such as links and nodes of the backbone network.
In this case, some examples of indicators should be represented by:

- the number of (new) citizens, accessing the network, and the fees collected through the project lifetime;
- the number of service providers (which operates using the network facilities offered by the deployed network infrastructures) and their economical benefits;
- the number of SMEs that will exploit the broadband connectivity.

5 References

[1] F. Matera et al, “About Broadband in Italy”, edited by Ministry of Communications and Fondazione Ugo Bordoni.