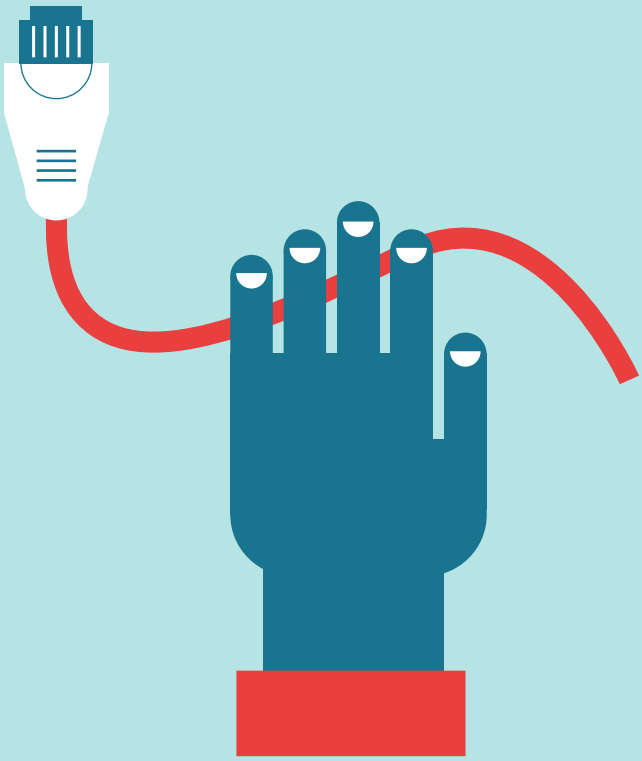
The Italian strategy for next generation access network

Presidenza del Consiglio dei Ministri



Introduction

Telecommunication networks have become the nervous system of any modern nation. A nation does not stop if you stop the transport system. Does not stop even for a general strike. But if telecommunication networks would stop - it never happened, very few activities would not be able to stop.

In perspective, and it's a perspective that is moving ever faster, telecommunication networks will be even more important. Not only will connect millions of people, but also tens of millions of computers and billions of objects (Internet of Things). The cyber war, which until recently was just a subject for political fiction books, fiction or espionage, is now a reality.

To destroy the reputation of a company what could be more simple than to hack their information systems? How long will it take before entire states are being targeted?

We should start thinking now the infrastructure on which to build our future.
In the past Italy has come late to large infrastructure choices, making short-sighted decisions. It was so on the third lane of

motorways, high-speed trains, for large airports and for the fiber networks.

High speed Internet infrastructure and services will be the raw material of our future, for the entire economic and social environment. It will be the essential resource on which to build the future competitiveness of the country and on which we will measure our ability to remain one of the most advanced nations of the planet.

Some, confusing infrastructure choices with technological ones, prefer to wait: as technology changes all the time, that of tomorrow will be better than today.

But infrastructure is the "physical" mean that carries information. Can be the either, a copper twisted pair, a coaxial cable or an optical fiber. The technology, however, is what makes it possible to transmit information through infrastructure. ISDN, ADSL, ADSL2, ADSL2 +, G.fast, GSM, LTE, LTE Advanced are all acronyms that define technologies. Technology evolves continuously, the infrastructure remains and does not change when technology changes.

Technological choices can also be opportunistic, because they have less constraints compared to infrastructural ones and are easier to edit. Infrastructure choices, however, affect technological choices because they decide what the future may offer and, ultimately, what will be our future.
The development of infrastructure is easily predictable but to change infrastructure choices is difficult, expensive and involves sunk costs that one day could be defined as misspend.

It is already clear that fixed networks will always offer better performances compared to wireless networks, and that optical infrastructure will always be capable of delivering broadband access services with enhanced characteristics as compared to existing basic broadband networks.

Similarly, it is already equally clear that the majority of users, unless they are public administrations or businesses, prefer to communicate through mobile connections, free from the constraints of physical proximity.

But performance of mobile networks will be more and more influenced by backhauling infrastructure on which they rely on: whether wireless (themselves) or fixed, if copper or fiber and how dense cell grids are to serve their users.

Having in mind this, the strategy set out in this document defines the framework within which public administrators, private operators and all stakeholders will be able to exercise the difficult art of discernment in the design of a future-proof telecommunication infrastructure, looking for the right balance between investments and benefits to the users of the various local communities, between technological flexibility and capacity-intensive technology demand.

But, ultimately, these will be the real infrastructure choices.

Someone, understandably skeptical might wonder: but are high speed broadband information highways really needed if today there are just few applications that can take advantage of the 100 Mbps speeds that they provide?

Metaphors sometimes deceive. "Information highways", both mobile and fixed ones, rather than being quick, guarantee "safer" performances.

They are defined "high speed ", but in reality they are "capacity-intensive": it's like a 100 lane road where it is very difficult to find a traffic jam, and for this reason information travels quicker.
This is why South Korea is already updating its network bringing it from speeds of 100 Mbps to up to 1 gigabits per second. Similarly, in the USA, since 2010 the government has set itself the goal of connecting all the premises of the public administrations with speeds of at least a 1 gigabits per second by 2020 and today, in

entire metropolitan areas as well as in many local communities, national and regional operators are building networks with speeds of up to 1 gigabit per second and presenting the first commercial offers for businesses with speeds of up to 10 gigabits per second. Equally, in Israel, Slovenia, Romania, South Africa, UK and in many other parts of the world, where there are optical networks already supporting speeds of 100Mbit/s, they are investing to make a quantum leap towards networks supporting speeds of up to 1 gigabits per second, because existing ones soon will prove unsatisfactory.

Italy is back in all the European charts for take up of advanced digital services and last for high speed networks availability. This is an alarming fact because it can be the source of other - and increasingly large - gaps that will be difficult to fill if they develop further.

To provide Italy with high speed networks is an indispensable condition, one day, to have a faster, more agile, less bureaucratic Italy. For this reason, the strategy for high-speed Internet infrastructure and services is not the answer to the nth request that comes from the European Union. On the contrary, it is the first step of a larger project that incorporates the objectives of the European Digital Agenda, but goes further. It is the focus of a new vision of Italy, projected into the future, that invests in future-proof infrastructures and thanks to advanced digital services will be better.

To achieve this we need the commitment of all, central and local Public Administration's efforts alone are not enough. An effort by the ICT industry as a whole, enterprises, associations and citizens is needed. Everyone needs to work together in a unified strategy to be implemented consistently over the next six years.

This unified strategy, illustrated in this document, builds on the experience gained in this field both in Italy and abroad. In particular, with regard to our country, it takes into account the experiences made with the Digital Plan – Super-Fast Broadband underway in

over 650 municipalities, mostly in southern Italy, as well as the survey, completed at the beginning of 2014,[1] coordinated by the then Special Government Commissioner for the Digital Agenda and the results of the public consultation carried out by the Ministry of Economic Development on national and local telecommunication operator investment plans, concluded on July 15th, 2014.

Instead, with regard to foreign countries, were evaluated the experiences of intervention in rural areas in countries like the United States, the United Kingdom and Sweden, the stimulus to the infrastructure's development for fixed and mobile networks adopted in the Nordic countries, the models of public-private partnership and coordination between local and national initiatives used in France, the method of financing the basic broadband infrastructure of the Korean and Japanese National Projects, as well as forms of direct intervention of the State in Australia and New Zealand.

The Government has made a strong and decisive commitment, defining a strategy that will be periodically updated, adapting to changing technologies, services and demand, but it will still be, from here on, the framework to guide and coordinate actions, measures and objectives of all stakeholders involved.

According to paragraph 41 of the Community Guidelines,[3] Italy has developed a national framework that defines the basic principles of public intervention, to support the development of high speed broadband networks, to ensure consistency and time saving use of public funds, reducing and sometimes eliminating administrative charges requested by local authorities.

A coordination of the various interventions is essential to achieve those intangible infrastructure, a crucial factor for increase business competitiveness and innovation, public services efficiency, and intrinsically related to the Government's strategy for Digital Growth. Both strategies - for High Speed Broadband and Digital Growth – have been subject to public consultation from 20 November 2014 to 20 January 2015. This version incorporates the

contributions received and for which we thank all those who have contributed to the drafting of this document with their ideas and their comments: in particular the more than 100 people, including experts, and NRA,Italian Space Agency, Alcatel Lucent, Anitec, Italian Association Internet Provider, Assintel, Assoprovider, Bank of Italy, Confcommercio, Cesena Net Srl, Club Managers Information Technology (CDTI) in Rome, Consortium Elettra2000, Confcommercio, Ericsson Med, Eutelsat Italy, Fastweb Digital World Foundation, I-Com, Infocert, Italtel, Lepida Spa, Linkem Spa, Metroweb Italia Spa, Ministry of Agriculture and Forestry, Ngi Spa, Rai Way, Puglia Region, Sirti SpA, Telecom Italia, Telespazio S.P.A., Vodafone and Wind.

The consultation helped to clarify what part in the project private investors can take to carry out this strategy and has thus allowed a better definition of objectives and measures.

[1] V. F. Caio, J. Scott Marcus e Gérard Pogorel (2014) Achieving the Objectives of the Digital Agenda for Europe (DAE) in Italy: Prospects and Challenges; Report of the expert advisory team appointed by President Letta. In particular, have been taken into account the indications to extend the coverage of the ultra-wideband beyond the limits of the operators' plans, promoting the sharing of infrastructure, stimulating investment and ensuring the availability of radio spectrum.

[2] The Consultation 2014, launched by the Ministry of Economic Development - Infratel according to 2009/C 235/04 Communication from the Commission "Community Guidelines for the application of State aid rules in relation to rapid deployment of broadband networks" and the European Commission's Black, Grey and White areas classification scheme, was published on the Official Gazette of the Italian Republic (GURI) n. 58/2014 of 23 May 2014, launched May 12th, 2014 on the electronic platform www.consultazioneinfratel.it and ended July 15th, 2014.

[3] Communication from the Commission, European Union guidelines for the application of the rules on state aid in relation to rapid deployment of broadband networks (2013/C25/01).

Brief summary

The Italian strategy for Next Generation Access Network aims at developing a high speed optical access network throughout the country to create a future-proof telecommunication infrastructure, reaching the objectives of the European Digital at the same time.

In concrete what does “future-proof” mean?

"Future proof" means not to build two-lane highways when it is already clear that before you complete them there’s already need for four-lanes ones.

Telecommunications of the future will be even more important than they are now, delivering services mainly through wireless and mobile broadband technologies, including high capacity live video streaming services, next generation HD video, with a number of devices and applications connected wirelessly ten times greater than it is now.

This is why South Korea is upgrading its network bringing it from the range of speeds of 100Mbit/s to speeds of a gigabit per second, as is the case in the US, in entire metropolitan areas and in local communities, in Japan, Israel, Slovenia, Romania, South Africa, UK, as in many other parts of the world.

The plan will be updated and reviewed annually on the basis of the achieved results.

Division into four clusters

At national level four clusters have been identified, with similar socio-economic features but with growing infrastructure costs and technical complexity (A,B,C,D). The country has been divided into 94,000 sub-areas (homogeneous groups of ISTAT census areas). Each municipality is divided into sub-areas belonging to one or more clusters (according to population density, presence of optical networks, rural areas, rural premises, and so on.).

The database with the map of the clustered municipalities and sub-areas will be managed by Infratel.

This strategy seeks the construction of a NGA network infrastructure to provide total population with above 100Mbit/s high speed broadband connections in cluster A and B (probably part of), and of at least 30Mbit/s high speed broadband connections in cluster C and D over an open and technology neutral infrastructure (fixed, mobile, fixed-wireless access, satellite).

Combinations of sub-areas belonging to the same cluster will be submitted to public competitive selection process to identify aid beneficiary.

Auction on time

The basic mechanism for the selection of the aid beneficiary is an evaluation on the time horizon for the rollout of the new infrastructure: the tender is awarded to those who, with the most "future-proof" technical offer (inherently greater bandwidth available: FTTH> FTTB> FTTdp> FTTC) provides the shortest time horizon for the deployment of the subsidized infrastructure.

In case of failure to meet the delivery times, contribution from the State will be proportionally reduced or refunded. All tender procedures on broadband State aid measures shall be monitored by Infratel.
AGCOM will monitor the execution of the contract and supplied technological solutions. In case of failure to comply with the technical requirements, beneficiary will be asked to comply first, then suspended from incentives, and then excluded from all tenders and then will be held liable for damages. Even citizens who have not received the promised service are eligible for damage refunds.

Some might argue that the time horizon criteria exposes to the risk of wasteful use of available resources. But being tender requirements homogeneous across the territory (price, quantity and roll out time), if a dedicated, central purchasing management office is appointed to oversee all tender procedures or a central office coordinates all the purchasing management offices involved, this danger is easily avoidable.

Moreover project resources will be made available during the time of validity of the plan (5 years).

Accompanying the migration

Even though operators consider the objectives of the strategy too ambitious, likely public resources alone will not be enough and Italy may still not be able to develop an extensive future-proof network nor to achieve the third objective of the European Digital Agenda 2020 (50% penetration to Internet connections above 100 Mbps).

The way forward then is an integrated system of new measures and regulations, which would lead all users to migrate to the new optical networks, in a progressive and coordinated way.

In this perspective, migration will be launched in a regulation framework that will be defined in the final phase of the Plan, and must be accompanied by the provision of vouchers for all end-users that migrate towards the new infrastructure, varying its amount according to the architecture of the underlying network.
In order to allow operators to formulate their own plans with the appropriate time horizon, proper regulation should be introduced, after the publication of this Plan, to address:

1. Digital Universal Service;

2. A guarantee fund;

3. Migration vouchers for all end-users;

4. Convergence of price for the new subsidised high speed networks and the price of basic broadband networks in the timeframe of the plan.

1. Within the context of the **strategic plan**

1.1 The objectives of the strategic plan

Considering that the problem of ubiquitous coverage of basic broadband services has been solved across Europe, the Italian strategy for Next Generation Access Network aims to maximize by 2020 population take up of Internet connections above 100 Mbps, which is the only one to be called ultra-fast broadband as described in the European Digital Agenda (below high speed or ultra-fast broadband) and to ensure to all population services with download speeds of at least 30 Mbps (fast broadband, as described in the European Digital Agenda).

The strategy, therefore, from an infrastructural point of view, is in line with the objectives that were set in 2010 for the second pillar of the European Digital Agenda: at least 50% of population covered with ultra-fast broadband internet services above 100 Mbps.

Alongside the construction of ultra-fast broadband networks, through the Digital Growth Strategy, the government will stimulate the development and the supply of services to promote population take up of ultra-fast broadband connections.

Italy starts from a very disadvantaged situation in which we are below the European average by more than 40 percentage points in the availability of access services above 30 Mbps and a delay of at least three years.

According to the business plans of private operators,6 only in 2016, fast broadband availability will reach 60% of the population with access connection services of 30 Mbps, with no commitments beyond that date. Moreover, none of the operators has official plan to start extending their 100 Mbps coverage, in 2016 or beyond.

The objective of the Strategic plan, therefore, is to bridge this infrastructure and market gap, creating the most favorable conditions to develop and integrated fixed and mobile telecommunications infrastructure, that beyond the European objectives, lay the foundations for a "future proof" infrastructure through:

- incentives aimed at lowering deployment costs, simplifying and reducing administrative charges;
- coordinated management of underground facilities through the establishment of a Cadaster of utility infrastructures under and ground to monitor the roll-outs and to take full advantage of existing infrastructures;
- Uniform national limits to European ones in the field of electro-magnetism;
- tax incentives, credit at subsidized rates and grants;
- direct government intervention in unserved/underserved areas.

Strategy targets	Provide 85 per cent of population with access to broadband connection services above 100Mbps
	Provide access to broadband connection services above 30Mbps to 100 per cent of population
	Provide access to broadband connection services of at least 100Mbps for public administration, local schools, health care facilities, industrial parks, high demographic density areas
Strategy	Net neutrality, open networks, equivalent and non-discriminatory access conditions, integrated wired and wireless network approach
	Lower economic barriers for infrastructures deployment
	Coordinated management of underground facilities through the establishment of a Cadaster of utility infrastructures under and above ground to monitor the roll-outs and to take full advantage of existing infrastructures
	The Plan has been divided into clusters, based on NGA market competition and availability
	Uniform national limits to European ones in the field of electro-magnetism
Tools	Simplifying and reducing administrative charges, tax incentives for infrastructure deployment
	Incentives to stimulate demand conditions and implementation of the Digital Growth Strategy
	Facilitating access to economic resources, establishment of a center for the attraction of funds/ guarantee fund and credit at subsidized rates
	Grants allocated to unserved/underserved areas to provide access to a broadband connection of at least 30Mbps
	Possible public direct infrastructure deployment in market failure areas
	Cadaster of utility infrastructures under and above ground
Public resources	FESR and FEASR funds
	National and regional funds (including Development and Cohesion Funds and residual programming 2007/13)

Coordination of actions	The Committee for the spread of ultra-fast broadband (COBUL) coordinates the implementation of the strategy and is participated by Government, MISE, AGID, Infratel, Agenzia per la Coesione
	The implementation of the strategy for the public sector is delegated to Infratel Italia SpA, possibly in coordination with Regional in-houses
	Regions, autonomous provinces and municipalities define the operational programs with the technical support of Infratel Italy and coordination of AGID.
Synergy	The public plan is synergic to TLC operator's plans and fiber networks built for smart grid, smart city, street lighting, etc.
	Bundle connectivity demand in more densely populated white areas and with high industry concentration through the analysis carried out by MISE, Unioncamere and local Associations
	AGID ensures synergy with other public policies put in place to stimulate technology take up such as The Good School, Health and Digital Justice, as well as with the Project of the Inner Areas
	AGID ensure synergy with the Public Administration virtualization's development plan, optimizing and rationalizing public investments
Coordination	COBUL - in coordination with the National Regulatory Agency, as an independent authority and Agency for Cohesion for deployment of resources

[5] In October 2013, Neelie Kroes, Vice President of the European Commission, stated that thanks to the additional coverage provided by the satellite the target of broadband for all scheduled for the end of 2013 in the European Digital Agenda has been crossed. In Italy, the National Broadband Plan, which plans to ensure a minimum target of broadband access of 2 Mbps through a mix of different technologies is nearing completion.
V. European Commission, 100% basic broadband coverage achieved across Europe – EU target achieved ahead of schedule. Next stop is fast broadband for all. Brussels, October 17, 2013, press - http://europa.eu/rapid/press-release_IP-13-968_en.htm.

1.2 Technological scenario

The amount of financial resources to be invested for the deployment of a "future-proof" optical infrastructure to reach as close as possible customer premises leads to the adoption of a strategy that size the right mix of technologies in relation to potential service take up and demand levels, selecting the most suitable technological solution or mix of technology solutions between areas where affordable and competitive broadband services are on offer and areas where such services are not.

Although it is clear that the fiber to the home (FTTH) solution represent the ideal architecture for the provision of a future-proof ultra-fast broadband network infrastructure, the efficient use of resources leads to a direct use of this architecture only in areas with major cities and with business potential, favoring an evolutionary approach in which the fiber is generally deployed initially in the first mile access networks (FTTC), and then extended in the last mile access networks up to the buildings (FTTB and FTTdp) and, if necessary, until the interior of the building units (FTTH).

For mobile networks and fixed wireless access, applies the same evolutionary approach, which may partly overlap, with a different granularity, in some cases next generation fixed wireless networks may be deployed at a certain degree of density and/or with advanced configurations that could be a viable alternative to wired NGA.

The infrastructure is not technology

A frequent source of misunderstanding is the confusion between two closely related but distinct concepts:

- infrastructure is the "physical" mean that carries information, for example, it can be towers, sites, twisted-pair copper cables, coaxial cables or optical fibers. The infrastructure has a very long life expectancy, which can easily exceed 50 years;

- The technology, however, is what makes it possible to transmit information through infrastructure. It's realized in the active equipment needed to encode information into signal to be sent through the infrastructure. These devices have a typical expected life of about 5-15 years.

Each infrastructure has physical limitations that define the possible range of speeds and services allowed. Given these limits, the performance of a connection depends on the full exploitation of infrastructure's capabilities by a specific technology. ISDN, ADSL, ADSL2, VDSL vectoring, G.fast, GSM, LTE, LTE Advanced are all acronyms that define technologies. Technology evolves continuously, the infrastructure remains and does not change when technology changes.

If infrastructure can be thought of as a road, a technology can be thought of like a car, which is distinguished by certain characteristics, which are not only speed. The main features that describe a technology, summarized in Tab. 1.1, are:

- **Data rate (speed of connection):** measure how much information can be transmitted per second. It's measured in Mbps or Gbps (1.000 Mbps).

- **Latency:** is the time it takes for a data transmission. Some applications are very sensitive to latency, which becomes critical. Examples of applications that involve strict requirements in terms of latency are: online trading, online gaming, video conferencing, remote collaboration.

- **Sharing:** multiple communications simultaneously can be transmitted on the same infrastructure through forms of sharing that have an impact on connection's speed of the single communication (because of the subdivision of the overall transmission capacity and, in some cases, for mutual interference between simultaneous communications). This means that the data rate actually available can be significantly lower than the value indicated by the operator.

- **Connection's symmetry:** is the ratio of download and upload speed. While TV stream needs only download speed, other applications, such as cloud computing, video conferencing, remote collaboration, some eHealth, social media and e-education applications also need considerable upload bandwidth. (6 - see Annex A)

To this basic considerations, however, it must be acknowledged, that, given the average length of the sub-loop, the Italian access networks have features that make it of particular interest for FTTC solutions.[6] The public consultation to which has been subjected this Strategy, has cleared that this feature, which until today has been used by private operators to provide FTTC solutions combined with

[6] Reported annually to the Ministry of Economic Development - Infratel according to the Communication from the Commission, European Union guidelines for the application of the rules on state aid in relation to rapid deployment of broadband networks (2013 / C 25 / 01) in order to identify the white areas, or those of market failure, where public intervention is needed to ensure coverage of ultra-wideband

VDSL2 technology, can be used to achieve FTTC solutions with new technologies that allow to reach, in some cases, download speeds of around 100 Mbps.

These solutions, properly assessed taking into account significant market, technology or regulatory constraints that could affect its use or the possible evolution towards more performing and/or more flexible solutions, can make the interventions economically more efficient, also reaching the strategy's objectives in less time.

In the implementation of this strategy play a key role demand stimulation measures and a further ahead vision to intermediate technical solutions that may lead to most advanced digital services (with controlled roadmaps for the transition and coexistence).

In particular, the definition of demand stimulation measures, together with policies to foster a favorable regulation framework and stimulate infrastructure investments, will determine the payback of intermediate solutions (FTTC) and will set the pace for infrastructure upgrades and the adoption of most advanced fixed technologies (FTTdp and FTTB/FTTH).

The provision of access services above 30 Mbps for the entire population (Objective 2 European Digital Agenda) brings to investigate the entire range of infrastructure and technology solutions in order to secure this target.

In this context radio technologies will also be considered (mobile, fixed and satellite radio access) to cover, in a financially sustainable way, some areas of the territory including those where there's no business case.

With regard to the objective 3 of the European Digital Agenda (50% population to take up Internet connections above 100 Mbps), that within the framework of this strategy, given the results of the public consultation, seems difficult to be achieved.

Table 1.1 A summary of the main infrastructure and communication technologies.
Source: European Commission, 2014 and integrations

Infrastructure	Technology	Top speed (download/ upload)	Sharing	Latency	Lenght basis
Fiber p2p	GbE	1/1 Gbps	NO	Low	80 km
Fiber p2p (PON)	GPON	Up to 2,5/1,2 Gbps	Yes	Average - low	20-45 km
Coaxial cable	DOCSIS 3	Up to 300/50 Mbps	Yes	Average	0,5-3 km
Twisted	VDSL2 + Vectoring	30-100/3-30 Mbps < 300 metri	Yes	Average	0,2-1,5 km
Mobile network	LTE advanced	Up to 3/1,5 Gbps	Yes	Average	Few km
Fixed wireless access	MU-MIMO	320/80 Mbps	Yes	Average - low	Up to 20 km
Satellite	Ka-band	Up to 20/8 Mbps	Yes	High	-

"Future proof" Infrastructure

The future telecommunication infrastructures must enable mobile and pervasive communication. In Italy, according to the Cisco Visual Networking Index (VNI) Mobile, mobile users in 2014 were 53.6 million (88% of the population), will be 55 million by 2019 (90% of the population): about 2, 6 mobile users per fixed line (which are 20 million), 3.7 per broadband line (which are 14 million).
Always between 2014 and 2019, Italians will pass from 2 to 3 mobile devices on average, M2M connections will grow to 6 times, reaching 94 million who will be joined by 13 million and a half of wearable devices.

All this will blow 4G traffic that will be 44 times that of 2014 and 81 times that of 2009, with an annual growth rate of 113%, more

than double the European growth (19 times, about 80% per year), from 2% of total connections in 2014 to 32% in 2019 (from 14% of mobile data traffic to 77%).

Overall, in Italy, in the next 4 years, mobile data traffic will grow at twice the rate of the fixed network.

These are the elements to be considered when defining the future to "build".

Copper networks are offering an important contribution to broadband communications but their technology is inching closer to its physical limits especially considering that, with time, copper cables's quality worse.

Some copper cables, particularly in the South, have more than 60 years and the latest massive replacements, only in some areas of the country, were made 20 years ago.

A fiber optic infrastructure is the only solution that can overcome the inherent limitations of the copper access networks for several reasons:

- the available bandwidth is already of an order of magnitude higher than those of copper and the physical limits of the optical fiber are still far;

- the fiber is the only infrastructure compatible with the development of new mobile access networks, for the development of dense cells (up to 50 meters of distance with a backhauling starting from 2.5 Gbps), equipped with fiber connections, required to support the traffic but also to enable the redistribution of the functions of signal processing between baseband and radio frequency (according to the principle of CloudRAN);

- the degree of availability of the fiber is far superior to that of the copper network (about ten times), which is particularly exposed to moisture, electromagnetic noise and interference;

- the security of communications of a fiber network is higher than that of copper for the less exposure to possible insertion of unduly activities to extract the contents of the information in transit;
- for levels of service and quality required, is the most suitable to support communication platforms at the base of the Smart Cities and the Internet of Things.

Moreover it is appropriate to focus on the development of this infrastructure especially on areas of the country with highest business potential, wisely selecting the appropriate technologies, promoting a rapid deployment and adoption, as well as working intensively on demand stimulation.

In this way it will be possible to create positive conditions so that a virtuous circle between the development of innovative services and the development of an increasingly demanding market, willing to purchase ultra-fast broadband services.

However a fundamental consideration must be made, to clarify the meaning of this strategy, moving away from the compliance perspective of those who simply want to comply to a European objective, talking about a "future-proof " network (v. box above) and looking at the real goal of this Plan.

Having an authentic infrastructural approach, is to consider that the aim of this strategy is to build a new platform to enable the development of emerging and future scenarios for the next 20 years, maybe even 30 and more,

This is not merely to replace copper cables with limited technical performances affected by the erosion of time with new, high capacity, fiber optic cables, but is to build a new infrastructure (with

modern rational), which will have different topologies and architectures, to support all types of communications that in this time frame will be useful to develop ubiquitous mobile communications, Smart Cities and the Internet of Things.

In short, is about creating a new infrastructure, flexible and spread enough to support a future that is coming very quickly, not to mend the old one.

Finding the right balance between a solid vision of the future and the prosaic but essential financial constraints will be the real challenge of this plan and its updates.

Annex A provides information on the state of the art and trends on technologies and network architectures for wired and wireless networks, as well as operators choices, with reference to the objectives of the Digital European 2 and 3

1.3 Telecommunication infrastructures scenario

The situation of telecommunications infrastructure in Italy is quite critical.

We are the last country in Europe in terms of ultra-fast broadband coverage, as shown by data from the European Commission (Figure 1.1). The Italian issue, however, is not limited to infrastructure and its performance, but also the supply situation that makes the nation with the largest extension of market failure areas (white areas of Next Generation Access, below NGA) in Europe.

The consequence is that only 21% of the population has the availability of Internet access to more than 30 Mbps, compared to the average European countries that have already reached 64% of the population.

Figura 1.1: NGA Coverage in EU countries

Source: EU Commission, 2013.

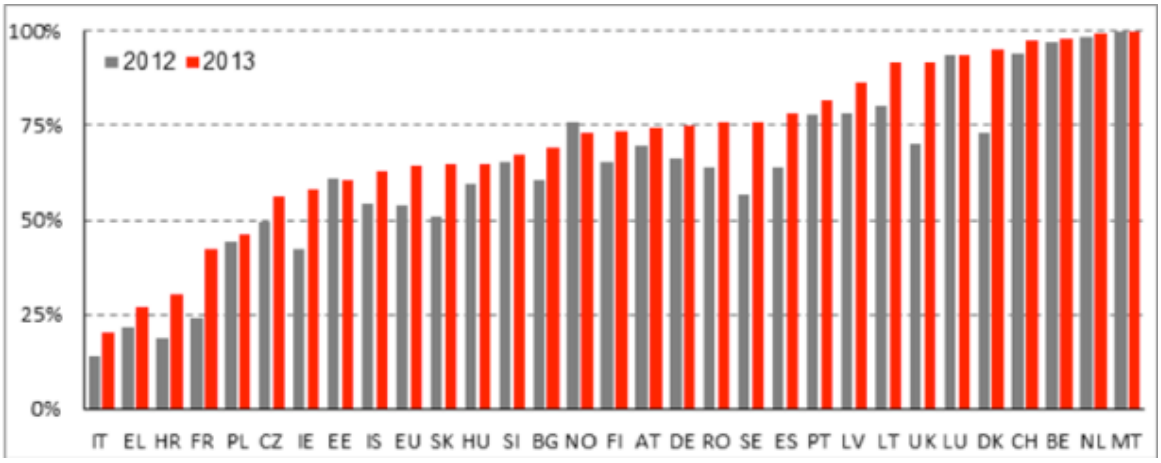


Figura 1.2: Base broadband coverage and broadband coverage > 30 Mbps, housing and population.

Source: EU Commission, 2013

	Copertura banda larga base (sulle abitazioni)	Penetrazione banda larga base (sulla popolazione)	Copertura banda larga >30 Mbps (sulle abitazioni)	Penetrazione banda larga >30 Mbps (sulla popolazione)
Italia	99%	25%	21%	<1%
Media europea	97%	30%	62%	6%
Francia	100%	38%	41%	3%
Regno Unito	100%	34%	82%	9%
Germania	97%	35%	75%	5%
Spagna	97%	26%	65%	4%

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As for the NGA, the public consultation carried out by Infratel Italia on behalf of the Ministry of Economic Development (MISE) and ended in July 2014 (see. Table 1.3 for coverage as of December 31, 2014 and Table 1.4 as of December 2016 according to telecommunications operators plans), although it was possible to record from operator's plans a significant recovery in the level of private investment over the years 2014-16, marking a clear break with the previous consultation, showed that the market alone is not able to put Italy in a position to fully accomplish to the objectives established in the European Digital Agenda.

The last annual update, summarized by region in Table 1.5, shows that by 2016 498 municipalities will be covered by private operators with fast broadband connections of up to 30 Mbps, with a total investment of less than € 2 billion in three years. The ongoing "Digital Plan – Super-fast broadband" will reach 639 more municipalities, already financed by many Italian regions, bringing by the end of 2016 a 30 Mbps coverage to a total of 1.137 municipalities.

While tripling the municipalities covered compared to the current situation and making a big step forward, nevertheless, planned investments will not be enough to align Italy to the European average coverage, in particular, the Centre-North, where public incentives were not used.

According to current commitments, Italy will reach only in three years the current European average coverage, when Europe will have moved even further its level of coverage. As for ultra-fast broadband services (FTTH / FTTB), the only case of extensive coverage remains that of the city of Milan, where Metroweb has rolled out its own infrastructure, and a few other cities where in some specific areas the market provides a sufficient broadband coverage, where there was a limited intervention by private operators in the early 2000s.

The last year has instead seen a rapid increase in the coverage of services of up to 30 Mbps, available from mid-2014 in about 70 cities, although in June 2014 NGA connections were approximately 540,000, of which slightly more than 300,000 were FTTH.

As shown in the aforementioned July 2014public consultation, private operators have not presented significant coverage plans with ultra-fast broadband networks of above 100Mbps and with FTTB/H architectures, except for limited areas in cities where operators can take advantage of existing infrastructure that municipalities have made available to them.

It is also to be noted that the public consultation with all stakeholders revealed a lack of interest on Cluster C for investments in FTTB/H.

As for the 4G mobile services coverage (LTE), this has more than doubled in the last year, reaching in mid-2014 a penetration of more than 50% of the population and a coverage of more than 900 municipalities.

Although LTE service penetration places Italy in the most advanced group of EU countries, however it should be noted that since the wireless medium is 'shared' the speed per user depends on the number of connected users in the area covered and is inherently subject to fluctuating environmental conditions, therefore mobile technologies must make use, to a certain extent, of a fiber support infrastructure (backhauling).

In this case, radio base stations with fiber-based connection is the solution that creates the best conditions to fully exploit LTE networks capabilities, removing backhauling limitations. Analysis of operators plans shows that, in 2016, coverage of NGA will be at 55%, while LTE networks could reach 90%.

Table 1.3 – Ultra Wide Broadband Coverage by private interventions as of 31 December 2014 according to the Public Consultation of July 2014

Source: Infratel 2014

Regions	Municipalities	% UI connected to 100 Mbps	% UI connected to 30 Mbps
Abruzzo	2	0,0%	9,5%
Basilicata	2	0,0%	22,0%
Calabria	3	0,0%	11,1%
Campania	8	0,0%	20,8%
Emilia Romagna	21	1,4%	30,2%
Friuli Venezia Giulia	2	0,0%	20,4%
Lazio	7	0,0%	38,3%
Liguria	3	0,0%	37,4%
Lombardia	15	13,7%	22,3%
Marche	3	0,0%	12,3%
Molise	-	0,0%	0,0%
Bolzano	1	0,0%	10,0%
Trento	1	0,0%	6,5%
Piemonte	6	0,0%	20,0%
Puglia	7	0,0%	16,7%
Sardegna	3	0,0%	8,5%
Sicilia	8	0,0%	25,0%
Toscana	13	0,8%	25,8%
Umbria	2	0,0%	17,4%
Valle d'Aosta	-	0,0%	0,0%
Veneto	10	0,0%	15,9%
Total	**117**	**2,4%**	**22,3%**

Table 1.4 - Ultra Wide Broadband Coverage by private interventions by 2016 according to the Public Consultation of July 2014

Source: Infratel 2014

Municipalities covered by private interventions by 12/2016	% UI connected by private initiatives	Municipalities covered by public interventions Model B by 12/2016	Municipalities covered by public interventions Model A by 12/2016	% UI connected by public interventions	% UI Total connected
4	14,4%	-	94	24,4%	38,7%
2	15,5%	64	-	52,7%	68,2%
4	13,0%	223	182	87,0%	100,0%
10	27,1%	119	-	42,7%	69,8%
50	44,7%	-	-	0,0%	44,7%
8	33,6%	-	-	0,0%	33,6%
42	59,0%	23	17	8,7%	67,7%
22	55,2%	-	-	0,0%	55,2%
124	45,4%	25	4	1,6%	47,0%
23	36,6%	-	14	9,4%	46,1%
1	10,9%	4	-	14,9%	25,8%
4	31,7%	-	-	0,0%	31,7%
5	24,9%	-	-	0,0%	24,9%
48	38,8%	-	-	0,0%	38,8%
7	22,1%	148	93	46,0%	68,0%
18	35,0%	-	-	0,0%	35,0%
10	27,1%	142	-	0,0%	27,1%
46	42,0%	-	12	6,0%	48,0%
7	36,7%	-	-	0,0%	36,7%
1	10,5%	-	-	0,0%	10,5%
61	33,4%	-	-	0,0%	33,4%
497	**37,0%**	**748**	**416**	**18,0%**	**55,0%**

Table 1.5 – Italian municipalities connected to 30Mbps per region by 2016 thanks to private plans or public incentives.
Source: Infratel 2014

Regions	Municipalities that will be covered by the private operators at 30 Mbps by 2016	Municipalities that will be covered at 30 Mbps thanks to incentive public by 2015
Abruzzo	4	-
Basilicata	2	64
Calabria	4	223
Campania	10	119
Emilia Romagna	50	-
Friuli Venezia Giulia	8	-
Lazio	42	16
Liguria	22	-
Lombardia	125	5
Marche	23	-
Molise	1	4
Piemonte	48	-
Puglia	7	148
Sardegna	18	-
Sicilia	10	60
Toscana	46	-
Trentino Alto Adige	9	-
Umbria	7	-
Valle d'Aosta	1	-
Veneto	61	-
TOTAL	498	639

[8] Source: Infratel, July 2014.

[9] In 2013 MISE public consultation detected only just over 150 cities covered by private operators plans.

[10] Source: AGCOM Quarterly Observatory, June 2014.

[11] Source: Ultra Broadband Observatory, Between, 2014.

1.4 The demand for broadband and ultra-fast broadband services

Conclusions drawn from evidence presented in Annex B, show a scenario on demand for connectivity services in Italy, useful in the laying out of this strategy and functional to foster a favorable environment to the development of new network infrastructure among both the citizens, enterprises and institutions.

First, the demand for NGA connectivity services, from end-user and businesses, penetration remains thus much lower and demand for capacity-intensive services is significantly lower than found in

major European countries, and the situation isn't better considering the use of ICT among the Public Administration.

On the other hand, the high number of "mobile only" users restricts the accessible user base for the realization of NGA network infrastructure brought about by the development of ultra-fast broadband services. So far, despite the increased performance of fixed broadband networks, the number of total amount of fixed lines has gradually decreased over the years.

Moreover, although there is a share of Internet users willing to pay a premium price for ultra-fast broadband connections, their penetration remains low.

The flexibility of demand to price depends on the quality of service level required by end users.

Finally, the spending power of Italian Internet users appears still below the European average, despite average price levels are in line with those in Europe.

In summary, the above situation, together with the specific socio-demographic and geographic features of our country, will bring telecom operators to make selective choices, giving priority to areas of the territory in which there's market potential and good population density as to guarantee an adequate return on investment.

1.5 Clusters Articulation Plan

Clusters were identified by analyzing the supply of already deployed or planned infrastructures for ultra-fast broadband, mapping areas of intervention to define a limited number of clusters depending on population density and socio-economic features of the territory.

This clustering was defined to maximize the effectiveness of public intervention with respect to available economic resources.
At the beginning, the granularity of analyzed areas was the same compared to that of the MISE's public consultation, described in Chapter 3, defining some 10,400 local exchange areas, then, through a finer granularity, were defined more than 94,000 areas resulting from combining ISTAT local census areas and local exchange areas.

Also as a result these areas have been classified into four clusters:

Cluster A

It is the cluster with the best cost-benefit ratio, where is most likely that private operators will invest:

- Includes the 15 major cities - black areas as regards to availability of networks delivering speeds above 30 Mbit/s (where there is - or will be - more than one network operator) (Rome, Milano[12], Naples, Turin, Palermo, Genoa, Bologna, Florence, Bari , Catania, Venice, Verona, Messina, Padua and Trieste) and the major industrial areas of the country;

- Constitutes 15% of the national population (about 9.4 million people);

- In this cluster the 'step change' required by EU legislation it's possible, bringing the connection speed from 30 to 100 Mbps by 2020 with the proper use of financial measures to facilitate access to debt (favorable terms on loans and low risk debts) through measures of tax exemption on investments.

Cluster B

It is made up of the areas where operators have realized or have planned the deployment of networks providing speeds above 30 Mbps, but the market conditions are not sufficient to guarantee an adequate returns on investments to upgrade networks to provide speeds above 100 Mbps.

Includes 1,120 municipalities, some are black areas and others are gray areas as regards to availability of networks delivering speeds above 30 Mbit/s (there is only one network operator and there are plans for a second one).

45% of the population (about 28.2 million people);

The cluster is divided into two sub-clusters:

- B1 in which private network operators invest directly;
- B2 that includes the areas in which public plans were deployed or are planned for the construction of networks with connectivity above 30 Mbps.

In these areas it is necessary to provide, as well as financial measures to facilitate access to debt (favorable terms on loans and low risk debts) and measures of tax exemption on investments, also grants with possible direct public intervention in the construction of infrastructure.

In these areas, grants for network upgrades from 30 to 100 Mbps will still be limited to the minimum, given that private operators may want to invest in many of the areas included in this cluster.

Cluster C

This are areas of market failure, rural areas, for which operators can be interested in investing in networks with more than 100 Mbps only thanks to state aid support.

Includes approximately 2,650 municipalities and some rural areas not covered by networks delivering speeds to more than 30 Mbps.

There are nearly 15.7 million people (25% of the population);

In these areas it is necessary to provide measures not only for access to subsidized credit and tax incentives, but also limited grants, proportionally greater than that of the cluster B

Cluster D

Market failure areas for which only through public intervention resident population can be provided with broadband connectivity above 30 Mbps.

Includes approximately 4,300 remaining municipalities, especially in the South, including some rural areas;
There are nearly 9.4 million people (15% of the population);

In this cluster, especially in the south, the public incentives can be granted to a greater extent, considering ultra-fast broadband infrastructure strategic in pursuing the goal of economic, social and territorial cohesion in areas with a GDP per capita below 75% of the EU-27 (17,000 EUR).

This intervention is already underway in some 300 municipalities.

Figure 1.2 - Clustering of Italy for the number of firms per thousand inhabitants and GDP per capita

Cluster segmentation and mapping are functional to design proper models of intervention for ultra-fast broadband, in line with the objectives of the strategy, to define the right public intervention to target local conditions.

Taking into account the adopted technological approach, to achieve the full implementation of the strategic plan investment required are 12.4 billion euro (see Table 1.6).

Table 1.6 Summary of cluster data[13]

Cluster	A	B	C**	D
Current Coverage	30 Mbps (FTTC)	30 Mbps (FTTC) in 102 comuni	ADSL	ADSL (97%)
Planned coverage	30 Mbps (FTTC)	30 Mbps (FTTC)	ADSL	ADSL
Target	Upgrade da 30 a 100 Mbps	Upgrade da 2-30 a 100 Mbps	Upgrade da 2 a 30/100 Mbps	Upgrade da 2 a 30 Mbps
Cost Euro 30 Mbps			1,055,432,252	1.075.517.066*
Cost Euro 100 Mbps	7,564,003,835		3,834,688,815	-
Incentive measures	▪ Tax exemption ▪ Subsidized credit	▪ Tax exemption ▪ Subsidized credit	▪ Tax exemption ▪ Subsidized credit ▪ Grants	
	Intervention exclusively by private operators	Use of Grants from public resources proportionately larger than the cluster B	Use of Grants from public resources proportionately larger than the cluster B	▪ The public intervenes directly realizing its owned infrastructure ▪ Incentives to operators for providing services from fixed/ wireless technology

(*) From 2018, in few areas, it is considered possible to have, over copper networks, an upgraded services of 100 Mbps using G.fast and vectoring.

(**) In Cluster C was assessed the possibility of achieving a FTTC network and then to upgrade it into a FTTB. This hypothesis is more expensive but also more inefficient rather than a network directly deployed as a FTTB that uses a more densely spread topology and targets with more flexibility and capacity service needs of the future communication

Conclusions

The Italian territory has been divided into 94,000 areas to define a limited number of clusters according to population density, local area socio-economic features, local business density and availability of ultra-fast broadband infrastructure. Such clustering allowed to design public intervention to target local area features and service target coverage. According to this classification were therefore defined financial needs and relative financial model for each cluster.

[12] The cluster A contains the city of Milan which however has not been estimated as a new investment because has already been largely infrastructured by Metroweb (about 75%).

[13] In the estimates of the investment are not taken into account the so-called "scattered houses" for which a financial estimation has not been performed yet. The difference is about 1.8 million housing units and approximately 2 million in terms of population

1.6 SWOT Analysis

The context analysis has allowed to detect some of the strengths and weaknesses that currently characterizes the process of modernization of the Italian communication infrastructures. At the same time from the perspective scenarios emerged potential opportunities and threats.

The main findings are briefly shown in a SWOT analysis shown below in Figure 1.3.

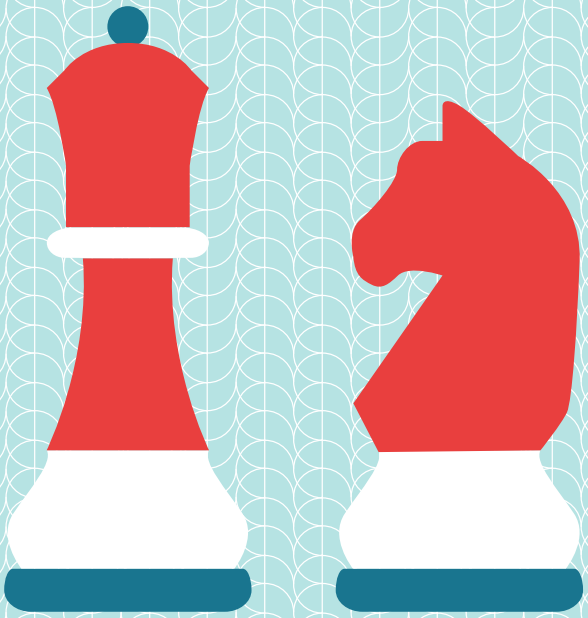
The Italian strategy exposed in the following chapters is built from considering critical issues and opportunities, as well as from assessing the right lines of action and tools that can have the greatest impact on the national context.

Figura 1.3 SWOT Analysis

OPPORTUNITIES	THREATS
▪ Definition of an Italian strategy for digitisation with an integrated program of actions for synergic development of infrastructure, digital services and access services to the population ▪ Start of a new season of programming for both the European Structural Funds and the fund for development and national cohesion ▪ Evolution of the regulatory framework for the spread of advanced technologies (vectoring, bonding, etc ...) ▪ Structural characteristics of the Italian fixed access network (quality and length of twisted pairs) ▪ Possible midterm technological scenarios and synergies between mobile and fixed network technologies ▪ Synergies with government plans to modernize infrastructure and digitisation (school, health, education, justice, etc ...) ▪ Implementation of Partnership Agreements 2014-2020 plans ▪ Implementation of simplification measures for the implementation of infrastructure projects and to stimulate investment sharing	▪ Investment needs to cover the entire population ▪ Extension of the coverage provided by telecom operators, in particular for the 100 Mbps ▪ Uncertainty related to possible consolidation of the telecommunications industry ▪ Duplication of private investment in areas with higher return on investment ▪ Prevalence of local autonomy that can create coordination difficulties, heterogeneity in interventions and inefficiencies ▪ Local transposition of the simplification measures for infrastructure projects ▪ Reduced presence of alternative infrastructure ▪ Slow evolution of the digital culture of the population ▪ Limited propensity to buy ultra-wide broadband connectivity services of more than 100 Mbps ▪ Possible effects of substitution between fixed and mobile network services

STRENGHTS	WEAKNESSES
▪ Centrality of the infrastructure pillar in the digital agenda strategy ▪ Agency fot Digital Italy established for implementing the strategy for the Italian Digital Agenda ▪ Definition of a framework of measures to simplify infrastructure interventions ▪ Experience in tackling the digital divide regarding broadband infrastructure, both in terms of leveraging private investment and coordinating government initiatives and local plans ▪ Existence of a Strategic Ultra wide broadband Plan and existing initiatives with different intervention models in line with Community Guidelines ▪ Identification of all resources required for its implementation ▪ Trial already under way of a Cadaster of above and below ground, which may be extended permanently nationally ▪ Continuous monitoring of the development of communications infrastructure by private and public sector ▪ Identification of priority action lines for the construction of favorable environment to innovation and digital inclusion (digital identity, digital single registry, electronic invoicing) ▪ Existence of a special purpose entity (Infratel) to facilitate coordination and operational efficiency of local initiatives	▪ Availability of ultra-wide broadband infrastructure ▪ Fragmentation of available resources ▪ penetration rate of broadband connectivity ▪ Penetration rate of computer equipment in households and small businesses ▪ Limited use of online services ▪ ICT skills level and digital culture in the population ▪ Reduced presence of alternative infrastructure ▪ High number of mobile Internet users only ▪ Heterogeneity in the local rules on the implementation of infrastructure projects ▪ Poor sharing of infrastructure projects between telecommunications operators

2. Strategy for ultra-fast broadband



2.1 Organization

The main actor of this strategy is the market that is called to invest in a strategic infrastructure for the country's development.

State aid is complementary and does not substitute investments of market players, encourage them.

Regarding the role of the public sector, as a whole, coordination of the various interventions is ensured by the Council Presidency (PCM) through the Committee for the Spread of Ultra-Fast Broadband (COBUL), composed by the Prime Minister's Office, the Ministry of Economic Development, Infratel and AGID (Agency for Digital Italy) that has defined this national strategy and will monitor its proper implementation, in relation to the involvement of public stakeholders, making suggestions for any corrective measure even by identifying further solutions that may produce most favorable environment for private investments.

The Ministry of Economic Development (MISE), which has the institutional competence for telecommunication infrastructure, implements the measures defined in the national strategy, making use of its in-house company Infratel Italia SpA and coordinates the activities of all public and private actors involved.

As described in Sec. 1.3 dedicated to the implementation of State aid-financed broadband projects, MISE will manage the Cadaster of above and below ground, which will also include the data necessary for monitoring the strategy (see par. 2.6).

The COBUL collaborates for the implementation and monitoring of the strategy with the Ministry of Agriculture, Food and Forestry within the Agricultural Fund for Rural Development who has devoted to the this Plan part of its resources.

The Italian Communications Authority (AGCOM) ensures regulation of competitors access to all broadband infrastructure facilities available on an equal and non-discriminatory basis, defining access rates and managing market regulations concerning the assessment of the maximum amount of revenue that may be raised through the management of subsided networks (claw back), as described in the monitoring section.

AGCOM will also have the role of verifying the connection speed performances in State aid-financed areas involved in the plan and penetration rate trends of ultra - fast broadband subscriptions at 100 Mbps, and will communicate to AGID, assessing positive impact of the aid measure in reaching strategy objectives.

Considering the nature of the funding of this Strategy, the Agency for Cohesion exercise its powers of coordination and control of expenditure evaluating and directing regional plans, as well as monitoring the implementation of the initiative through the COBUL and analyzing the data published by MISE (see cap. 2.6).

As was the case, in the past, with the Cohesion Action Plan, the Agency may also directly define development initiatives and, in coordination with Regions and Local Authorities, implements all the measures that allow optimization of public resources and the reduction of operating costs.

Within this framework, Regions and Local Authorities (R&P), who are directly involved in the strategy, define the operational

programs, set intervention priorities, and therefore local area models to be applied consistently with this Strategy.

With the support of the MISE and Infratel, also realize their own infrastructure plans and manage public resources to finance the strategy.

MISE in coordination with the AGID, the National Association of Italian Municipalities (ANCI), the National Regulatory Agency, Minister for the Environment, Land and Sea, the Committee for the technical rules on the spatial data of the public administrations and Central and Local Authorities Joint Conference, defines the content of the federated "National Information System for the Infrastructures of Above and Below Ground" (v. par. 2.3.2), the technical rules for its set up and subsequent updates, for the production, documentation and compulsory exchange of spatial data held by each relevant administration and other entities owners or operators of infrastructures, as well as rules for the use of data between the central and local governments and other entities owners or operators of underground infrastructures.

ANCI promotes the ultra fast broadband strategy and ensure coordination and consistency of implementation of the federated “National Information System for infrastructures of above and below ground” among Italian municipalities, possibly sanctioning operators that don’t update properly the system.

Finally, the Digital Champion at the Presidency of the Council will ensure the dissemination and communication of this strategy.

2.2 Lines of action

An integrated and synergic approach between fixed and mobile access.

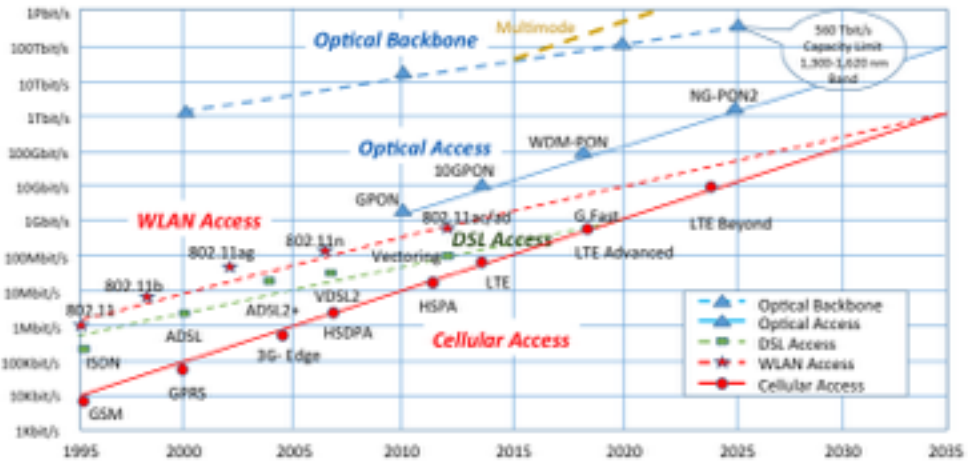
Market trends show a shift towards the use of mobile devices for personal use (smartphone, phablet, tablets, e-book), but especially of wearables (connected clocks, bracelets with sensors, viewers, etc) GPS integrated with mobile networks, sensors and other devices which make up the so-called Internet of Things.

All this already involves, and increasingly more, aggregate bandwidth needs with significant growth in wireless access demand.

This demand for wireless traffic, massive and growing, can be properly addressed with policies to promote efficient use of the radio spectrum, which can't be provided for without the deployment of radio base stations in greater proportion in regions of higher traffic with fiber support infrastructure for backhaul connections to core networks with high levels of quality and capacity (connection's availability).

Moreover, the design of new generation radio networks natively includes the principle of heterogeneity in access technology (in particular the evolution of Wi-Fi and cellular mobile radio to the 5G, see Figure 2.1), focusing on intelligent coordination for different degrees of coverage, declined in macro, micro, pico and femto cells, and different regions of the spectrum, through a coordinated and unified approach of flexible and intelligent use of the radio signal along an evolution line based on HetNet and cognitive radio principles.

Figure 2.1 - The evolution of wired and wireless technologies 1995-2035
Source: M. Dècina, 2014, based on data of Bell Labs, G. Fettweis, and others, in 2013.



There is therefore awareness of the need to design an advanced network infrastructure suitable to provide, in a synergic way, mobile service demands accessed through mobile devices and fixed ultra-fast broadband service demands that are accessed typically from a landline (Smart TV, Smart home, cloud, social media, Smart work, telepresence, remote collaboration, etc. in companies, in public administration and in shops).

Consequently, while maximizing the initiatives for ultra-fast broadband infrastructure already completed or in the process of completing, the strategy sets the conditions for the realization of deployment solutions that modulate the presence of the new fiber infrastructure in main and distribution access network according to

different local conditions, through a synergic approach of service habilitation to devices, both fixed and mobile, and neutral with respect to the type of architecture and / or technology.
The decision to focus firmly on the construction of infrastructure able to offer above 100 Mbps to the widest possible population is the result of a strategic vision. Italy is in the last positions in all the charts of advanced digital services availability. Taking into account data traffic growth in world trends, but also in our country, to decide otherwise would be an error of perspective, like choosing to build two-lane highways when you already know that soon there will be need for three-lane ones.

Would be short-sighted not to adopt a forward looking perspective in order to enhance as much as possible investments and to prevent the future demand needs.

This approach leads to promote primarily, wherever possible and consistently with market development, network topologies that bring fiber closer to every home and every business, which involves the deployment of fiber optic networks both in the main access network and in distribution access networks, reaching at least the base of the buildings (FTTB) or the user's home (FTTH).

The deployment of fiber access networks is fundamental for enabling fast and ultra-fast broadband services, also for wireless access networks service upgrading, both Fixed type or Fixed Wired Access (FWA), WiFi advanced and radio mobile (with technologies 4G and 5G).

Satellite solutions retain an important role in tackling the residual "digital divide", especially in the most extreme cases, guaranteeing the availability of broadband and fast broadband services also to that part of the population living in rural areas that is likely to never be reached by landline networks due to extremely high cabling costs.

Thanks to the adoption of new architectural and technological solutions, resulting also from experience gained in Italy in the use

of satellites for existing broadband services, satellite is able to provide users that are most affected from "digital divide", throughout the country, with connections with a speed exceeding 30 Mbps, with equivalent quality to that provided by wired solutions but at significantly lower cost of infrastructure.

In addition to traditional configurations, which see the use of satellite for direct users connection, can also be used in configurations where satellite service is used to connect groups of users or radio stations for the provision of radio broadband access services. To this must be added that satellite services can guarantee, with full autonomy and security, connections in case of emergencies

Towards the second goal of the European Digital Agenda

The market conditions for the development of infrastructure that can enable the achievement of the Digital European second objective (100% of the population with access to at least 30 Mbps) are gradually mature.

Recently main private players have started rolling out their plans and are progressing rapidly, driven by market conditions that offer adequate return on investment and moderate risks. These interventions take place mostly where potential demand is higher and concentrated, sometimes private parties compete in multi-technology infrastructure investment (the case of Milan with wired FTTC / FTTB / FTTH solutions by different operators) and address progressively also less densely populated areas where return on investment takes longer.

However, it is estimated that some 4,300 municipalities, where lives about 15% of the Italian population, will remain white NGA areas regarding connection services with speeds of at least 30 Mbps, even providing financial support for the provision of broadband services.

In these cases use of public resource is involved in the form of direct grants and direct public intervention model (Model I, see par. 2.3.1). Ultimately, satellite solutions is to be preferred to address "scattered houses", also considering the technological evolution described in Annex A.

Towards the third goal of the European Digital Agenda

Today market condition is rather weak and certainly demand is very concentrated in a few high potential areas for private players to get committed in the construction of a ultra-fast broadband infrastructure, a network infrastructure capable of delivering at least 100 Mbps. Demand levels for ultra-fast services still convey a reduced interest from telecommunication operators, not allowing yet massive investment in a 100 Mbps network.

With regard to this, together with the conviction of the fundamental importance that ultra-fast broadband infrastructure have for the development and competitiveness of the country, the strategic plan focuses particularly on this goal: provide service connections of at least 100 Mbps to 85% of the population using all the available infrastructure (electrical, heating, sewage, etc.) which allow its realization in an economic sustainable way.

In particular, electricity networks are particularly suitable for sharing infrastructure for the development of FTTH / FTTB / FTTdp networks, having many easily usable airlines, a greater density for distribution cabinets (on average in the ratio of 3 to 1 compared to telephone networks, with an average distance of up to 50 meters to the end user) and are distributed in a particularly favorable way for the development of FTTH / FTTB / FTTdp networks, especially in cluster C and D.

All measures to stimulate demand and supply described in this plan are aimed at achieving this goal: except for the Cluster D, for which the objective of having a connection services of at least 30 Mbps is residual.

Depending on the TLC and Utilities private operators's response in terms of investments, this goal can be achieved by covering up to 85% of the population with connections of at least 100 Mbps and the rest of the country of at least 30 Mbps.

This means that contribution of private investment is essential for achieving the objectives of this plan. In their absence all the objectives will be resized proportionally.

On the basis of the consultation launched on 20 November and ended on 20 December 2014, various telecom operators have requested the inclusion in the plan of funding measures to support infrastructure demand.

Conclusions

This strategy seeks the construction of an advanced network infrastructure suitable to serve, in a synergic way, mobile service demand through mobile terminals and emerging ultra-fast broadband services demand from fixed access networks in businesses, in public administration and in retail.

Market conditions for the development of fast broadband infrastructure enabling 100% of citizens to 30 Mbps are gradually maturing.

The real challenge, and the objective of this plan, is to bring a connection of at least 100 Mbps to 85% of the population and, residually, give at least 30 Mbps to the remaining part of the population.
The key points of the strategy in terms of lines of action for infrastructure development are:

- design a network infrastructure oriented, in a synergic way, towards fixed and mobile access services demand;
- definition of an open, carrier-neutral, fiber optic network;
- priority to the development of fiber access networks (not only in the main access network but also in the distribution access network) to cover the largest portion of the population, targeting buildings (priority solution FTTB), but also radio stations used for providing connectivity for fixed and mobile services;
- valorization of all access technologies, satellite and radio, fixed and mobile, to reach in a sustainable way population located in rural areas and where the private sector is unlikely to invest rapidly.

2.3 Context, conditions and measures of the plan

This Plan defines the high-level strategy for what, in synergy with the Digital Growth Plan, the Government intends to accomplish. In this perspective, the Plan outlines a decision-making process that becomes a local action's plan through four great choices to make within the framework defined by the Plan.

1. **The choice of the type of infrastructure to be developed:** is the most important choice. Within the technological scenario outlined, which is the type of infrastructure to be developed (FTTH, FTTB, FTTdp, FTTC, FWA, etc.)? With what territorial articulation (ISTAT only census areas, a municipality, some municipalities, etc.)? Which technology is meant to connect end users (Vectoring, G.fast, MU-MIMO, kaband satellite, etc.)? The choice of the type of infrastructure also defines the dimensions of infrastructure investments to be achieved and the key points for the economic and financial sustainability of the initiative.

2. **The choice of the investment model**: this is a decision that can be either very difficult or obvious. In a local context, the infrastructure can be developed in different ways, a publicly owned company, a public–private partnership (PPP), incentives granted to a telecommunications operator (eg, local or national, vertically integrated or NetCo, etc.), developing a bottom-up initiative, by participating in a group of investors, etc.? Within this alternatives, local public administration, telecommunications operators and stakeholders involved in an infrastructure deployment project, must define the role that each can and/or plan to play (lenders, technology partner, facilitator, demand aggregator, etc.).

3. **The choice of business model**: This choice defines the roles played by various actors, from the simplest model (a vertically integrated operator that plays all the roles on its own also selling connectivity services to end users or to other operators) to a distributed model, where management of passive infrastructure, active infrastructure and backbone can be performed by different actors. In this context different models of intervention can be adopted and whether to give concessions for infrastructure management is preferred, or create a municipal network, or infrastructure deployed and managed by a vertically integrated national operator, a NetCo or another hybrid option is to be assessed.

4. **The choice of financial instruments**: is the last great choice, but not the least. The Plan provides various financial measures ranging from tax incentives to public grants that must be compensated by means of a significant participation of private investors. Besides this, the definition of a time frame for investment is a key element to define priority among projects to be to financed or incentivized within this Plan.

The set of these choices can be made at different times and not all choices are independent, since some imply closely some of the

others. But together constitute a single decision-making process leading to the approval of the action plan and its implementation.

EU Constraints: What is not possible to do

The regulatory framework defined by EU for ultra-fast broadband infrastructure initiatives such as this Plan, define some limitations to be aware of in order to have a realistic picture of the situation as a whole.

Within EU regulation is not possible:

- Award grants or incentives to an operator without public tender;
- Define competitive tender procedure that do not ensure technology neutrality and a real opening to competition;
- Assume full control by an integrated operator of the entire new network subsidized with public funds;
- Not guarantee ex-ante that the subsidized networks can be accessed and offered to all operators on equal terms;
- Not respect the 'EU Guidelines" for all public broadband interventions;
- Not provide mechanisms of claw back in the event of excess profits.

The tools of the Plan

To be able to reach up to 85% of the citizens with connection speeds higher than 100 Mbps, and however guarantee to the remaining part of the population services with speed of 30 Mbps, increasing

at the same time subscriptions to Internet connections with speeds of 100 Mbps to reach at least 50% of the population, it is expected that public action is set forth on three main fronts, acting both on the demand and supply side.

A. Incentives to lower the barriers of cost of infrastructure: measures that affect supply. The main element is made up of simplification measures for both the legislative framework (one-stop office, aerial installation, simplification of authorization procedures, vertical pre-wiring of buildings, etc.) and the industry regulation to accelerate infrastructure investment by reducing costs (stability and certainty of rules, rules that encourage investment, etc.). The pillar of simplification, however, is represented by the Cadaster, which is a tool capable of ensuring transparency, efficiency and coordination (see par. 2.3.2), a much larger project compared to a "simple" Cadaster of above and below ground infrastructure facilities. Fall, finally, on this macro area all policies intended to rationalize the frequency spectrum.

B. Facilitating access to economic resources: in addition to the four models of intervention described in par. 2.3.1 three measures are defined that encourage investment through tax exemption and the establishment of a pole of attraction for funds to facilitate access to credit.

C. Stimuli for triggering demand: to overcome the serious gap penetration described in chapter. 1.4, some specific measures have been planned to support the demand for connectivity such as demand aggregation and the development of digital services provided in the strategy for Digital Growth.

Table 2.1 - The tools of the plan at a glance

Supply stimulation	Incentives to lower the barriers of cost of infrastructure	Regulatory simplificaton Measures to reduce costs Infrastructure deployment Cadastre of above and below ground Facilitated regulatory framework Spectrum reviews
	Facilitating access to economic resources	Tax-exempt investments in ultra-wide broadband infrastructures Credit at subsidized rates with government guarantee Incentives for the construction of ultra-wide broadband infrastructures Benefits for local governments
Demand stimulation	Voucher Prior demand aggregation Digital Agenda: "Digital Strategy for Growth 2014-2020"	

In line with Point 7 of the Communication from the Commission[14] and in accordance with cohesion policies also this strategy has provided the use of public resources directed to accelerate the deployment of NGA networks and eliminate digital divides, identifying various models of intervention combined depending on the areas of intervention and according to the cluster articulation proposed in cap.1.5.

Models for infrastructure deployment

The use of State resources from EU, both national and regional (ERDF, EAFRD and FSC), in this ultra-fast broadband strategy takes different forms: tax cuts, low interest loans, other types of preferential financing conditions, etc. (see par. 2.3.3). In this section, however, are described only the four models of public intervention for the construction of ultra-fast broadband networks.

All four models optimize the reuse of existing infrastructures, both publicly owned (such as sewers, public lighting, multiservice tunnels) and those of private property (ducts and existing infrastructure of local multi-utility or operators) in accordance with Directive 2014/61 / EU of 05/15/2014, for which it is intended the acquisition of rights of use.

This approach is facilitated by the implementation of the Cadaster of the below and above ground (see par. 2.3.2) that in this strategy assumes a key role for ensuring transparency and good coordination of actions.

All models are designed in accordance with EU legislation on state aids[15] which binds deeply architectural options. The use of state aid, in fact, is limited to the correction of market failures in order to strengthen the competitiveness and competition. The public aid, precisely, is accompanied by a series of context measures described below.

To achieve the goal of the European Digital Agenda to score at least 50% of subscriptions to Internet with a speed exceeding 100 Mbps, the strategy exceptionally[16] provides public intervention for NGA over 100 Mbps in areas already covered with services of 30 Mbps, providing that the 'step change' condition is met as is set out in point 51 of the same Communication and that there is perspective demand for ultra-fast connections.

The fulfillment of this last requirement will be guaranteed by the analysis described in par. 2.3.4, also making use of measures to coordinate and promote demand for ultra-fast broadband access.

The adopted reference infrastructure is:

- technologically neutral, does not favor nor exclude any technology or platform that operators want to implement using the technology solutions they consider most appropriate;

- a technical solution completely open and neutral, deploying only passive infrastructures and laying optic fiber according to a fiber-to-the-building (FTTB) reference architecture to allow the wholesale unbundled access to all operators;

- the most economically advantageous, suitable for any network architecture of next generation access that telecom operators will decide to implement, without favoring any in particular, wired, wireless or satellite technology[17];

- if the business model with which the intervention is realized is "wholesale-only", with reference to Article 3[3] f of Directive 20 14/61 / EU, is provided the ability to refuse access to passive infrastructure to protect the investments made;

- the primary access network is optimized for the connection of radio stations and distribution cabinets of existing copper networks to offer wireless ultra-fast broadband services of at least 30 Mbps, thus maximizing the integration between the fixed and mobile. A forward looking solution, able to support the expected demand peaks without affecting user access.

Considering the variety of funds used and considering the capillarity of the intervention, are mapped:

- The white areas of intervention divided by type of dedicated funds (eg. ERDF, EAFRD, FSC);

- The offices of the public administration and the areas of economic interest supplied with infrastructure that provide services of at least 100 Mbps.

Here are the four models that will be adopted by public administrations for implementation based on the belonging cluster of each area of intervention. As shown by the outcome of the public consultation, it is necessary to emphasize that the application of intervention models in different clusters is understood to be flexible and non-binding.

Model I - Direct intervention

The direct intervention has the objective to provide a passive, neutral and open infrastructure (for example, multi-operators conduits, laying of cables in the main and distribution access networks, pylons etc.). Infrastructure, while remaining in public ownership, is given in concession for management and commercial exploitation.

- The aid beneficiary is to be chosen following a competitive selection process, according to the criteria of the most economically advantageous offer, and is awarded to the bidder who has submitted the best project, maximizing the use of innovative technologies with low environmental impact, as provided for in Articles. 81 and 83 of Legislative Decree 163/2006;

- Roll out completed, the ownership of infrastructure remains public. With a public tender a concessionaire is selected to offer the passive access and lease infrastructure's rights of use to third parties. Operators will then provide next generation connectivity services to end users, while the concession holder will be responsible for the maintenance of

the infrastructures, ensuring service level agreements (SLA) agreed upon with operators.

- The concession will be of limited time, for example, 10 years, and will be in relation to investment and amortization that the concession holder with regard to the risks that specifically will have to endure.

- Management of infrastructure will safeguard public interest and maximize the best economic exploitation of the new infrastructure, also to ensure maximum openness to the market on a fair and non-discriminatory basis for all operators who request access and to achieve the widest possible spread of ultra-fast broadband services.

The granting of access to various network segments and price level will be regulated by AGCOM before the public tender. The model I will indicatively be adopted in areas belonging to the "cluster D", which includes about 4,300 municipalities and in which resides 15% of the Italian population, as well as across all clusters, on limited areas that will prove not attractive to privates operators.

The possibility to identify areas of digital divide within covered municipalities by telecom operators, make it imperative to deploy a public infrastructure suitable to serve exclusively the population excluded.

In line with market conditions[18], in remote areas especially, identified through an ex ante expression of interest, both on the demand and on the offer side, an incentive to operators that will commit to implement the active components of the network can be identified.

Model II - Public Private Partnership

The public-private partnership (PPP) is a partnership between a public entity and one or more private entities participating in the investment for the construction of infrastructure providing access to infrastructure to private partners, according to requirements defined into calls for tenders, giving the opportunity of exploiting immediately the right to use over infrastructure.

In summary:

- The PPP allows to extend investment volumes, through the contribution of the private sector who will in any case be subject to a strict control system, to avoid monopolistic positions that slow competitive exploitation of infrastructures from other operators;

- The award of contracts takes place in a single solution, with the Public Administration that identifies through a competitive public tender, in full compliance with applicable regulations, one or more parties that participate in the investment for the construction of infrastructure in a specific area;

- Interested parties must submit a technical and economic solution accompanied by a business plan for the implementation of intervention in line with the preliminary draft defined in the tender and the subsidized amount. In the selection of the private partner, through a public tender process, public authorities must also assess the experience of running a wholesale infrastructure networks, the company organization, the technical offer for project management, how to offer wholesale services, quality plans provided;

- The duration of the concession and the clauses relating to the infrastructure described in the model I also apply to this model;

- The ownership of the infrastructure newly built will be given to a separate legal entity, company or consortium.

AGCOM will be given to the task of regulating the conditions of wholesale offer. The model II is considered to be the ideal model for the access to the national fund that contains other funds and project bonds and is open to all private investors, which could therefore also not be telecommunications operators, such as companies or groups of private investors interested in the development of the territory on which infrastructure insists.

Model III - Incentive model

The incentive model consists of a public funding allocated through a public tender, favoring a more rapid spread of networks, as the beneficiary operator is also interested in a better exploitation of the networks to have a faster return on investments.

The main features of this model can be summarized as follows:

- The involvement of the private sector guarantee maximum efficacy of intervention and the capacity to attract investments (funds of the private sector are at least equal to 30% of the total identified need)

- The incentive model provides, in fact, a public contribution (in the form of tax incentive) for the construction of NGA network that will be granted by public administration to one or more operators identified by public tender;

- The beneficiary is selected through a public tender which includes a technical and economic offer and the relative business plan, providing that for each covered user part of the infrastructure costs are subsidized;

- Ownership remains to the beneficiary operator and, in exchange, the operator who is awarded the public grant commits to comply with the conditions of maximum openness on the subsidized infrastructure;

- Selected operator will set up a structurally and legally separate entity such as to ensure transparency of business operations and ease of control performed by the administration, allowing the monitoring of the profitability of the investment, every six-months, the quantifying any over-revenues and the recovering of the redundant part of the public contribution granted;

AGCOM will be given to the task of regulating the conditions of wholesale offers before the calls for tenders are issued.

Model III is feasible, however, only in some areas characterized by low average density of residential units per square km, found mainly in marginal areas.

Model IV - Intervention for demand aggregation

To encourage use of resources and energy to achieve the goal of extending the coverage at 100 Mbps, it is identified a fourth intervention model which is made of parts of the three models shown above, aggregating demand for connectivity at 100 Mbps inside specific areas, such as industrial areas, or for interventions in local areas that are able to organize themselves and reach a sufficient critical mass. Therefore, to promote adoption of ultra-fast broadband services public administration can stimulate demand aggregation combined with direct interventions (Model I), PPP (Model II) or incentive intervention (Model III) whenever local conditions apply to proper models.

In areas or sub-areas in which the model applies, aggregated demand must be economically and financially sustainable.

Furthermore:

- The promoter can be public, private or even a PPP and become the owner of the infrastructure in line with the regulations of the intervention model used;

- This model includes the involvement of local authorities on whose territory lies the area or sub-area, which will cooperate with Infratel Italia for the implementation of the Plan;

- The promoter carries out an analysis of the area or sub-area to define a business plan that verifies the costs and conditions of maximum economic and financial sustainability of the intervention according to the demand aggregation reached;

- Based on the business plan, the promoter starts to proactively coordinate demand for broadband access from public administration, local schools, and health care facilities in the targeted area or sub-area;

- If the promoter reaches a preliminary demand aggregation adequate to ensure economic and financial sustainability, with the technical support of Infratel Italia, the promoter proceeds according to the regulations of the chosen model (intervention model I, II or III as illustrated above).

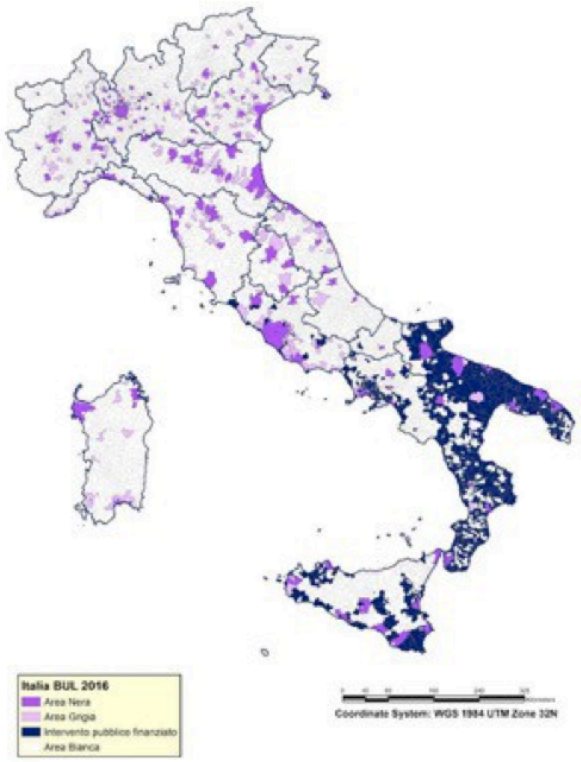
For all the models described there is a claw back mechanism for the recovery of any excess profits of the beneficiaries of public funds. The incentives put in place by this strategy are capable of drastically change the investment framework and, therefore, it is necessary to properly establish the eventual public investment granted. The presence of a close monitoring by the Public Administration (see Sec. 2.6), evaluating all the resulting costs, will ensure through regular checks the implementation of the measures

and the eventual presence of any extra profits, ensuring that the Public Administration is refunded of any over-compensation, if the market responds more quickly and massively than budgeted. At the end of four years, the private operator will be required to repay the government grant if revenues from the activities exceed the limit defined in the tender. The relative rate of return will be defined on the basis of the WACC established by AGCOM and profit in excess will be recovered in proportion to the intensity of the aid.

Conclusions

This strategy includes different intervention models and solutions to promote the rapid development of ultra-fast broadband infrastructure, reducing development costs and facilitating access to credit. The socio-economic situation and orographic conditions of Italy are such that make it unavoidable to adopt different solutions according to the targeted area features, thus minimizing the public investment necessary.

Figure 2.2 - Mapping of the areas of market failure in Italy



Incentives to lower economic barriers to entry

Simplification of the regulatory framework

Italy is adapting the regulatory framework to facilitate the vertical cabling inside private properties and condominiums, also favoring the deployment of mobile broadband networks in order to lower the capital expenditures therefore directly benefiting telecommunications operators and indirectly end users.

In particular, also following consultations with industry associations, a program focused on priority measures has been defined beyond those already contained in the decree "Destinazione Italia"[19] and "Sblocca Italia" [20].

The goal is to make it easier to make use of underground infrastructures (public lighting, pipes, ducts, etc.), including aerial infrastructures, to lay the optic fiber infrastructures.

Already today, installing a new radio site, or an addition to an existing site are not subject to landscape authorization if performed on existing buildings and poles and do not exceed a certain size, the variation of which, if limited, can be notified with a simple communication.

However, it is still necessary to promote national installation standards for vertical cabling of broadband infrastructures over building's facades in order to allow access points located inside the buildings.

Finally, like the French experience, it is necessary to make compulsory the vertical cabling for all new constructions and for those under renovations.

Cadaster of utility infrastructures under and above ground

The Cadaster of utility infrastructures under and above ground, according to the principle of "digital first", is, first of all, a tool of coordination and transparency of the whole strategy.

The Cadaster of utility infrastructures, therefore, is not limited only to promote infrastructure sharing by a comprehensive management tool of under and above ground infrastructures and deploying initiatives, but becomes the dashboard that efficiently manages and monitors all measures described.

Enabling three different types of access - citizens, roads authorities and managing bodies, utility operators - will make possible to manage a communication at three levels that would provide, in an open format, all relevant information regarding the various types of available transmission resources (wireline, wireless, and satellite) and laying resources (cable ducts, mini-trenches, above ground, aerial, etc.).

To be effective, the Cadaster of utility infrastructures must be supplied compulsorily by telecom operators but also from all other public and private authorities that own or build, in any order, utility infrastructure that could be used for the deploying of new optic fiber networks, such as local administrations (municipalities and provinces) and Utility operators (gas, electricity, water etc).

A national Cadaster of utility infrastructures operated in a federated form, therefore, to provide a mapping of all the utility infrastructure in order to:

- Promote ongoing private and public initiatives and in particular those related to this strategy, collecting and disseminating best practices;

- Monitor ongoing broadband deployment initiatives and compare actual-to-planned time schedule;

- Enable the adoption of more efficient business processes that takes full advantage of existing infrastructures, avoid inefficient infrastructure duplication and reduce the environmental impacts and the overall cost of the system, also through agreements between operators and public authorities;

- Facilitate the design of ultra-wide broadband infrastructure and improve the process of maintenance;

- Manage permitting procedures, coordinate broadband deployment measures and maximize Infrastructure sharing;

- Verify the adequacy of broadband deployment measures with available fiscal incentives;

- Ensure transparency and fairness on permitting procedures, and timely permission management;

In summary, according to paragraph 78 of the above Guidelines [21], the described Cadaster of utility infrastructures is, therefore, an essential tool to facilitate the reusability of existing infrastructures, to reduce deploying costs and consequently the amount of public funding needed, both to avoid unnecessary duplication and minimize impact over the environment and citizens.

But it is mainly a tool that ensure a high degree of transparency regarding state aid measures that, making available large amounts of data, will also generate a positive impact on jobs creation;
To facilitate the definition of a national Cadaster of utility infrastructure, was the successful European project VIRGO (Virtual Registry of the Ground Infrastructure) as a database of existing infrastructure networks and also of public utility services, duly georeferenced.

The Cadaster of utility infrastructure, coordinated by Infratel Italia, is implemented according to Directive 2014/6/EC of the European Parliament and of the Council of 15 May 2014 fostering measures to reduce the deploying costs for wide broadband networks, as well as according to Directive INSPIRE (Infrastructure for Spatial Information in Europe), 2007/2 /EC of the European Parliament and of the Council of 14 March 2007, in coordination with AGID. In fact on AGID's repertoire are inserted the geospatial metadata held by the public authorities.

The Cadaster of utility infrastructure is consistent with and complementary to the access network's database established by AGCOM.[22]

For the startup cost of the project and its maintenance will make use of the savings from the (reduced) cost of access applied to operators who request it.

This measure must require that all bodies that hold infrastructure suitable for the accommodation of electronic communications networks are subject to the duty to provide all the required information, updating them timely.

To ensure compliance with the measure and then the correct population of the Cadaster of utility infrastructure, the National Association of Italian Municipalities (ANCI) should be identified to coordinate and support the municipalities and may also be endorsed with sanctioning powers towards operators of the above and below ground infrastructures that do not respect the indications provided in the measure.

A regulatory framework to foster investments

AGCOM, also in relation to what was stated in the recent Survey [23], plays a central role in the development of electronic communications and, in line with the European regulatory

framework, in the definition of support measures for ultra-fast broadband services take up. In order to reduce costs, stimulate investment, according to the European Digital Agenda targets, maximize infrastructure competition and / or "service based" in different areas increasing consumer protection and solving disputes between access seekers and the subsidized infrastructure operator.

AGCOM, in fact, has contributed directly to the drafting of the aforementioned aid scheme no. SA.34199 (2012 / N) " Digital Plan – Super-fast broadband " for the definition of prices and general wholesale access conditions.

This Plan sees the role of AGCOM even more central, given its strategic importance, essential for the economic development of the country. Regulation processes could simplify and accelerate the necessary process to enable infrastructure implementation for the achievement of the European Digital Agenda 2020 objectives, including those aimed at safeguarding competition, however, protecting investment activities.

Due to the high volume of investment required to the private operators, the implementation of FTTdp / FTTB / FTTH networks require a reliable and stable regulatory framework consistent with the time frame and the objectives of the European Digital Agenda 2020.

Management of the electromagnetic spectrum

Frequency is valuable for the development of mobile ultra-fast broadband services, for this reason it is appropriate to introduce regulations that improve spectrum use and foster a more efficient use of spectrum and the development mobile broadband services. As known, TLC operators are implementing today LTE networks following the 2011 auction with the release of the 800 MHz band. The auction identified digital divide target areas for which was established an obligation of coverage. The MISE is monitoring the

actual fulfillment of the obligation, however, to encourage ultra-fast broadband service upgrading radio base station have to make use, to a certain extent, of a fiber support infrastructure, in order to be able to deliver NGA services.
All proposed models of infrastructure implementation involve optic fiber connections for radio base stations, in order to maximize offer of wireless ultra-fast broadband services.

With current technological evolution ultra-fast broadband services are guaranteed using increasingly efficient technology, therefore, it is important to facilitate the deployment of 4G / 5G infrastructure, and other advanced radio technologies capable of achieving the objectives of the European Digital Agenda.

Demand for mobile broadband continues to grow, meaning more spectrum is needed for both coverage and capacity reasons, and has to be ensured a coverage extension in order to facilitate the development of new mobile technology.

In line with the European policy that leads to an improved and more efficient use of spectrum and as over the next few years it is likely that there will be further growth in mobile fast broadband services, placing increased demand on broadband network capacity, Italy can look at further spectrum releases. Mobile networks are continuing to develop and improve both indoor and outdoor coverage by a more efficient use of spectrum.

According to this, while ensuring spectrum resources that are currently reserved for other uses, a strategic role for marginal areas and rural areas can be played by fixed wireless access services, that in Italy has already achieved important results in large areas of the territory

Its use implies, within a more efficient use of spectrum, a competitive tender procedure for the selection of operators able to provide broadband services in marginal areas of identified clusters, in particular, in Cluster D.

The granting of spectrum, in order to increase the range of spectrum allocated for broadband services, allow the private market to cover areas that would otherwise require public funding, directing public resources to other areas, and increasing the impact of public benefits.
The free concession should be accompanied by a "use-it-or-lose-it" mechanism reinforced by administrative measures against the selected operator if fails to comply to coverage obligations provided in the selection procedure.

As a single European Digital Market, therefore, applying common rules and opportunities, Italy will have to comply to other European countries policies in spectrum use with immediate advantages in terms of the spread of wireless ultra-fast broadband connectivity service.

Conclusions

Incentives aimed at lowering cost barriers for infrastructure development are defined, first of all, in order to bring order, eliminate inefficiencies and establish a legal and regulatory environment fostering the development of ultra-fast broadband infrastructure investment.

The Cadaster is the centerpiece of the entire strategy, since it is a tool for coordination and close monitoring of the implementation process and obviously a tool to create efficiencies, reduce costs, also maximizing synergies and utility-sharing.

As a single European Digital Market, from standardizing rules and opportunities, Italy will have to gradually meet other European countries policies in the use of spectrum, with immediate advantages in terms of the spread of wireless ultra-fast broadband connectivity service and satellite.

Facilities for access to economic resources

Financial solutions to improve access to capital

The investment in infrastructure is crucial for the transition of the economy towards a more sustained growth. It is affirmed by the International Monetary Fund, the finance ministers of the G20, the Document of Economics and Finance 2014, the Committee on Transport and Post and Telecommunications, the EU Council and the European Commission in the EU 2020 Strategy and, with specific reference to Italy in the National Reform and the Stability Programme 2014's assessment document.

In the latest "World Economic Outlook" (October 2014), the International Monetary Fund has presented the results of a study aimed at assessing the macroeconomic consequences of public investment in infrastructure. These results, confined to intangible infrastructure and tailored to Italy's economic characteristics, which it's a low-growth economy, reveal how debt financing instruments, implemented by efficient investment systems, ensure the best results in terms of growth rates of GDP, compared to neutral budget solutions.

It is capital intensive investments that contribute to the country's growth by increasing demand in the short term and improving services in the medium to long term, presenting characteristics such as to promote an in debt public intervention:

- Very high initial costs;
- Identification of benefits over a very long time;

- Positive social externalities that could exceed the private returns for the operator.

In the case of intangible infrastructure, unlike physical ones, is less risky to predict the quality of the proposed investments, provided that the infrastructure keeps its openness of access and its technological neutrality identified by this Strategy.

The EU2020 Strategy and in particular the European Digital Agenda, have, in fact, a vision for future-proof investments that should guide the Member States.

However, the implementation of development policies based on a boost of public investment in infrastructure has an objective difficulty related to the need to comply to strict policies (Fiscal Compact) in the management of the public budget.

Considering that these are large investments, this is a problem that often stops the investment project if based on intervention plans that provide solely for the direct use of public funds.

This strategy, therefore, involves the use of different financial instruments that leverage on the low cost of financing and the potential liquidity of financial markets, or:

- Bank loans, possibly by institutions with specific development missions;

- PPP operations based on:
  - Project financing;
  - Issuance of project bonds (aimed at financial investors including institutional ones).

However, the market shows that the investment risk with which private parties have to deal with is too high to unlock operator's infrastructure plans unless proper financial measures are put in place in order to lower risks, such as:

- Guarantees (with public funds) on loans granted to PA for the construction of infrastructure to be used, in particular, to the most profitable areas and, in part, to those marginal;

- Targeted interventions of "credit enhancement" of private funding, with the goal of making financing attractive to a wider audience of investors.

In accordance with the Community model, therefore, this strategy proposes the establishment of a financial instrument that draws on other funds and programs with the participation of institutional investors, national and European, focused on medium to long term investments, established at the MISE.

The public contribution to the ultra-fast broadband plan is, therefore, both in the form of grants - drawn on from EU funds (ERDF and EAFRD), national (FSC) and regional – and guarantee of debt, with the goal of:

1. Provide the greatest possible involvement of private resources by facilitating access to credit lines and ensuring low risk rates;

2. Provide for use of public resources in compliance with the fiscal compact;

3. Ensuring the regularity of financial flows between the implementing bodies and companies engaged in the realization of the projects in which the plan will be divided.

The public financial needs to be updated annually with the investment plans of private operators, with the technological evolution and with the intervention models applied, including those described in par. 2.3.1 dedicated to used intervention models.
Like the French proposal of so-called "Réseaux d'Initiative Publique (RIP)," Italy, foresees the use of public resources with a leverage

factor ≤ 2, compared to private resources, according to the target area.

The second objective, "to provide for the use of public resources compatible with the European Fiscal Compact", affect the mix combination of structural funds and FSC funds to be used and is particularly relevant in areas where projects are carried out exclusively with public resources. In such cases use of institutional lines of credit are provided.

The creation, with community resources, of a multi-program and multi-fund financial instrument provides the flexibility to use the public resources needed to carry out the plan, and allows maximum enhancement of private contributions, also to supplement the national contribution, possibly supported by a government guarantee, with obvious benefits in terms of stability.

Finally, the third objective, "ensuring the regularity of financial flows between the implementing bodies and companies engaged in the realization of the projects in which the plan will be divided" requires the creation of a system of financing supplier for companies involved in the implementation of the plan.

This system will be equipped with a public guarantee of growing size in relation to the extent of the contribution of private resources to the plan.

This aspect is very important in relation to the direct impact of the implementation of the plan on the regions and, in particular, on the industrial sector that will be the real operating arm of the implementation of the network.

Ensuring a direct channel and fixed times for payments to these companies is, in fact, a prerequisite for reconstructing a supply chain, that of the engineering and the plant engineering, devastated in recent years by the sharp decline in private investment.

Compared to traditional factoring or credit assignment, the "financing supplier" has the advantage of centrally providing best credit for businesses, both large and small, and also to prevent possible problems of debts accumulation by the PA.

Tax-exempt investments

In areas where no operator has declared its intention to invest in the next three years, it is determined a tax credit on the IRES and IRAP from the total owed by the company performing the infrastructural deployment that enable ultra-fast broadband services, under ln 133 of 2014, Art. 6.

An incentive mechanism open to new investments in ultra-fast broadband, which is estimated to be capable of stimulating investment for the development of connection services beyond 100 Mbps in municipalities exceeding 50 thousand inhabitants.

If extended in the years following 2015 is conceivable to reach a coverage with services beyond 100 Mbps in the first Italian cities, especially if combined with the guarantee system set out in the previous paragraph, managed through the funds pole of attraction and if accompanied by measures to support demand.

Consistently with the legislation, for cities that have more than 50 000 inhabitants, then, making a connectivity service upgrade that would bring speeds from 30 Mbps to 100 Mbps due to the tax exemption. It is, therefore, the ideal solution that will be more likely to be adopted by private operators in areas belonging to the Cluster A. Furthermore, it is possible that this measure will stimulate further investments in the areas of the country where no 30 Mbps connections are available. This are not planned investments by private operators and, therefore, new investments that would not be possible without the tax relief measures. The implementation of this measures follow the normal procedures for tax exemption. The monitoring of interventions will be implemented by Infratel Italia combining the data obtained from the Cadaster of the above and below ground, and operators planned interventions declared

annually in the public consultation (see Sec. 1.3.). The information from Infratel Italia will be made available to the Agency for Revenue.

Consistent with paragraph 78 of the Community Guidelines, Infratel will publish on its website the main characteristics of the measure and a list of white areas, as well as the national database on the availability of existing infrastructures that could be re-used for the spread of ultra-fast broadband, in order to promote competition in the provision of services in the areas covered by both private and public infrastructure, ensuring a high level of transparency.

Private operators plans, also under this incentive measure, mark the boundary, updated annually through the public consultation, outside which direct government grant can be used.
Therefore, the greater the private commitment, the lower will be the effort required public.

Incentives for local governments

The Presidency of the Council stressed the importance of the Single Digital Market for Europe by putting the emphasis on investment in digital infrastructure, which must remain outside the Stability Pact because it "does not represent a cost but an investment for the future."

The objective of this action, therefore, is to anticipate, thanks to public investment, the achievement of the European targets by releasing regional resources already available but not usable because of the Stability Pact, also taking advantage of the investment fund (see Sec. 2.5.).

Conclusions

The strategy identifies a number of measures to maximize the use of private resources in the implementation of the plan, these

measures are complementary to intervention models described and are extraordinary, therefore have a limited lifetime.

Tax-exempt investments is, to date, only active for 2015, as an experimental measure to maximize investment by private operators. Even the possibility of derogation from the Stability Pact is an exceptional measure intended exclusively for ultra-fast broadband infrastructure interventions considered strategic for economic development.

However, the described financial measures to increase access to capital, are solutions that will not only encourage investment but also ensure the continuity and regularity of the funding for ongoing activities to avoid delays associated with the economic and financial administration of the plan.

Demand stimulation

A major challenge for the development of ultra-fast broadband services in Italy is represented by a low potential demand and a decreasing trend of active lines on fixed networks in favor of mobile lines. This figure is present throughout the country, including the cities belonging to Cluster A where multiple operators compete for the establishment of FTTC networks.

However, investigation over demand shows a possible room for development where 60% of users show interest in ultra-fast broadband connections and 33% are willing to pay a premium price for these connectivity services compared to current band broadband services.

Taking into account the competitive environment and the conditions of the domestic market, with the objective to make most efficient and performing telecommunications networks, economic incentives to demand would only be provided to allow the migration from copper access network to optic fiber ones.

The demand aggregation measures form an integral part of the measures to stimulate demand (see Model IV in Sec. 2.3.1), allowing to maximize the effectiveness of interventions for the development of ultra-fast broadband network while at the same time minimize the risks connected to public intervention.

The most important measure for the development of the demand is, however, made up entirely by the implementation of the Italian Digital Agenda and, in particular, of the plan: "Strategy for Digital Growth 2014-2020" to which this plan is fully consistent.

Conclusions

The solutions to trigger demand are guided by the need to:

- achieve the third objective of the European Digital Agenda "that at least half of the population subscribes to connectivity services beyond 100 Mbps";

- stimulate demand with the aim of a more sustainable realization of infrastructure enabling services above 100 Mbps, including through public support (in accordance with paragraph 82 of the Community Guidelines).

This section is closely linked to the Digital Growth Strategy, where are described in detail the drivers for demand development mentioned here, accompanied by a plan for communication and dissemination of the digitization processes by the Agency for Digital Italy in collaboration with Italian Digital Champion.

2.4 Time objectives

Consistently with paragraph 41 of the Community Guidelines[24] Italy has developed a national plan that defines the basic principles of public initiatives to support the development of ultra-fast broadband infrastructure in the next 6 years to achieve the objectives defined in the European Digital Agenda.

The strategy is conceived as a dynamic measure that will be periodically updated, adapting to the evolution of technology, services and demand but that still represent the compass in terms of actions, methods, organization and implemented tools.

The COBUL will publish the plan based on the outcome of the public consultation to which this Strategy has been submitted. The plan will be updated every six months starting from the second half of 2015.

This strategy is consistent with the "Digital Plan – Super-fast broadband"[25] and constitutes its next stage ensuring the continuity of the activities. The launch of the first calls for tender is planned for the second quarter of 2015 and during 2020 will be issued the last calls to allow the infrastructure's completion within two years.

Following the approval of this plan the project of the Cadaster of below and above ground is immediately launched, which is central to the implementation of the strategy.

Table 2.2 Summary of coverage targets

	Initial target 2015	Intermediate target 2018	Final target 2020
Population covered to at least 30 Mbps	45%	75%	100%
Population covered to at least 100 Mbps	1%	40%	85%

2.5 Financial requirements and financing sources

The strategy aims to achieve two distinct objectives of coverage described in section 2.2, that will be pursued to maximize the coverage of 100 Mbps and ensure to all citizens at least 30 Mbps.
Based on the division of intervention areas into clusters, various financial solutions have been identified (described in Sec. 1.5) and have been calculated the financial needs of each.

For calculating the financial needs a priority is identified: the connection services of at least 100 Mbps for areas with high population density and where strategic locations of the Public Administration have residency. For example: sites of new-generation data center, schools, hospitals, tourist centers, industrial areas and strategic logistical hubs (airports, ports and freight);

universities, research centers, technology parks and community services centers, health facilities.

The priority actions follows a cross cluster indication and is consistent with the rapid development of digital services described in the Digital Growth Strategy.

Public funding is complementary to private funding. Public funding maximum amount will be updated from time to time according to Plan's evolution and, in relation to the needs of individual identified clusters, and will be allocated according to a schedule that will be continuously updated according to the contribution of private subjects.

This strategy is funded from four types of funds from the Community, national and regional ERDF, the EAFRD, FSC. A portion of the resources will be used for capital grants and the other to feed a guarantee fund that has a multiplier effect on investment. The allocation between capital and guarantee will be complementary to the performance of private investment.

Table 2.3 - Summary of the possible funding sources

funding sources	EURO
ongoing private operators investments	2 billion
ongoing BUL Strategic Plan	419 million
Regional Operational Programmes (ERDF and EAFRD) 2014-20	2,4 billion
National Operational Programmes ERDF (2014-20)	230 million
Development and Cohesion Fund (2014-20)	Up to 5 billion

In addition to these funds, contribute to the financing of the strategy also:

- a portion of the Junker Funds, as soon as they will be allocated;
- funds of the "Sblocca Italia" plan, in terms of tax credits related to investments, and their future refinancing;
- economies / synergies developed by the efficient management of the Public Connectivity System.

Furthermore:

A. Based on the results of the public consultation that ended in July 2014, described in Sec. 1.3, we can estimate a commitment by private operators concentrated in the first 482 Italian cities for a total investment of just under 2 billion euro;

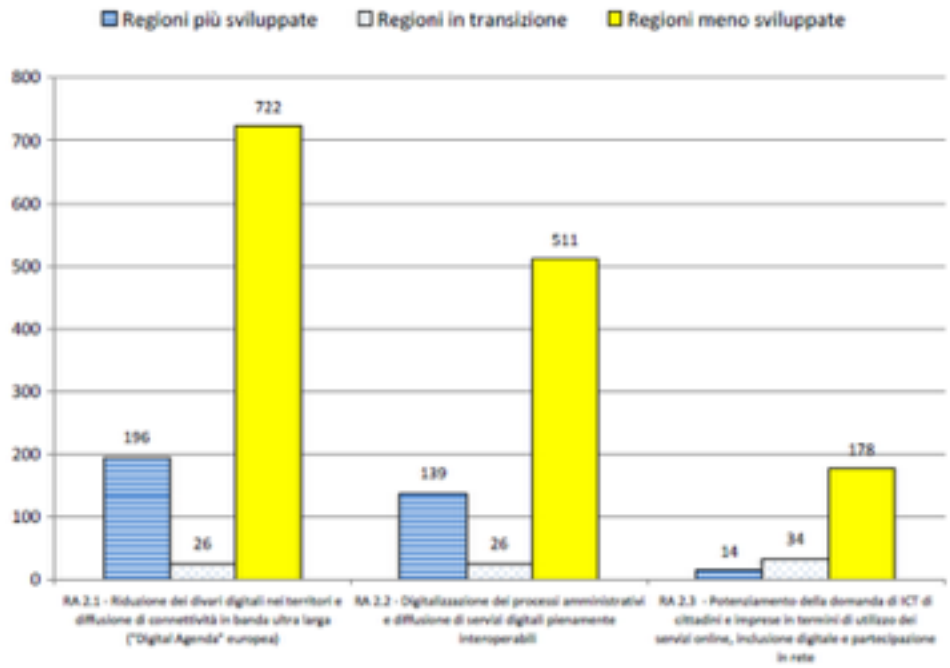
B. The "Italy Digital Plan – Super-fast broadband", operating since 2013, has put out to tender 419 million euro to connect 639 municipalities as detailed in Chapter 1.3.;

C. In the Community programming ERDF 2014-2020 the ultra-fast broadband is a European priority and this Plan will see the use of European structural funds dedicated to the Thematic Objective 2, improving the access to information and the communication technologies, as well as the quality use of them. Through the ROP - ERDF and EAFRD - will be allocated 4.2 billion (including national co-financing), in a balanced way between supply and demand for digital services. In particular, approximately 2.4 billion (including national co-financing) will be dedicated to infrastructures enabling ultra-fast broadband services (30 and 100 Mbps). The portion of the Community ERDF (European Regional Development) is allocated as follows in the territory:

1. 722 million for the four convergence regions;
2. 26 million for the transition regions;
3. 196 million for the competitiveness regions;
4. 256 million, finally, are related to EAFRD resources (European Agricultural Fund for Rural Development) largely devoted to cover rural areas's needs.

These funds are permanent, but the destination of which can vary slightly between different targets in the context of the Partnership Agreement between Italy and the European Commission, as well as in relation to the choices of the Regions and Autonomous Provinces

Figure 2.4 - Allocation to financial program, expected result and category region (ERDF alone, millions of euro)



Source: Partnership Agreement 2014-2020 for the use of structural funds and European investment EAFRD, dedicated to Objective 2, about 258 million (more than the national co-financing) which help to bring the ultra-fast broadband in cluster C and D municipalities. [26]

D. With respect to the PON Competitiveness 2014-2020 and, in particular within the strategy "Digitizing to increase the

competitiveness of firms in the South", 230 million euro are dedicated to ultra-fast broadband infrastructures, to be allocated in synergy and complementary to the aforementioned thematic objective 2. Then, depending on availability and regional needs, it is expected to connect to 100 Mbps all businesses of Southern Italy.

E. The Fund Development and Cohesion finally allow the completion of this Strategy. In particular, it will allow to maximize connections over 100 Mbps, out of this fund will be allocated up to 5 billion for telecommunications infrastructure from 2017. In view of the urgency with which Italy has committed to close the gap, a credit institution may bring forward to 2015, about 1.5 billion euro, also from the Juncker Fund that supports, integrating the EU budget and the EIB, ongoing public and private investment, taking advantage of the flexibility of the rules on the Stability Pact.

F. Even the Public Connectivity System (SPC) will help to fund the plan, exploiting economies guaranteed by the contract management framework for the connectivity services in the context of SPC in the next seven years and transforming the current spending planned for connectivity services in capital spending for the construction of infrastructure enabling services to 100 Mbps for the offices of the PA. Once the ultra-fast broadband infrastructure is built, subsequent SPC's public tenders will not have to contemplate the cost of infrastructure, but only of services. Moreover, such services, being able to travel on an enabling infrastructure at 100 Mbps, will provide higher performance and will open to further savings by reducing virtually the distance of so-called internal areas [27], limiting migration, creating new employment opportunities thanks to the implementation of digital services of key areas, such as education, health, justice, tourism and cultural heritage.

Depending on the contribution of the private sector, taking into account the resources made available by the public, three different scenarios are configured, reported in Table 2.4:

Scenarios	% public investment	% public investment	Cluster A	Cluster B	Cluster C	Cluster D
Best	50% (6 billion)	50% (6 billion)	15 most populous cities Upgrade from 30 to 100 Mbps	1.130 municipalities Upgrade da 30 a 100 Mbps	2.650 municipalities Upgrade da 2 a 100 Mbps	4.3000 municipalities Upgrade da 2 a 30 Mbps
Average	60% (6 billion)	40% (4 billion)	15 most populous cities Upgrade from 30 to 100 Mbps	487 municipalities Upgrade from 30 to 100 Mbps	2650 municipalities Upgrade from 2 to100 Mbps	5000 municipalities Upgrade from 2 to 30 Mbps
Worst	84% (6 billion)	16% (1 billion)	500 municipalities Upgrade from 30 to 100 Mbps	7.600 municipalities Upgrade to 30 Mbps	-	-

Conclusions

The financial public needs assumed to achieve the objectives of the strategy is covered by integrating resources of a domestic and community nature drawn from different programs. The amount of private participation will be defined by the responses of the private sector in identified sub-areas.

Based on consultation with all stakeholders, none of these declared at the moment to be interested in investing in the Cluster C for FTTB/H networks at 100 Mbps while all operators showed broad agreement that the new technologies over copper (vectoring, G.fast) can help achieve the European target without additional investment in fiber access networks.

It is believed that the Cluster C and D such technologies will be decisive to reduce required public expenditure.

2.6 Monitoring

The importance of the Plan, both economically and socially, involves a close and regular monitoring activity whose responsibility is primarily of the MISE, but subject to a more extensive analysis by the COBUL, coordinated by the Council Presidency and whose members are representatives appointed by the MISE, the MPAAF, the NRA, the AGID, the Agency for the Cohesion and Infratel Italy.

All documents and relevant information of the strategy are also accessible from a website, in accordance with the Community Guidelines mentioned (28) and, in particular, with point 48 and with the transparency requirements specified in paragraph 78.

AGID has the task of ensuring the harmonization of national interventions concerning the Italian Digital Agenda with the European Digital Agenda, as provided by Law 134/2012. MISE coordinates all actions described in this strategy and, through its in-house society, Infratel Italia, implements it.

Making use of the information system dedicated to the Cadaster of below and above ground, publishes, in a specific georeferenced

portal, all information relating to the infrastructure built with public funds, including, in particular:

For each conduit:

- street, address and route
- cables
- laying technology
- number of pipes
- size pipe
- material
- length
- depth
- distance from the center road

For each well:

- street, address
- size
- material
- space used / available

For junction boxes:

- street, address
- optical fiber available

The Cadaster must also maintain information about the status of resource use and availability for additional uses, administering the life cycle of the allocation of resources for intended additional uses. Infratel has also the task of reporting on the specific aid measures relating to this strategy and submit an annual report to the European Commission and AGID.

The report will contain information on, in particular: the details of tenders, selected outcome of the tender, the actual aid amount and intensity, the date when the network becomes operational,

technology choice, products and wholesale access charges, the number of applicants for access and active service providers on the subsidized network, the number of homes served, the number of subscribers to the new network.

Every six months the system will therefore examine the data that the managers of the infrastructure will provide to Infratel, on behalf of MISE, regarding the cost of the subsidized activity, such as: operating costs, maintenance costs, the SLA of the services offered, the occupancy of the infrastructure (% fiber optic sold/fiber optics total), unit revenues for optical fiber, contracts for the sale and application of the rules of pricing, the number of customers operators of infrastructure, marketing plans for the infrastructure, the number of housing units served (UI), the churn for operator and the pricing applied.

With regard to the implementation of Model C of the "Italy Digital Plan – Super-fast broadband", Infratel will verify that the State-aid does not exceed what is defined in the tender and offer throughout the period defined. AGCOM, as provided in art. 30 of the Decree Law of 6 July 2011, no. 98, converted with amendments into Law 15 July 2011, No. 111, is responsible of the definition of the price system to encourage necessary investment to realize a national infrastructure and to ensure nonetheless adequate return on invested capital. In addition, the Authority is responsible for the definition and enforcement of the regulations framework to ensure effective and fully unbundled access to third parties in accordance with the Community Guidelines.

The MISE report to AGCOM any changes in access charges that may be requested by the beneficiary in partial additions or modifications of the conditions of the tender. AGCOM is also called to explicit its role in the ex post "regulation", in relation to the calculation of any extra profits of the beneficiary of public funding (Model C).
The Authority will check the increase in subscriptions to the ultra-fast broadband services with speeds of over 100 Mbps, thus assessing the impact of the measure in support of the demand and will communicate such data to AGID.

The AGCOM and users cooperate to monitor the effectiveness of the intervention both from an infrastructure's point of view, verifying the actual connection speed in areas included in the project, and from the point of view of ultra-fast broadband services penetration, making use of Ne.Me.Sys quality control service system.

Based on this information, also making use of the Cadaster of below and above ground (see par. 2.3.2) AGID will publish the results of the following performance indicators:

COVERAGE

- Population coverage to at least 30 Mbps. (data provided by MISE - Infratel)

- Population coverage to at least 100 Mbps (data provided by MISE - Infratel)

- PA coverage to at least 100 Mbps (data provided by MISE - Infratel), in particularly of:
  - Schools;
  - Health facilities;
  - Ministry of Justice's offices;
  - Ministry of Defence's offices;
  - Businesses coverage to at least 30 Mbps (data provided by MISE - Infratel)
  - Businesses coverage to at least 100 Mbps (data provided by MISE - Infratel)

DEMAND

- High-speed Broadband Subscriptions to at least 100 Mbps (data provided by AGCOM)

- SME's High-speed Broadband Subscriptions to at least 100 Mbps (data provided by MISE - Infratel - Unioncamere)

QUALITY OF DESIGN AND IMPLEMENTATION

- Average percentage of infrastructure sharing (data provided by MISE - Infratel)

- Average percentage of laying alternative technologies utilization (data provided by MISE - Infratel).

- Average issuing permit Time (data provided by Infratel - ANCI)

To achieve the goals of the European Digital Agenda described in this strategy is complex, costly and implies a strong coordination between government and private actors. The variables are many and therefore should be closely monitored to allow possible adjustments while implementing the plan.

In particular:

- The investments of the private operators are monitored annually with the public consultation described in Section 2.2, so that the areas of public intervention can be redefined complementarily to those included in private plans;

- AGCOM will monitor annually high-speed broadband subscriptions penetration to record service take up in the areas where services at 100 Mbps are available. The trend of adoption will affect the implementation of policies to support the demand.

- AGID periodically monitor the proper implementation of this strategy (in synergy with the strategy for Digital Growth) in relation to the final objectives to be achieved, then graduating the amount of public resources and assessing compliance with the time schedule and results.

Conclusions

Monitoring includes a detailed analysis of both the coverage and the use of the connectivity services. The tool with which the coverage monitoring will be implemented is the Cadastre of below and above ground defined by MISE, which is the solution that guarantees objectiveness, transparent and real time verification of investment activities.

The analysis of service take up, however, is run and managed by AGCOM.

The COBUL contributes to monitor the implementation of this strategy, coordinated by the Council Presidency.

2.7 Impact assessment

To assess the impact of this strategy, three levels of analysis have to be defined: the impact intended as the achievement of the European Digital Agenda's objectives, the impact of the measure on economic growth and direct employment, the induced indirect impact.

- **Achievement of the European Digital Agenda's objectives**: at the end of the Strategic Plan, 100% of the population will be able to access 30 Mbps services and 85% will be covered with access services of more than 100 Mbps.
  But how many Italians will subscribe to 100 Mbps? Italy should also recover a gap in ICT use, even before the diffusion of infrastructure, this strategy, together with the Digital Growth Strategy, defines some drivers of development that will inevitably lead to the development of skills for ICT use.
  In the "Good School" plan the Ministry of Education reports that in 2014 "only 10 percent of primary schools and 23 percent of secondary schools are connected with fast broadband connections. The others are linked with medium-low speed access connections, but with very different situations and often sufficient to connect only the secretary office, or the lab tech. Almost in a school out of two (46%), the connection does not reach classes and therefore does not

allow the educational innovation that the Web can enable". The strategy therefore requires that all schools will be connected at 100 Mbps allowing to apply digital teaching measures determined in the "Good School" plan. Similarly to that, will be guaranteed connectivity at 100 Mbps to health facilities now not reached by broadband among the more than 350 health facilities across national territory, justice offices, including in particular part of the 1.300 courts in digital divide that do not allow the implementation of justice digital services.

Finally, the strategy is developed in synergy with the infrastructure plans of the Ministry of Defense, to integrate and rationalize both the programs related to the telecommunications structure of the individual ministries and activities for their continuing maintenance.

This solution allows not only the start of the PA digitization plans that have a fundamental social importance, but also to engage almost all of the Italian population in the process of digitization. School, in fact, between staff directly employed, students and their families is, by itself, in contact with the 50% of the population.

While digitization of Health services will reach all adults, especially those over 65, particularly reluctant to the digitization process.

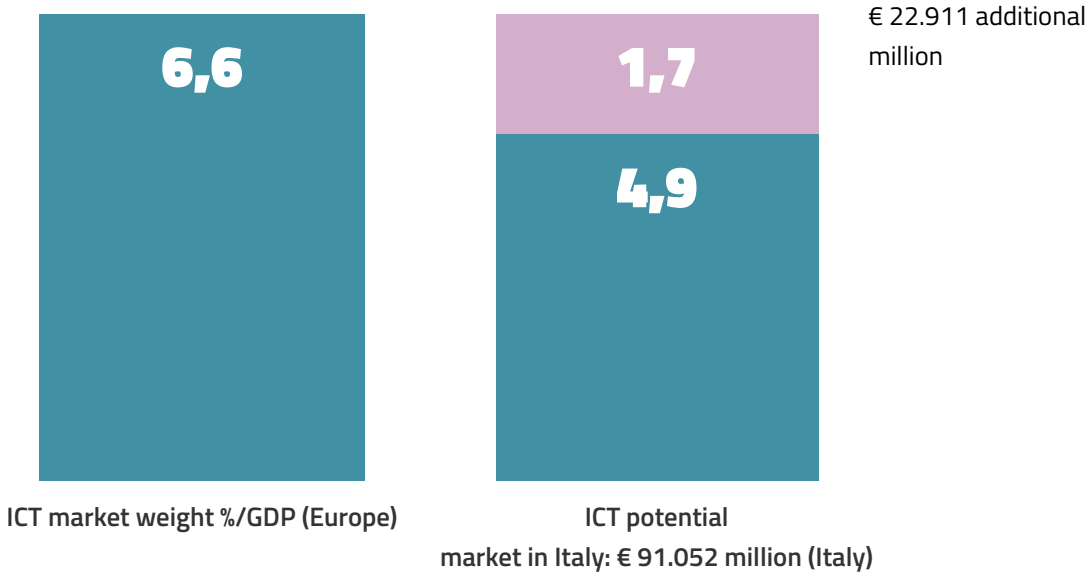
- **direct impact**: duly determinable, affecting a sector currently in crisis, which affects those who realize infrastructure (designers, engineers, and workers for the installation and maintenance of the network), as well as the electronics industry.

- **induced impact**: what is far more pervasive and long-lasting is the transformation of the way businesses run their services through ultra-fast broadband, improving productivity, and for citizens, both by increasing the per capita income and by improving productivity and quality of life. The contribution to GDP growth due to an increase of 60% of ultra-fast broadband accesses can significantly increase GDP.

To be in line with the European average, the Italian should invest 23 billion euro more per year in ICT. As the Assinform 2014 report highlights the weight of this sector in Italy is 1.7% lower than the European average.

Figure 2.5 - Italy invests too little in ICT

Source: Based on data NetConsulting OECD, 2013



[14] Communication from the Commission, European Union guidelines for the application of the rules on state aid with regard to rapid deployment of broadband networks (2013 / C 25/01).

[15] The intervention models are those defined in the framework of the "Strategic Plan Ultra wide broadBand", - aid scheme no. SA.34199 (2012 / N) - drafted by MISE (pursuant to art. 30 of the decree-law July 6, 2011 n. 98 into law July 15, 2011 n. 111) and authorized by the European Commission Decision C (2012) 9833 on 18 December 2012. Therefore, a more detailed description is available on the website of the Ministry of Economic Development.

[16] Consistent with paragraph 82, notwithstanding point 77 of the mentioned guidelines.

[17] The architectural solution adopted, in fact, is the only one to admit public investment even in the most densely populated areas in accordance with paragraph 82 of the Community guidelines.

[18] This refers to the public consultation to which this Plan has been subjected.

[19] Article 6, paragraph 4 of Decree. 145 of 2013, converted with amendments by Law no. 9 of 2014.

[20] Article 6 of the Decree Law paragraphs 3,4,5 September 12, 2014, n. 133.

[21] European Union Guidelines on the application of the rules on state aid in relation to rapid deployment of broadband networks (2013 / C 25/01).

[22] According to Article 6 paragraph 5 bis of Decree Law no. 145 of 2013, converted with amendments by Law no. 9 of

[23] AGCM and AGCOM, Survey on the static and dynamic competition in the access services market and the prospects for investment in fast and ultra-fast telecommunications broadband networks, Rome, 2014.

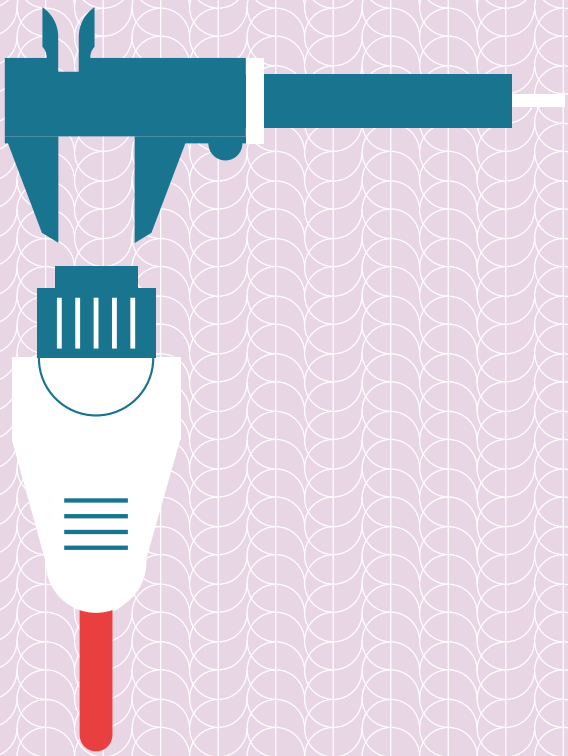
[24] Communication from the Commission, Guidelines of the European Union for the application of the rules on state aid in relation to rapid deployment of broadband networks (2013 / C 25/01).

[25] SA.34199 (2012/N) – "Italy Digital Plan – Super-fast broadband"

[26] Classification of the most marginal, rural and sparsely populated municipalities produced by the Ministry of Agriculture, Food and Forestry.

[27] The project for the internal areas anticipates the implementation of e-health and digital school plans in the most disadvantaged areas of all the Italian regions.

Annex A- Enabling Technologies for Ultra Fast Broadband services.



Technologies enabling the provision of 30 and 100 Mbps connectivity services to end-users.

The objectives of the European Digital Agenda for ultrafast broadband are expressed in a synthetic way indicating respectively coverage and penetration targets to the minimum download speed (30 Mbps for Objective 2 and 100 Mbps for Objective 3), over a transparent, open-access, carrier-neutral infrastructure. Consistently with paragraph 58 of the Commission Communication, NGA are defined as access networks which are capable of delivering broadband access services with enhanced characteristics (such as higher throughput) and which consist wholly or in part of optical elements close enough to the end user to ensure effective transmission at very high speed and support a range of advanced digital services, including IP-based converged services.

This allows each nation to set up a plan to achieve the objectives of the European Digital Agenda accordingly to national market structure (demand-side and supply), geographic conditions and to population density.

The use of fiber optic infrastructure is crucial for the construction of network architectures that can enable the achievement of the European Digital Agenda objectives, whatever technology, wired or wireless, used for service access.

However, given the massive investments needed for the deployment of new infrastructure to host fiber cables, especially in remote areas, (low potential demand areas and rural locations disadvantaged by orography) it is reasonable to design the development of the network architecture towards the goals of the European Digital Agenda for the ultra-fast broadband according to a logic of intelligent use of a variety of access technologies, which combine the use of fiber infrastructure with effectiveness and

efficiency criteria, and even considering the overall market conditions.

The role of Radio technologies

The fourth generation of mobile radio technology, Long Term Evolution (LTE), now widely available in modern devices and rapidly spreading, is able to offer peak capacity downstream of the order of 10-100 Mbps given that the speed per user depends on the number of connected users in the area covered and is inherently subject to fluctuating environmental conditions. Theoretically, LTE achieves a transmission rate (gross) of 75 Mbps upstream and 300 Mbps downstream (due to spatial multiplexing).

It is rare, however, for the planning of an LTE radio system to target delivery of 30 Mbps downstream per cellular user (and even more rare to target 100 Mbps) because it would be difficult to achieve a return on investments.

Costs for denser cell packaging (using smaller cells), evolved MIMO antenna technology and increased backhauling capacity would be targeted in the most profitable areas (i.e. urban and densely populated) where rate of return for investment is adequate, with respect to the specific characteristics of local areas (from dense urban areas, to extremely dispersed rural areas).

LTE-Advanced, currently under development by market players and standard organizations, is expected to increase access speeds in various ways.

In some countries, operators have already started the deployment of LTE-A (example: the United States and South Korea), while in Italy were made the first trials and announcements of commercial launches at the end of 2014. The aggregate theoretical peak speed of upstream and downstream point to 1.5 Gbps and 3 Gbps respectively. Also the efficiency of spectrum use is expected to

reach up to 16 bit / s / Hz version for 3GPP R8 and 30 bit / s / Hz in version R10.

Further technological innovations aims at achieving improved performance at cell edges and a higher capacity available to each user (such as the use of 2x2 MIMO downlink at least 2.40 bits/s/Hz/cell, carrier aggregation, and intra-site and inter-site Coordinated Multi-Point - CoMP -transmission/reception and increasing network capacity through the efficient reuse of spectrum, using coordinated macro-cells and micro / pico-cells, according to the paradigm of HetNet).

By 2020, mobile services will make an important contribution to reach 30 Mbps in areas with low population density (rural areas), while it is not expected that Mobile networks will make an effective contribution to the 100 Mbps objective. In urban and suburban areas, mobile services will provide a cost effective solution to complement, but not to replace, the fixed network, enriched with radio WiFi access with the function of lightening (offloading) the load of traffic addressed to the mobile radio resource, for delivering ultrafast broadband services.

To ensure that Italy can fully exploit wireless technology it is essential that Spectrum allocation policy ensure valuable spectrum availability for mobile and fixed wireless broadband services, including possible use of the 700 MHz band for mobile broadband, which is now heavily used in Italy for digital terrestrial broadcasting. Spectrum allocation must be internationally coordinated to a significant degree with Community policies, in order to promote harmonization in the use of radio frequencies and pursuing a single European market's strategy.

In addition to the mobile networks, radio technologies express two other alternatives that may contribute, each with its own specificity to reach the objectives of the European Digital Agenda, especially in less attractive areas for mobile coverage: fixed and satellite radio access technology.

Fixed access technology (Fixed Wireless Broadband Access, FWA) is playing an important role in achieving the first goal of the European Digital Agenda (covering 100% of the population at least 2 Mbps), as identified by the National Plan for Broadband within public interventions led by MED and developed with regional tenders. The fixed broadband access is provided either in the licensed 3.4-3.6 GHz frequencies and in the unlicensed spectrum of 5.4 GHz band. FWA radio planning can be more effective and more predictable than with mobile wireless technology. The performance provided to active customers can be better than with mobile because the radio link is not dependent on the mobility of terminal equipment.

The peak rate currently provided are of the order of 30 Mbps per user and the development plans of the technology point to 50 Mbps over the next few years, relying modulation efficiency of usage of spectrum (4 to 8 bit/s/Hz in emerging radio technologies exploiting efficient modulation and evolved MIMO techniques). The FWA technology is mainly used in point-to-multipoint configurations, sharing the transmission capacity offered to a local area. However, in point-to-point configurations radio resources can be delivered to a single user, providing dedicated capacity in excess of 100 Mbps.

Fixed broadband wireless technology will be important in achieving 30 Mbps broadband service, Objective 2 of the European Digital Agenda, in low density areas in addition to mobile networks, while are not expected to be effective in achieving 100 Mbps service, objective 3 of the European Digital Agenda.

Satellite technology is likely to address only the most remote areas of the territory (islands, mountainous terrain) and extreme market conditions (highly dispersed population).

Satellite technology based on geostationary orbits leads to a delay of some 270 milliseconds (a quarter of a second), which limits the desirability and suitability of satellite services. The capacity of satellite communications must be shared among all users.

Currently, the systems in Ka-Band satellite offer peak capacity per user of around 20 and 8 Mbps down and upstream, respectively.

The increased costs of installation of satellite antenna is a barrier to adoption and therefore are generally identified public subsidy to facilitate take up. In this context, Satellite appears to play a gap-filler role to provide 30 Mbps (Objective 2 European Digital Agenda) to dispersed houses.

Wired technologies

The construction of networks that reach as close as possible end-user premises with fiber infrastructures is generally considered as the long-term network architecture that will enable operators to deliver ultra-fast services at 100 Mbps per single user.

However, the construction of infrastructure in which the fiber is deployed to the base of the building (FTTB) or to the single flat (FTTH) requires substantial costs, primarily due to the civil works needed to implement the cable ducts and the deployment of an access network consisting of optical fibres lines in both the feeder and the drop segments of the access network (including in-house wiring).

The transport capacity available with fiber links is not only compatible with the objectives of the European Digital Agenda, but allows to go far beyond the set capacity targets of downstream and upstream.

This statement is valid whether Point-to-Point (P2P) technology is to be used that sees the use of one or two fiber links dedicated to one premise (building or dwelling unit, but mainly indicated and used for corporate offices), or Passive Optical Network (PON technology) is used that involves the shared use of fiber links as part of a multitude of premises (eg. 48, 16, 8 or building housing

units for fiber in the drop segment, with more aggregation levels in the feeder segment).

The FTTH solution also involves, for city buildings that include a multitude of condominium units, the deployment of vertical fiber infrastructure to reach housing units, where network reaches the end-user premises with fibre for fixed or mobile users. The FTTB solution instead, is based on the use of cables in pairs of unshielded copper to direct services from the cabinet at the base of the building, where fiber infrastructure is terminated, and then copper, coax or LAN is used within the building, until the single unit.

With the final connection being copper the transmission capacity available to the individual user, in the case of FTTB, is conditioned by the quality of copper infrastructure within the building and the evolution of technologies that provide broadband services over copper (that, over short copper loops, are considered to be suited to achieve speeds of 30 Mbps, and, in some cases, of 100 Mbps). Recent technological developments have given new life to copper infrastructure in the access network, and have substantially increased the bandwidth available using advanced technologies over copper with the need to extend the fiber connection only until the primary network (from the central to the street cabinets, or "cabinet" from which the word FTTC, Fiber To The cabinet).

In fact, thanks to VDSL2 (Very-high-bit-rate Digital Subscriber Line 2) technology, it is possible to achieve ultrafast broadband transmission speeds over existing copper. Transmission speeds accessible on copper are limited by the quality of copper infrastructure (which requires maintenance activities in order to maintain the transmission quality) and the length of the cable (the maximum transmission speed decreases progressing along the cable).

The FTTC solution offers the possibility to plan the evolution of ultrafast broadband infrastructure gradually, progressively driving fiber deeper into the network over time for FTTB / H solutions, making investment in ultrafast broadband network deployment

more viable, since FTTC avoids incurring into high implementation cost for civil works, due to reaching customer premises and home fiber wiring, replacing copper from the MDF to the street cabinet with fiber optics infrastructure (primary network is based on fiber infrastructure).

This opportunity is particularly interesting in Italian network configuration where copper sub-loop lengths are among the shortest in Europe (in Italy average sub-loop length in Italy is just 300 metres. The median sub-loop length is about 200 metres, i.e. half of all sub-loops are shorter than 200 metres).

VDSL2 technologies can achieve speeds of 50-80 Mbps over shorter than 500 mt copper loops. Vectoring technology has been developed and proposed in order to address crosstalk limitations, to achieve 100 Mbps data rates in access networks based on copper loops shorter than 300 mt. It should be underlined that this technology requires forms of structured coordination among operators to counter the effect of interference among twisted pairs that are located in the same cable, but used by different operators with technologies of different generations, resulting in a dramatic decrease of performance.

As a result, the possibility to reach 100 Mbps through FTTCab networks is related to the possibility to use the "vectoring" technology (technical checks are underway in a table that sees the National Regulatory Authority and telecom operators, supported by manufacturing).

Through using multiple copper lines between the cabinet and the customer's premises, you can enhance throughput for each user termination through enabling inverse multiplexing for parallel channels on each pair (bonding). The application of bonding is destined to play a marginal role as it requires the availability of multiple pairs of copper per unit connected.

The future of transmission technology over copper is represented by G.Fast, an emerging technology, that achieves 100 Mbps and

1Gbps speed (aggregated downstream and upstream) where copper loop lengths are very short, generally less than 100 metres. This technology is bringing out a new option for ultrafast broadband network architecture, called FTTdp (Fiber to the distribution point), indicating a solution in which fibre is deployed closer to the user to the distribution point, placed near the buildings or at the base of the buildings, leaving to copper infrastructure, equipped with G.Fast active terminals, to carry ultrafast broadband transmission for the final user's connection (including any vertical infrastructure in the building).

Recently, some market players have announced technological advances that are likely to enhance FTTCab capabilities to further exploit the capabilities of existing copper pairs, improving performances over time, given that these technologies are validated, standardized and produced on an industrial scale.
In view of the objectives of the European Digital Agenda for ultrafast broadband technology FTTC is likely to contribute significantly to the achievement of the objective 2 (30 Mbps) for a large part of the territory (urban and sub-urban densely populated areas), while it remains to assess its contribution for Objective 3 (100 Mbps), depending on the applicability of vectoring technologies, the length of the sub-loop and quality of copper infrastructure.

The FTTdp solution is likely to contribute to objective 3 (100 Mbps), but is linked to the maturation of the technology and requires the deployment of fiber in secondary network, until the distribution cabinet. FTTB / H network architectures offer a long-term strategic solution, able to reach and exceed the speed indicated on the European Digital Agenda's targets.

The deployment costs of a fiber infrastructure in the secondary network are recoverable in high-profitability urban areas with a high concentration of business and population. The return on investment for network architecture that drive fiber deep into the network may benefit from measures to facilitate civil works and a concerted vision of the use of fiber for connecting mobile users.

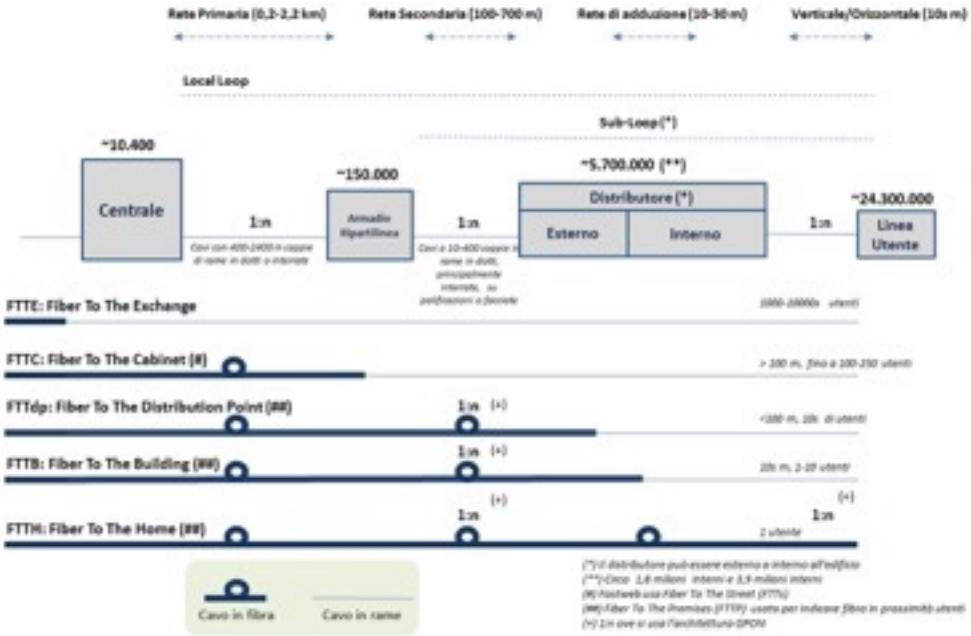
Choices of the telecommunications operators in Italy

One of the results of the expert group led by Francesco Caio has been the definition of a reference framework of shared by the major telecommunications operators engaged in Italy for the deployment of a ultrafast access network with different FTTx options, as well as the strategic role that technologies play in the short time horizon defined by the objectives of the European Digital Agenda.

We report here some findings that are useful to determine the reference framework and especially to highlight the importance of different elements that make up the fixed network architecture for broadband and ultrafast broadband services and reference dimensions for the cable lengths in the different sections of the network.

It should be noted that the model represented does not show the cases, widespread in some urban areas, in which the connection of the user is realized with a single copper cable which run fiber all the way from the central office (with its Main Distribution Frame (MDF)) to the customer premises (without passing through the Cabinet).
In any case, moving from top to the bottom of the FTTx options, it is evident that each step provides optic elements deeper into the network and closer to customer premises and is associated with greater costs and complexity (number of components to be connected and increasing line lengths contribute to get an idea of the magnitude and diversity of the different architecture options).

Figure A.1.1 diagram of the basic architecture
Source: Fondazione Ugo Bordoni.



The analysis of the current and future potential of the various FTTx options shows a big challenge on the main Italian operators for the development and exploitation of VDSL2 and vectoring technologies to achieve the objectives of the European Digital Agenda (including the 100 Mbps target), and also uncertainties remain reasonable on the ability of VDSL2 and vectoring technologies to deliver the 100 Mbps speeds called for Objective 3 of the European Digital Agenda in areas where more than one operator has realized its FTTC infrastructure, as has occurred in several areas where implementation of multi-operator FTTCab infrastructure is rolling-out.

Figure A.1.2 The FTTx different options and their future evolution
Source: Fondazione Ugo Bordoni.

	Current View	Future View
FTTE: Fiber To The Exchange	ADSL2+ up to 20 Mbps and 1 Mbps upstream	VDSL2 evolution up to 50 Mbps DS and 10 Mbps US depending on copper length, copper quality and concurrent usage of pairs in a cable, vectoring to secure top speed on pairs bundled in a loop cable
FTTC: Fiber To The Cabinet	VDSL2 up to 30 to 100 Mbps DS and 3 to 30 Mbps US based on sub-loop length (up to 100Mbps for sub-loops < 300 m), vectoring being tuned to secure top speed on pairs bundled in a sub-loop cable	VDSL2 evolution to improve performance/distance tradeoff, depending on copper quality and concurrent usage, vectoring to secure top speed on pairs bundled in a sub-loop cable – G.Fast (sub-loops<100m)
FTTdp: Fiber To The Distribution Point		VDSL2 evolution and G.Fast, vectoring up to 500-1000 Mbps aggregate (DS+US)
FTTB: Fiber To The Building		VDSL2 and G.Fast, vectoring up to 1000 Mbps aggregate (DS+US)
FTTH: Fiber To The Home	scalable to >= 1 Gbps Existing footprint Metro-Ring and P2P up to 100 Mbps DS and US GPON: shared bandwidth up to 2.5/1 Gbps	scalable to >= 1 Gbps Metro-Ring and P2P scalable to >=1 Gbps GPON: shared bandwidth up to 10/2.5 Gbps NGPON2: shared bandwidth up to 80/80 Gbps

Telecom Italia, the incumbent fixed network operator, has based its roll out plan for providing ultrafast broadband services mainly on a FTTCab network architecture, primarily addressing urban areas where return on investment is adequate, taking into account also the possibility to access public funds made available for the realization of investments in ultrafast broadband infrastructure.

Italy Telecom offers access to its infrastructure through regulated wholesale prices and conditions in the form NGN services based on VULA and bitstream services. It should be noted that Telecom Italy has a FTTB / H coverage in Milan, largely based on Metroweb's passive fiber infrastructure.

Being a fixed and mobile operator, Telecom Italy design its plans for fiber infrastructure enhancing synergies between fixed and mobile networks coverage.

Fastweb also has focused on the FTTC solution, designing a deployment plan that tends to cover the same areas as with that of Telecom Italy (although addressing a reduced number of cities and a reduced level of population coverage), benefits from a coordination

agreement with Telecom Italia for joint operational planning and deployment to ensure that infrastructure investment can be shared efficiently. Fastweb has a FTTB / H coverage in Milan (based on Metroweb's passive fiber infrastructure) and in some areas of Naples, for a total coverage of about two million residential units and companies.

Vodafone has recently started a deployment plan based on FTTC architecture, after having addressed AGCOM to finalize the rules and conditions to implement multi-operator cabinet sharing for the realization of multi-operator FTTC solutions.
Alongside Vodafone launched the commercialization of NGN services based on VULA and bitstream services provided by Telecom Italia Wholesale and in the city of Milan (and soon Bologna), Vodafone also offer services based on FTTH GPON architecture, over Metroweb's infrastructure (Vodafone recently launched a 300 Mbps offer in Milan).

Even Vodafone, being a fixed and mobile operator, Italy design its plans for fiber infrastructure enhancing synergies between fixed and mobile networks coverage.

Metroweb is a neutral passive infrastructure operator. Its mission is to deploy fibre optics access networks (ducts and cables) in the major metro areas and to offers wholesale access to operators interested in delivering ultrafast broadband services. Metroweb has focused on FTTB / H architecture and has built up on its fiber passive infrastructure deployed in Milan. Further deployments are in progress according to agreements with Vodafone, Fastweb and Wind. Metroweb has a modest infrastructure in Genoa and has recently announced plans to proceed with the construction of a FTTB / H network in some areas of the city of Bologna.

Before Fastweb and Telecom Italy started their massive FTTCab roll out plans, Metroweb had announced an infrastructure plan that would address 30 cities with FTTB / H technology. At present, this plan has been put on hold by Metroweb's shareholders, due to uncertainties over return on investment.

Other telecommunications operators are active in the Italian market that have deployed and developed their own fiber access infrastructure to deliver ultrafast broadband services to their client companies (eg. BT Italy, Wind and Colt).

Technological scenarios

At present, there is a strong concentration of private investment in areas where there's the greatest business potential.
In Milan, for example, broadband services have focused in densely populated areas on competing multi-operator FTTC and FTTB / H infrastructure, in addition to the extensive coverage of the 4G mobile networks. The most densely populated urban centers, with highest business potential, are addressed by different operator's FTTC development plans, and is not uncommon that ultrafast broadband services are based on different FTTC infrastructure (two or three operators including Telecom Italy, Fastweb and Vodafone at present).

Timing for adequate return on investment becomes problematic when there are multiple parallel infrastructures, if you consider that potential customers' target for single site with more than one "Cabinet" is on average 200-250 units.

The Italian Government's address plays a key role in showing a way of greater efficiency and effectiveness in the use of capital for the construction of ultrafast broadband infrastructure, also in the light of the objectives of the European Digital Agenda.

The emerging technology scenarios must envisage the application of the full range of technology alternatives for providing ultrafast broadband services, FTTB / H, through FTTC, to the mobile radio solutions, FWA and satellite, to achieve the objective 2 of the European Digital Agenda (100% coverage at 30 Mbps) in an effective and efficient way.

As for the European Digital Agenda objective 3 (50% adoption of at least 100 Mbps) should concentrate efforts on the areas of the country with the highest concentration of potential business, wisely selecting the appropriate technologies, promoting a rapid deployment and take up, and working intensively on measures to stimulate demand.
In this direction, uncertainty about the actual potential of the FTTC and vectoring technology should be dissolved quickly, to achieve speeds indicated by the objectives of the European Digital Agenda, especially on sites where there are infrastructure of different operators.

Finally it is to be made clear that the coexistence of FTTC and FTTdp infrastructure is under study and also the potential role played by G.Fast technology in the secondary network is to be assessed as well.

It is conceivable a gradual migration from FTTC infrastructure towards solutions with optic fiber closer to client's premises (FTTB / H and FTTdp) in areas of high concentration of bsuiness potential.

This may take place in a selective manner in areas where an adequate potential demand is developed and where effective actions for facilitating the deployment of fiber access infrastructure are put in place by the Italian Government.

Conclusions

Based on the above evidence, some concluding remarks are drawn:

- The scale of investment required for the deployment of an infrastructure that provides optic elements deeper into the network and closer to service access points, leading to the adoption of a strategy that modulate infrastructure intervention in relation to the potential market and the gradual maturation of demand, according to an evolutionary logic, diversified according to the territory.

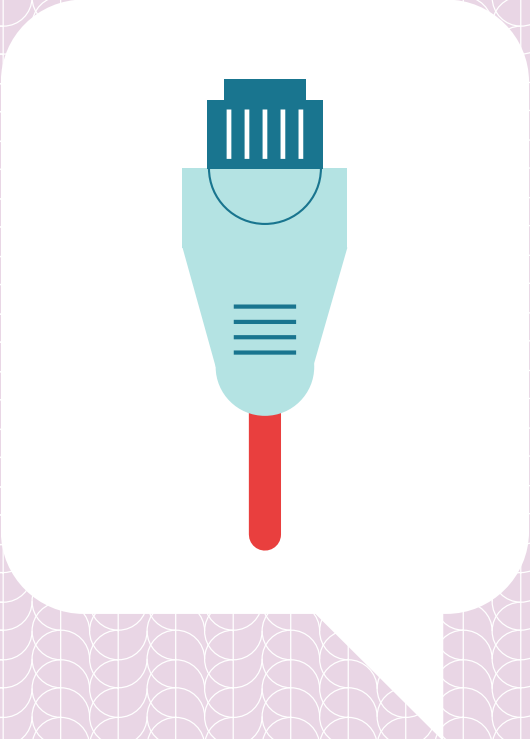
- Although it is clear that the FTTB / FTTH is the ideal solution for the provision of a future-proof ultrafast broadband network infrastructure, the reasonable use of economic resources leads to direct investments in FTTB / FTTH deployment towards targeted areas where there's the greatest business potential and values the solutions in which the fiber is deployed progressively in the primary network (FTTC) and secondary, to the secondary cabinets (FTTdp), and then until the building (FTTB) and flat (FTTH), according to an evolutionary logic;

- The development of demand and the opening to intermediate solutions to progress toward the most advanced solutions (with transition pathways and coexistence controlled) play a key role in the implementation of this Strategy. In particular, the definition of demand stimulation measures, together with policies to foster a favorable regulation framework and stimulate infrastructure investments, will determine the payback of intermediate solutions (FTTC) and will set the pace for infrastructure upgrades and the adoption of most advanced fixed technologies (FTTdp and FTTB/FTTH).

- The provision of access services above 30 Mbps for the entire population (Objective 2 European Digital Agenda) brings to investigate the entire range of infrastructure and technology solutions in order to secure this target. In this context radio technologies will also be considered (mobile, fixed and satellite radio access) to cover, in a financially sustainable way, some areas of the territory including those where there's no business case.

- With regard to the objective 3 of the European Digital Agenda (50% population to take up Internet connections above 100 Mbps), it is appropriate to focus on the development of this infrastructure especially on areas of the country with highest business potential, wisely selecting the appropriate technologies, promoting a rapid deployment and adoption, as well as working intensively on demand stimulation.

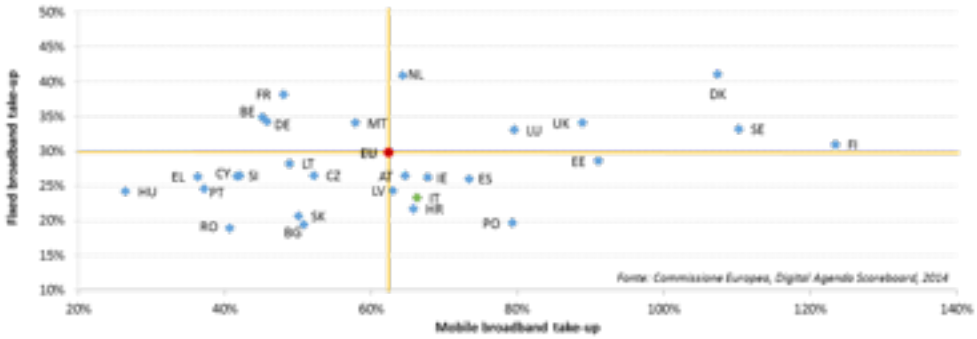
Annex B - The demand for broadband and ultra broadband services



The delay in Italy

According to the latest data of the Digital Agenda Scoreboard[1], Italy continues to show a significant delay in the use of broadband connectivity services, despite now the complete coverage of the territory.

Figure A.2.1. Landline broadband and mobile broadband penetration
Source: European Commission, *Digital Agenda Scoreboard, 2014*



With regard to landline broadline, the number of accesses each 100 inhabitants amounted to 23 in Italy, against a European average of 30. The situation is, however, much better for mobile access, with a penetration of 66 units per 100 inhabitants, compared to an average European equal to 62.

A correct interpretation of these data, however, must take into account some specifics as:

- While access to the fixed network are usually shared among several people, those mobile network are typically individual;

- The average number of mobile access per individual can vary greatly depending on the countries, resulting from the

[1] European Commission, Digital Agenda Scoreboard, 2014.

penetration of the different devices, personal and non personal (eg. Machine to Machine applications).

Consequently, understanding the role of the two trajectories (landline and mobile) for the diffusion of the broadband, requires a careful consideration of the effective penetration, both in a domestic and professional environment, of the possible effects of substitution and complementarity (cfr. infra), as well of the effective performance of the different services .

A second element to consider is the dynamics of broadband access. From this point of view, in the last year the number of landline broadband accesses has grown very slowly and the increase is referable essentially to radio accesses by fixed location.[2] Furthermore, Italy is the Country that has shown the lowest growth of fixed network broadband connections in the EU, while the dynamics of the mobile network broadband connections continue to grow much faster than the european average.[3]

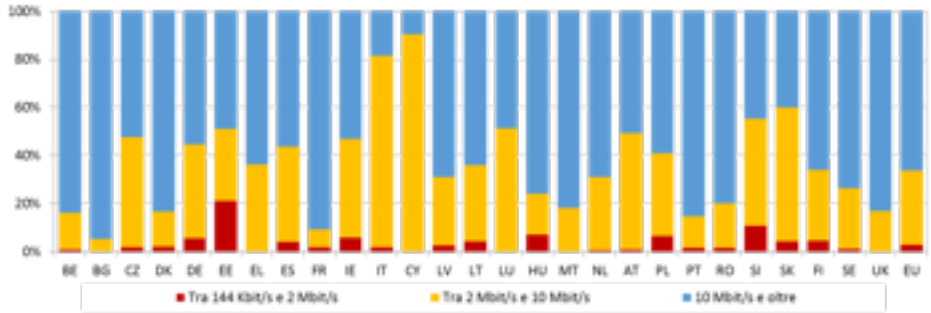
Another focus of attention concerns the broadband services performance level. The european comparison on the speed of downloads of fixed network broadband accesses highlights a relative weight of about 20% for the connections with speed between 2 and 10 Mbps. On one hand, this result is still the effect of the marginal existence of infrastructures enabling the ultra wideband connection, on the other hand it is necessary to notice how such penetration is largely inferior to the effective coverage of ADSL plus services (with nominal performance up to 20 Mbps), which according to the Ultra Broadband Observatory is higher than 80%.[4] Actually, in spite of the coverage level and the price differential lower and lower compared to the cheaper services, the national demand appears to be reluctant in adopting the faster connections available.

[2] AGCOM, Quarterly Observatory on Telecommunications, June 2014. In the past year the positive balance of 240.000 units is the result of a decrease of 130.000 units for ADSL accesses and an increase of 370.000 units of other accesses (radio and fiber). In June 2014, the number of accesses NGA is equal to 540.000 units.

[3] European Commission, Digital Agenda Scoreboard, 2014.

[4] Between, Ultra Broadband Observatory, June 2014.

Figure A.2.2. Fixed broadband connections per speed of download.
Source: Communications Committee, 2014



In the past year, the acceleration process in the investments for the realization of new generation networks, landline and mobile, is increasing significantly the coverage both of the NGA and of the 4G ones. Consequently, the take-up of the ultraband[5] connection services is increasing rapidly, but also in this case the rapidity of the process of adoption will depend on both the effective differentiation facts and on the price differential compared to the existing services.

People's demand

The expansion of the coverage of broadband services makes their penetration tightly linked to the effective use of the Internet.
The examination of the profile of utilization of the Internet allows, then, to identify further relevant aspects in order to facilitate the development of broadband and ultra broadband in our Country.

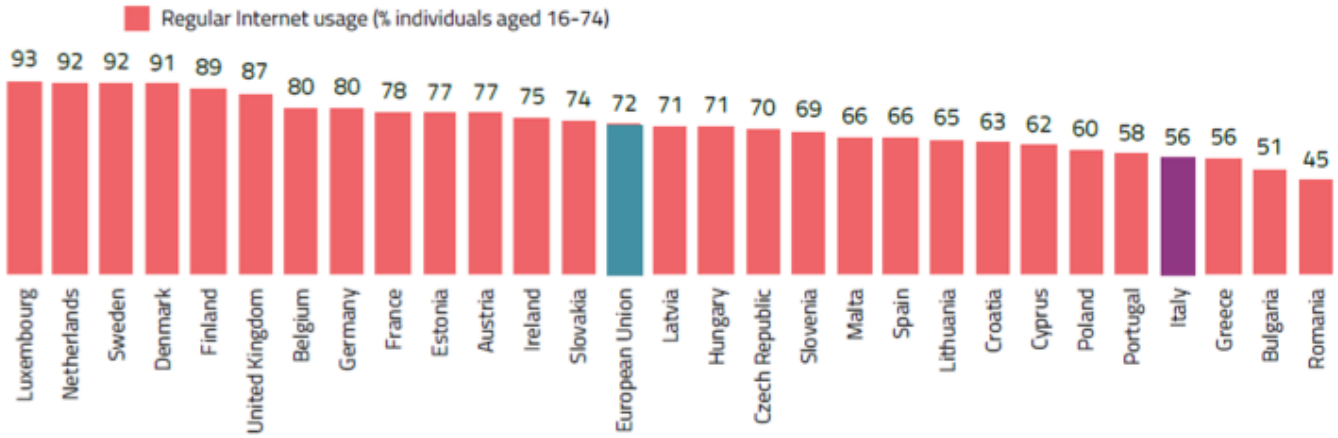
According to the latest records of the Digital Agenda Scoreboard, Italy continues to occupy the last positions with respect to Internet utilization from the population. In fact, only 50% of the population with an age range from 16 to 74 years uses regularly the Internet, in opposition to the european average of 72%.[6] Instead for the age

[5] AGCOM, Quarterly Observatory on Telecommunications, June 2014. In June 2014, the number of accesses NGA is equal to 540.000 units

[6] European Commission, Digital Agenda Scoreboard, 2014.

range from 16 to 24 years the differential is of about 10 points percentage in opposition to the european average, the gap grows significantly for the further age ranges (15 points for age range 25-54 years and 18 for age range 55-74 years).

Figure A.2.3 Regular Internet Users (at least once a week)



In addition to the delay in the utilization of the Internet also the gap in digital skills. In Italy 61% of individuals from 16 to 74 years old own a low ICT skill level (21%) or none (40%), in opposition to 46% in Spain, 42% in the United Kingdom, 40% in Germany and 37% in France, up to inferior values of 30% in Finland, Sweden, Holland, Denmark and Luxembourg.[7]

Further differences are observed also with respect to the services utilized by Italian Internet users in opposition to the ones of other EU Countries. The diversification index of the activities carried out online is inferior to 5 in Italy, in opposition to the european average of 6.2.[8] In fact while the activities linked to communication and information show diffusion levels equal to the european average, with respect to transactive activities the gap remains particularly wide (32% online purchases in opposition to 61%, 37% online banking in opposition to 55%). At the same time, Internet users

7 European Commission, Digital Agenda Scoreboard, 2014.

8 European Commission, Digital Agenda Scoreboard, 2014. Index on 12 possible activities online.

which have used eGovernment services in the past year have been 34%, in opposition to the european average value of 54%).

As demonstrated by the Istat's socio-demographic prospect,[9] age remains the first cause to explain the gap within the utilization of the Internet in Italy. In short, the main differences can be summarized as follows:

- Internet utilization grows with age, reaching up to 99% for the age range from 18 to 19 years, and then decreases progressively under 75% for the age range from 35 to 44 years, under 50% for the age range from 55 to 59 years, until values under 10% from 75 years on;
- A differential of slightly more than 10 points remains between the utilization of Internet by men and women;
- Penetration with respect to the geographic area varies from 60% in the North East to 50% in the North West and in the Islands;
- Penetration with respect to professional status is around 20% for housewives (21%), and the ones retired from work (18%), but increases, respectively, over 75% and 90% for workers and students;
- 85,7% of families with at least one underage own an Internet connection, while in families composed by old people from 65 on the presence of Internet decreases at 12,7%.

[9] Istat, Citizens and new technologies, December 2013.

Fugure A.2.4 PC and Internet users and by gendre, age, geopraghical area and working condition.

Utenti Internet ultimi 12 mesi	2008	2009	2010	2011	2012	2013
Sesso						
Maschi	45,8%	49,8%	54,6%	56,6%	58,3%	**60,2%**
Femmine	35,0%	39,4%	43,6%	46,7%	47,0%	**49,7%**
Classe di età						
6-10 anni	22,2%	30,5%	36,7%	38,2%	40,7%	**44,9%**
11-14 anni	59,3%	69,6%	75,7%	78,0%	76,3%	**80,7%**
15-17 anni	76,7%	82,1%	87,2%	89,1%	88,3%	**89,6%**
18-19 anni	77,2%	83,7%	90,4%	88,7%	88,6%	**89,9%**
20-24 anni	71,0%	77,6%	82,1%	85,5%	85,6%	**85,4%**
25-34 anni	62,6%	67,9%	73,3%	77,0%	78,9%	**80,1%**
35-44 anni	53,8%	58,2%	64,6%	69,4%	68,9%	**73,4%**
45-54 anni	44,0%	48,6%	53,0%	56,0%	58,6%	**61,2%**
55-59 anni	29,7%	33,1%	41,0%	42,2%	45,2%	**48,7%**
60-64 anni	18,0%	22,8%	25,2%	28,6%	30,9%	**36,4%**
65-74 anni	7,2%	8,5%	12,1%	13,8%	16,3%	**18,9%**
75 anni e più	1,3%	1,5%	2,0%	2,7%	3,3%	**3,5%**
Ripartizione geografica						
Nord-Ovest	44,7%	48,3%	53,6%	56,5%	57,1%	**58,0%**
Nord-Est	45,4%	48,2%	51,3%	55,9%	57,6%	**60,1%**
Centro	42,9%	46,8%	51,3%	54,2%	55,0%	**57,6%**
Sud	32,1%	37,3%	41,9%	43,6%	43,3%	**46,7%**
Isole	33,5%	39,5%	44,5%	44,0%	47,5%	**49,9%**
Condizione occupazionale						
Occupati	59,0%	63,6%	68,7%	71,7%	73,0%	**75,7%**
In cerca di nuova occupazione	40,0%	47,5%	54,8%	58,8%	56,3%	**61,0%**
In cerca di prima occupazione	41,7%	55,3%	59,7%	68,9%	66,5%	**68,0%**
Casalinghe	10,8%	14,3%	17,1%	19,5%	19,3%	**21,6%**
Studenti	85,0%	88,3%	91,8%	92,3%	93,2%	**92,1%**
Ritirati dal lavoro	9,3%	10,6%	13,3%	14,7%	16,3%	**18,3%**
Altra condizione	12,2%	16,2%	22,6%	23,2%	24,3%	**24,9%**
Totale	*40,2%*	*44,4%*	*48,9%*	*51,5%*	*52,5%*	*54,8%*

As per the reasons explaining the lacking of Internet utilization by families, the first obstacle remains the missing of skills (43%), followed by the sense of uselessness (27%), while the barrier of financial accessibility assumes a relatively less important role (10% of interviewed claims the cost of the connection and 9% the cost of the instruments necessary to the connection). It is notable, furthermore, how 13% of families declare they connect from other sites.[10]

The definition of a strategy for the development of new network infrastructures cannot disregard the current effective utilization of networks and of Internet connection devices, even more so since the increase of devices and the development of network performances.

We must remember how the penetration of landline connections in Italy aew largely inferior to the european average and it is estimated that 1/3 of Italian families currently do not have a landline connection. According to the latest evaluations of the Ultra Broadband Observatory, 58% of Italian families have both a landline and mobile broadband connection (with a major use of the landline connection), 29% uses only mobile broadband connections, while 13% connects to the Internet only through landline connections. On the other hand, there are more and more Internet users that utilize different devices to access the Internet from different sites. In other words, if it is true that the PC remains the most common device for Internet access, little less of the 2/3 of users utilizes by now more than one device.

According to the investigation carried out in the past years by the Utra Broadband Observatory[11] further useful observations may be deduced for the definition a national strategy:

[10] Istat, Citizens and new technologies, December 2012.

[11] Between, Utra Broadband Observatory, 2014

- The level of satisfaction for the current landline broadband connectivity service performances remains high. In fact, 54% of users is enormously satisfied, while, on the contrary, less than 10% underlines a high level of satisfaction;

- Nevertheless, the majority of Internet users (83%) believes that the Country needs new ultrabroadband infrastructures, competitive as opposed to what's in progress in the main industrialized Countries;

- 37% of Internet users believes that public administrations should represent a guiding role in the realization of new generation networks, while 36% believes that realization of new networks requires the definition of cooperation plans between both public and private institutions.

- 60% of Internet users claims a self interest in the utilization of both landline and mobile broadband services, while 21% tends to prefer landline broadband services and 19% the mobile ones;

- The proneness to pay ultrabroadband connectivity services appears to be slightly increasing in the past year, but the availability to pay a premium price is high only in less than 10% of cases; even though about 1/3 of users are willing to evaluate the purchase of a service at a higher price with respect to the current one.

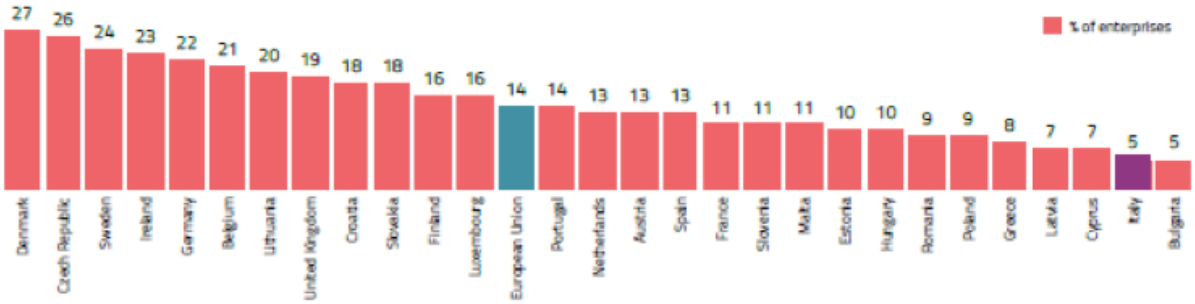
The situation described above underlines how the goal of the Digital European Agenda to obtain 75% regular Internet users by 2015 is not persuable in our Country. In the past 5 years Internet utilization has grown from 40,3% to 54,3%, by annual increase that is equal to a few percentage points in the past period.[1]

[12] Internet use by 6 years old people and more. Istat, Citizens and new technologies, December 2013

Companies and institutions' demand

The penetration of broadband connectivity services in companies is dichotomic. On one hand, in companies with 10 or more operators, the diffusion level is similar to the one of the main European Countries. Infact, 94,8% of companies utilizes landline and/or mobile broadband connections. The maximum connection speed raises with the dimension, but 71% of companies still have connections with performances that are inferior to 10Mbps and only 12% of companies claim to use connections at at least 30 Mbps.[13]

Figure A.2.5. eCommerce use in companies – December 2013 records.



As for companies with less than 10 operators, broadband penetration and diffusion of online activities serve the difficulties already observed by citizens, emphasized for companies where the businessman's age is higher.

According to the 2011 census records, micro-companies (3-9 operators) connected to the Internet were 77% and 65% utilized a broadband connection. Electronic commerce was realized by 25,1% of companies, but the opportunity to sell online was carried out only by 5,1% of companies, while 23,4% purchased on the web.[14]

[13] European Commission, Digital Agenda Scoreboard 2014

[14] Istat, Structural assets and competitivity factors of italian companies: micro companies in Italy, November 2013.

Within the inferior dimensional range, the penetration levels of broadband connections and the utilization of online services are actually inferior with respect to those of families, as a proof of the difficulties regarding the involving of minor companies in the digital innovation processes.[15]

Some recent investigations[16] carried out in industrial areas beneficiary of new infrastructure operations show that the interest in adopting ultra broadband services is strictly connected to the companies' dimension and to the manufacturing typology. It is also necessary to underline how against one third of companies that claim their interest, more that 20% believe that they should postpone the decision due to the current recession.

The Istat investigation on information regarding communication in Public Administrations[17], points out how by now almost all local administrations utilize broadband connections. In 90,9% of Regions and 64,2% of Provinces the connection are already made through optical fibre, while in the other cases the connections are still mainly the xDSL type. Nevertheless, the performance gap between the different districts remains relevant in many Regions.

[15] Between, Ultra Broadband, 2014. Investigation on random sample of 2.000 cases, representing companies' Internet utilization.

[16] Uniontrasporti, Analysis of demand potential for broadband services in industrial areas, 2013.

[17] Istat, Technologies of information regarding communication in Local Public

Figure A.2.6 Districts with broadband connections and the difference between the percentage of districts that use broadband technology and those that claim a nominal speed of at least 2 Mbps

According to the analysis carried out by the European Schoolnet[18] on ICT use in schools, Italy shows a deficient situation in the utilization of information technologies and broadband with respect to other European Countries. While the average number of students per PC is equal to 12 in Italy, the average european value is equal to 4 units. As per the broadband presence, Italy occupies the last position in the European Union, with a higher percentage of students in schools with no broadband connections.

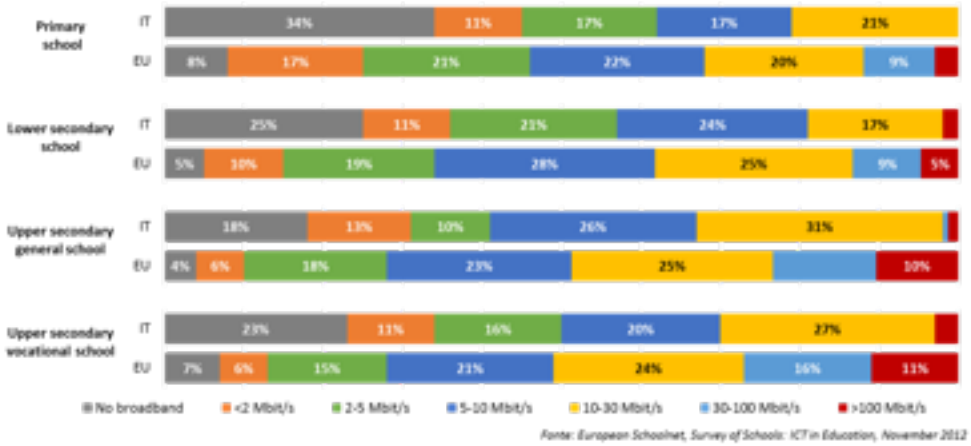
According to the latest records available,[19] only 10% of our primary schools and 23% of our intermidiate schools is connected to the Internet through high speed networks. The other ones are connected through medium-low speed, but in different situations, and often they are only sufficient to connect the staff's office or the technology lab. In almost one every two schools (46%) the

[18] European Schoolnet, Survey of Schools: ICT in Education, February 2013. According to a comparative analysis, the percentage of students in schools with no broadband varies, from 2011 to 2012, from 18% to 34%.

[19] MIUR, The Good School. Let's make the Country grow, September 2014.

connection doesn't reach the classes and consequently doesn't allow the educational innovation that the Network can enable.

Fugure A.2.7 Broadband Speed in schools.



As per the interest and the perspectives for broadband connectivity utilization services, the companies'[20] point of view is not far from all above pointed out with respect to citizens:

- 42% of companies is enormously satisfied with the current level of the Internet connection, while less than 10% claim a high level of unsatisfaction;

- 72% of companies believes that the Country needs new ultra broadband infrastructures, competitive as opposed to what's in progress in the main industrialized Countries. The value grows substantially with the increase of the companies' dimension;

- 53% of comapnies claim a self interest in the utilization of both landline and mobile broadband services; while the prevalence of landline or mobile networks is quite equally distributed, even though minor companies tend to prefer the importance of mobile networks and larger companies preferthe landline;

[20] Between, Ultra Broadband Observatory, 2012, 2013, 2014. Annual investigation on a random range of 2.000 cases, representing companies which use the Internet.

- The proneness to pay a premium price is high only in less the 10% of cases, but doubles from minor companies to medium and large ones. Overall only 1/3 of companies are willing to evaluate the purchase of a connectivity services at a higher financial condition with respect to the current ones.

Also as per companies, Italy will probably not reach the goals expected by the Digital European Agenda for 2015.

Conclusions.

Based on the evidence above it is possible to draw some final considerations regarding the features of the demand for connectivity services in Italy, which must be taken into account in order to create a favorable environment for the development of new network infrastructures:

- The demand for landline connectivity services, home and business, presents levels of penetration and sophistication levels significantly lower than those seen in the main European Countries. However the interest is essentially alligned with the rest of Europe for informaton, communication and entertainment services;

- The large number of “mobile only” users reduces the accessible base for the realization of new generation landline infrastructures, if not considering an increase of landline accesses generated from the development of ultra broadband. So far, despite the evolution of the performance of the broadband fixed network, the consistencies of landline accesses have been gradually decreased in years;

- Although there is a share of Internet users willing to pay a "Premium price" for ultra-fast connections, their influence remains relatively low. The flexibility of the demand to price will depend on the actual increase in performance and on the differentiating services that wil be effectively enabled.

Furthermore, the purchase index of Italian Internet users appears to be still lower than the European average, allthough the medium levels of prices appear to be alligned with the European ones.

- The situation described above, together with the socio-demographic features and the urban peculiarities of our Country, will lead the telecommunication operators to make discerning choices, preferring territorial areas in which the market potential and the financial thikness are such in order to grant an adequate earning from the investments.

Annex C – Guidelines: National Federated Information System of Above and below ground utilities

Reasons of a choice

The Digital Agenda for Europe highlighted the need to implement policies that can reduce installation costs of broadband across the EU, including through proper planning, proper coordination and reducing administrative burdens.

The installation of electronic communication networks for high-speed fixed and wireless throughout the Union requires huge investments identified in more than € 300B, of which a large part is the cost of civil engineering projects.

Limit, in this context, some expensive civil engineering projects would make dissemination of innovation more effective to all European citizens.

In this regard, the benefits arising from the development of infrastructure enabling broadband connections, whether fixed and / or mobile, reside specifically in aspects of techno-economic nature involving the whole country system.

According to McKinsey & Company, the increasing penetration of broadband to the homes of users by 10% results in a boost to GDP of between 0.9% -1.5%.
The OECD points out that the development of fiber optic technology is justified by savings, by between 0.5% -1.5% over 10 years in each of the sectors of energy, transport and health. Chalmers shows that doubling the speed of the broadband leads to an increase of GDP of 0.3%.

In a macroeconomic worn like the present one, the measures designed to improve the efficiency of use of existing infrastructure and to cut costs and obstacles in the implementation of new civil engineering projects are able to make a decisive contribution to the rapid and wide deployment of high speed electronic communications networks.

These guidelines are intended to provide the first step for the realization of the national information system of the federated above and underground in order to put in place a first and decisive acceleration, on the Italian territory, to the development of ultrafast broadband services at 30Mbps, 100Mbps and beyond.

this system will represent, developed widely, a useful and important tool for land management for both central and local authorities.

National Framework

The Italian situation and the need to launch a national register of above and underground

Many of the interventions dedicated to the construction of infrastructure for broadband connectivity and ultra in Italy were made as part of national plans defined by the Ministry of Economic Development during the 2007-2013 programming.
In this regard should be noted the tackling of the digital divide, broadband of at least 2 mbps, and the realization of ultrafast broadband, of at least 30 mbps.

The sum of these two measures, together with the development plans of private operators, means that in December 2014, the national average of coverage from fixed network to 30Mbps attesting just above the 20.1% (compared to the EU average of 61.8%) which is added little 1% coverage by landline to 100Mbps.
Mobile broadband sees Italy with a 3G coverage Adv (HSPA) of 97%, compared with the European average of 97.1%, and a penetration of LTE, which stands at 39.3%, against a European average of 59.1%.
For the realization of ultrafast broadband and achieve the EU objective to bring 30Mbps to 100% 100% of the population and 100Mbps to 50% (take-up rate) by 2020, it was estimated a total requirement of about € 12B.

This estimation is based on the current situation of broadband and ultra throughout the country, the investment plans of the operators, on plans currently in place in the regions of the south and center on the technological evolution that will bring down the costs of installation, on the development of wireless technologies and the exploitation of the copper pair.
The requirement rises to over € 15b€ considering the 100% of the population covered with FTTB FTTH technologies, technologies that go beyond the goal of 100Mbps providing services with capacity of 1 Gbps and higher.

In a challenging environment like the one just described, reusing infrastructure installation is a discriminating factor for the development of NGA on European territory and Italian to achieve the objectives of the EU 2020.
The start of the new ultrafast broadband networks operators and municipalities engage in occupation of several km of public roads. The knowledge of the subsoil, and therefore the reuse of the existing, allow:

- lower by 20-30% the cost of development of optical fiber to the UI
- avoid damage due to interference between the excavations of the operators and infrastructure services under existing
- encourage the investment of operators who can reduce deployment costs
- drastically reduce the inconvenience to citizens
- lessen the impact on the environment

The reduced cost of installation of electronic communications networks and high speed will also help substantially to the digitization of the public sector, enabling users to leverage digital in all sectors of the economy, in addition to reducing costs for

administrations public and greater efficiency of services offered to citizens

The actions taken by the Government in 2014 for broadband development

In view of the current state of penetration of ultra broadband at 30 and 100Mbps, the government immediately put in place stimulus initiatives aimed at encouraging investments using the main carriers regulatory available.

- Dl. 133/2014 "Unlock Italy"
- Buildings broadband read
- Creation of the national information system federated infrastructure (hereinafter the "cadastre")
- Incentive to operators TLC investing in white areas at 30 and 100Mbps
- Using aerial installation
- Simplifications authorization for mobile networks
- L. "provisions for the formation of the annual and multi-state" - "cd stability "
- Allocation of frequencies for increased mobile network ultrafast broadband capacity (L-band)

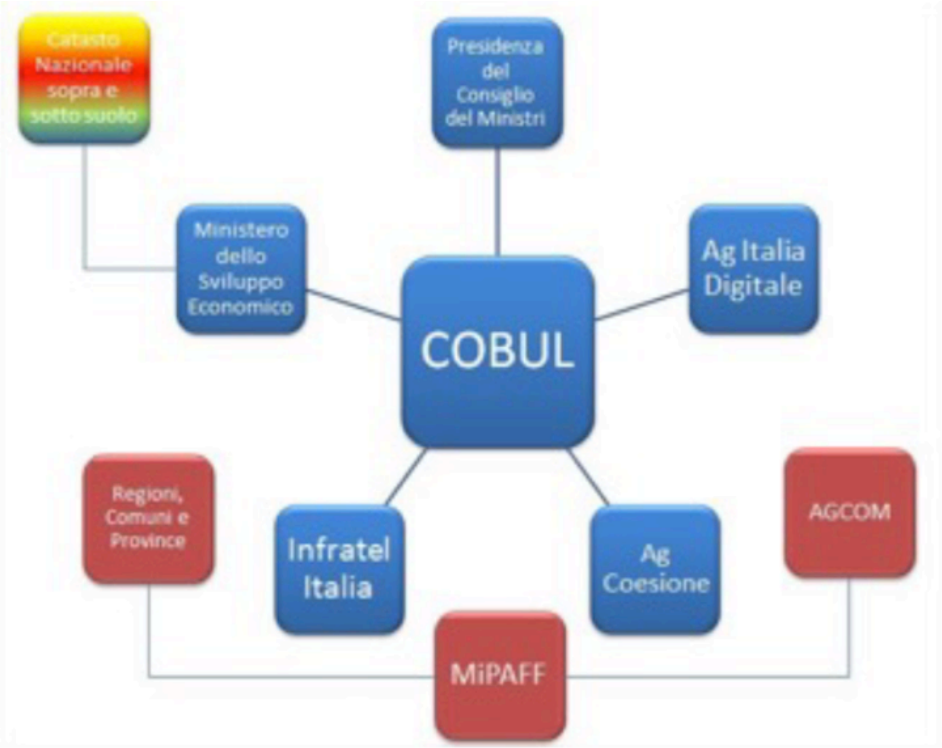
To further increase the factor of coordination and strengthen the action of the Government, in the fourth quarter of 2014, were carried out for consultation two national strategies: one for the spread of ultrafast broadband and one for digital growth

National strategy for the spread of Ultra Wide Band

The strategy is the first step of a larger project that incorporates the objectives of the European Digital Agenda. It is the focus of a new vision of Italy, projected into the future, that invests in future-proof infrastructures and thanks to advanced digital services will be better.
To provide Italy with high speed networks is an indispensable condition, one day, to have a faster, more agile, less bureaucratic Italy.

The strategy, from the point of view of infrastructure, it is aligned to the objectives that were set in 2010 for the second pillar of the European Digital Agenda: an Internet in ultrafast broadband to more than 100 Mbps that has at least 50% of the population as a user.
Parallel to the creation of digital infrastructure, will then be the task of the Strategy for Growth Digital stimulate the creation and supply of services that make it attractive to use.
The main actor of the strategy is the market that is called upon to invest in infrastructure considered strategic for the country's development. Public intervention is then only subsidiary to private investment in order to stimulate them.

Figure A.3.1 The Committee for the spread of Banda Ultrawide (COBUL)



As for the role of the public sector, as a whole this is coordinated by the Prime Minister's Office (PCM) through the Committee for the spread of ultra-wideband (COBUL) that defined this national strategy and will monitor the correct implementation, where necessary by corrective measures even further by identifying solutions that make the most favorable private investment in the field.
The COBUL is made by the Prime Minister, the Ministry of Economic Development, the Agency for Digital Italy, by the Agency for cohesion and Infratel Italy

EU Directives

DIRECTIVE 2 of 2007 (INSPIRE)
The Dir 2/2007, called INSPIRE, establishing an Infrastructure for Spatial Information in the European Community defining general rules aimed aggregation shared and accessible data for the

purposes of Community environmental policies and policies or activities which may have an impact on 'environment.

Inspire shall build upon infrastructures for spatial information established and operated by Member States, applies to spatial data sets that relate to an area where a Member State has and / or exercises jurisdictional rights, are available in electronic format, they are held by or on behalf of a public authority or third parties and cover one or more of the themes.
The data, made available between the United States through an open network, must be open, interoperable, continuously updated and georeferenced.

Among the various categories, namely the "public utilities and administrative services", the directive focuses on sewage, waste management, energy supply and water supply, and public services such as administrative and social administrations public, the civil protection sites, schools and hospitals.

DIRECTIVE 61 of 2014
The Dir 61/2014 provides for measures aimed at reducing the cost of installation of electronic communications networks at high speed by promoting infrastructure sharing existing physical and allowing a more efficient deployment of new physical infrastructure to reduce the cost of installation of such networks.
According to the Directive, Member States shall ensure that each network operator has the right to offer to companies that provide or are authorized to provide electronic communications networks access to its physical infrastructure for the installation of elements of communication networks high-speed electronics.

The Directive identifies in particular:

- network operators involved

- the minimum set of information that must be provided to the applicant for access
- the need for a one stop office for permits
- the need for the infrastructure of buildings in the optical fiber

The national information system of the state above and underground

Introduction

The national federated information system of above and underground (hereinafter the "cadastre") is the pillar of simplification of the Italian BUL strategy. Designed on the principle of 'digital first' is above all an instrument of coordination and transparency.

The "cadastre" in fact not only encourages the sharing of data on infrastructure but also acts as a dashboard to manage and monitor effectively all the measures to promote the development of ultrafast broadband infrastructure.

The "cadastre", developing widely, foster the emergence of a useful and important tool not only for the dissemination of ultrafast broadband technology but also for land management by the authorities, both central and local.

The "cadastre", on that basis, is intended to ensure the rational use of subsoil to facilitate homogeneous diffusion of network infrastructure, both in large urban centers and in disadvantaged or market failure areas, while achieving economies of scale in the medium and long term.

At European level a sample database of existing network infrastructure, including utilities, appropriately geo referenced is the Virgo project (virgoregistry.eu).

The project, coordinated by Infratel, defined in fact the creation of a cadastre in accordance with the Directive 2014/61 / EU, and in line with the application of
Directive 2007/2 / EC INSPIRE.

MISE will manage the " national federated cadastre" in which it will be possible to share data on infrastructure of the above and below ground including even the functional data for monitoring the Italian BUL Strategy.

Will be documented not only the infrastructure but also classical buildings "Broadband ready", those buildings that will be equipped with vertical cabling and fiber optic connection as recently approved by the Decree. "Unlock Italy".

Actors and the roles of competence

In order to engage in an extensive analysis of the above and below ground and build a comprehensive and accurate database, all those who manage infrastructure in the underground and above ground must provide cartographic and georeferenced documentation of the managed infrastructure.
A similar obligation is imposed on the implementing body of the deployment or infrastructure buyer in connection with maintenance or laying new infrastructure.

Figure A.3.2 Examples of experiences in regional and national cataloging data

TIPOLOGIA	NORMATIVA	COMPETENZA
Catasto delle infrastrutture e reti sotterranee	Legge regionale n 7 del 2012	Regione Lombardia
Catasto Regionale degli Impianti di Telecomunicazione	Legge regionale n 27 del 2002	Regione Emilia Romagna
Catasto Regionale delle infrastrutture TLC.	Legge regionale n 31 del 23 dicembre 2013	Regione Umbria
Catasto Regionale delle sorgenti fisse degli impianti radioelettrici per telecomunicazioni e radiotelevisivi con potenza superiore ai 5 W	Legge regionale 2 del 2000	Regione FVG
Catasto informatizzato delle strade	D.M. 01 Giugno 2001	ANAS
Catasto delle Reti Radiomobili di Comunicazione Pubblica e degli Archivi Telematici	D.M. 29 gennaio 2003, in attuazione dell'art. 12, com. 3, Dlgs. 198/2002.	Ministero dello Sviluppo Economico
Catasto delle Frequenze	L. 249/1997 Art. 1, com. 6, lett. a	AGCOM (ROC).
Banca di dati di tutte le reti di accesso ad internet di proprietà sia pubblica sia privata	D.L. 23-12-2013 n. 145	AGCOM

In Fig. A.3.2 Examples of experiences, on a national and regional level, of cataloging of data on infrastructure above and below ground.

That said, the potential actors, then, who for various reasons will be affected by the establishment of the "cadastre" are:

- Public Administration
  - MED with the support of Infratel
  - Central
  - Local

- Private operators
  - TLC operators, both fixed-line and on mobile network;
  - Service providers including those that manage services:
    - Gas (DIR EU 61/2014)
    - Electricity including public lighting (DIR EU 61/2014)
    - Heating (DIR EU 61/2014)

- Water including sewage systems, waste water treatment and drainage systems (DIR EU 61/2014)
- Transport including railways, roads (DIR EU 61/2014)

- Citiziens

Anyone running above and underground reusable infrastructure for the development of high speed communication networks must share this data through the "cadastre".

The "cadastre" will be attended by all parties involved in the development of ultrafast broadband strategy, each for its specific area of competence.
In particular:

- COBUL Participants;
  The COBUL as part of the national BUL strategy and in reference to the "cadastre" approves these guidelines and is constantly updated on the construction and operation of the same.

- Local Authorities;
  Besides being the first subjects that will benefit from the services offered by the "cadastre", it will be their task to provide EL retrieve data and to make them available by interfacing the local databases if available.

- ANCI – Regions;
  The Regions and ANCI will provide coordination of Local Authorities.

- other Ministries;
  In order to streamline administrative procedures and obligations for operators, all administrations that implement data for the operators will be involved

Also all ministries that manage information in the development of ultrafast broadband infrastructure and connectivity will be involved to enrich the “cadastre".

- AGCOM

  AGCOM which is required to implement the database of all access networks owned by both public and private, will be involved to make those databases interoperable with the forthcoming 'cadastre'.

In order to allow proper interfacing between all the actors involved a working group within Mise will be set up in order to define the procedures for setting up and functioning of the National Federated Information System for infrastructure interfacing where considered necessary with all the organizations involved in the project.

Infratel Italy, in collaboration with MED, is entrusted with the role of defining the development and commissioning of the system and the management of the land registry.

The "cadastre", developed capillary, is intended to make available all the experience gained locally to encourage the creation of a useful and important tool not only for the spread of ultrafast broadband infrastructure, but also for land management.

Functional requirements and architecture of reference

The "cadastre" will offer a portfolio of value-added services, addressed to the PA, the Operators and citizens. The "cadastre" is therefore not a simple database on which will be conveyed or made accessible data for geographically distributed infrastructure.
the development of ultra-broadband technologies. The services that will be paid will be:

Infrastructure management of the above and below ground

The data will remain in the proprietary systems of those involved but will be made available to the “cadastre” through common services and interfaces. This allows to always have updated information, maintain management responsibility to owners and at the same time to share information and to provide services, processes and development framework in a profiled way for all involved in the process of development and infrastructure management of the above and below ground, functional to the development of ultrafast broadband infrastructure: ministry, regions, municipalities, operators, citizens. The data thus collected will be made available in the form of interoperable and open data, in accordance with paragraph 3 of Article 68 of Legislative Decree 7 March 2005, n. 82, which can be processed electronically and georeferenced without compromising the privacy of sensitive data.

- Operators’ request management
  - The "cadastre" will constitute in fact a single platform where operators of the underground (not only telecommunications operators) can design interventions and apply directly to Local Authorities without leaving the “cadastre”, as the "cadastre" should serve as one-stop office for civil works’ permits.

- Single point of management for municipalities
  - The project is accompanied by the request of the legal representative of the operator may be approved by the technical department of the local municipality providing the operator with the tracking number of the request until the permit is released

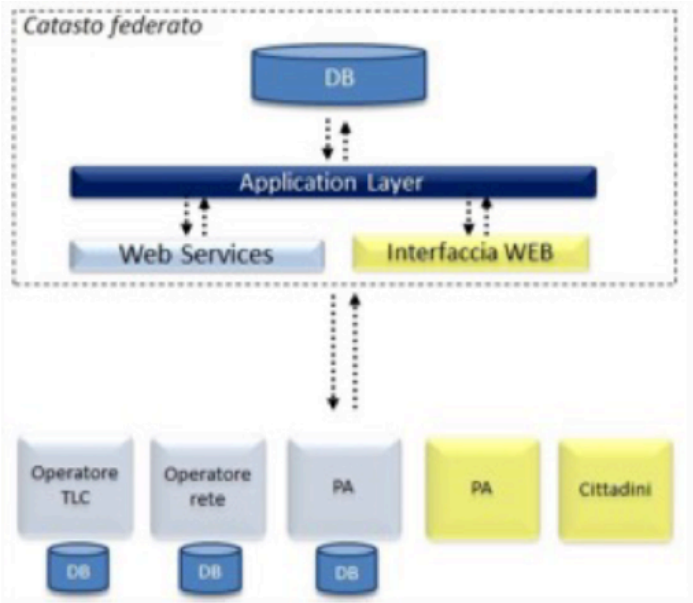
- Sharing between operators of the infrastructure in place and to be implemented
  - The system allows to coordinate the excavation works between different operators; an operator which applies for civil works through the cadastre launches a notification to the registered operators that can share construction

facilities reducing costs of both operators and reducing inconvenience for citizens together with producing less pollution.

- Management consultations on operators' investment plans
- Monitoring investment plans (public and private)
- Public Services and open data
  - The cadastre will provide services to citizens such as local areas levels of service provision and also time of implementation of new infrastructure.
- Any other service useful to the digitization of the country.

The cloud-based design will pivot on the sharing of information (data sharing) from all the players involved. A multilayer system, characterized by policy of access to data differentiated according to type of user (Fig. A.3.3).

Figure A.3.3 Functional architecture of the Federated Cadastre



The master / server open source will allow, those who already have available tools for cataloging data, to interface directly with the

cadastre. For those lacking of proper cataloging software will be able to use the client interfaces / slave through which to load and manage their data.

Possible infrastructure to be surveyed

Both the EU Directive INSPIRE 2007 EU Directive 61 of 2014 identified some of the infrastructure to support the development of ultrafast broadband infrastructure.
In order to spread as quickly as possible throughout the country the use of ultrafast broadband fiber-optic and wireless technologies, while achieving economies of scale in the medium to long term, all possible infrastructure in the above and underground suitable for the above purpose will be surveyed.

Figure A.3.4 Possible infrastructure of the above and the subsoil according to EU 2/2007 and 61/2014

	DIR 61/2014	DIR 2/2007
Impianti Idrici	V	V
Impianti fognari	V	V
Impianti Energia Elettrica compresa illuminazione pubblica	V	V
Impianti Gas	V	
Impianti di TLC		
Impianti di riscaldamento	V	
Trasporti comprese ferrovie e strade	V	

Minimum information and access policies

The Dir 61/2014 EU provides a few simple guidelines (Article 4 paragraph 1) on the minimum information necessary for those who require the access to infrastructure, such as:

- Site
- Route
- Type and use of existing infrastructure
- Point of contact

Based on this experience, and in view of the EU Inspire Dir that identifies the technical features and the relative formats for open data, the Agency for Digital Italy has drawn up the technical specifications identifying the appropriate standardized templates for data entry type:

- Paths for linear elements and punctual nodes of water supply systems
- Paths for linear elements and punctual nodes of water disposal network
- Paths for linear elements and punctual nodes of power grid
- Paths for linear elements and punctual nodes of gas network
- Paths for linear elements and punctual nodes of telecommunication network
- Common attributes to all classes

These technical specifications (see Annex 1) will be the basis of the national federated "cadastre" of the above and below ground. Access to the cadastre will be ruled by a policy that provides different profiles depending on the type of user.

Regulatory issues

For the realization and the continuous updating of the "cadastre" a national regulation has to be put in place.
Interesting insights proposed by some regions, especially Lombardy Region, and the same DIR 61/2014 EU, that will analyzed to verify applicability at national level.

For example:

1. All those who manage infrastructure in the underground and above ground (as described in paragraph 3.4), from December 1st 2015 and no later than 31st January 2016, must begin to share their data in an open and georeferenced form. The failure to comply with this requirement will result in a fine of 15 € per meter of infrastructure as well as prohibiting the issuance of new permissions to work for the construction of infrastructure in the subsoil of the same territory (ref. LR Reg. Lombardia n. 7 of 2012) .

2. The authorization for the construction of new civil infrastructure for the spread of BUL TLC will not be issued if the same service can be ensured through the use of existing civil infrastructure, without compromising the efficiency and effectiveness of services provided (ref. LR Reg. Lombardia 26 of 2003).

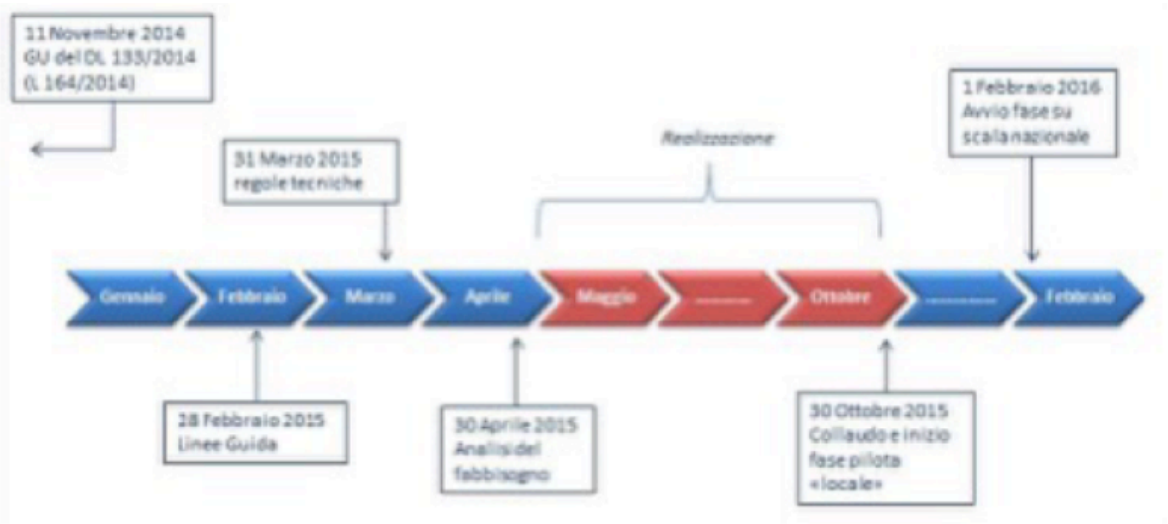
3. Member States shall ensure that each network operator has the right to offer to companies that provide or are authorized to provide electronic communications networks the access to its physical infrastructure for the installation of elements of high speed electronic communications networks. Conversely, Member States may provide the right for operators of public communications networks to offer access to their physical infrastructure for the installation of networks other than electronic communications networks (ref. DIR 61/2014 EU).

4. Member States shall ensure that, upon written request of a company that provides or is authorized to provide public communications networks, each network operator has the obligation to meet all reasonable requests for access to its physical infrastructure according to fair and reasonable terms, including those on price, for installation of elements of high speed electronic communications networks. (ref. 61/2014 EU DIR)

Time and costs

On November 11, 2014 was published in the GU DL 133/2014 establishing the "cadastre"; by the second half of February, guidelines will be compiled and published; by March 31, with special DM, technical rules we will defined.

Figure A.3.5 Timing for the realization of the national federated "cadastre"



By November 2015, considering intermediate stages of analysis and preparation of the management platform, the "cadastre" will go into "local" or "partial" pilot-scale to begin the procedures for coordination / implementation of the data on "national" scale from 1 February 2016.

The cost items are identified in:

1. Costs for the construction of the platform

2. Costs for the digitization of data (geo-referenced and not georeferenced) and platform data loading if digital data base are not available

3. Costs for the data aggregation and platform data loading if data base are available

4. Management costs

5. Maintenance costs

6. Costs of central and peripheral staff training

The costs referred to in point 1 shall be sustained by the Ministry of Economic Development.

It was estimated (Table A.3.1) that thanks to the realization of the "Cadaster", and then to its widespread use by TLC Operators, about 20-30% of the cost of development of the optical infrastructure per UI will result in economics savings.

Table A.3.1 Average cost savings per UI resulting from the implementation of the Cadastre

Tecnologia	Cluster	Risparmio (%)	Range di costo finale (€ x UI)
FTTB	A	20-30	200-250
FTTB	B	20-30	200-250
FTTB	C	20-30	450-550
FTTC	C	20-30	150-180
FTTC	D	20-30	>200

The costs shown in the table do not include the vertical infrastructure internal to the building that if not available can be estimated at an additional € 150 for UI.

Summary of Objectives

With these guidelines, the Government intends to give a further boost to the development of ultrafast broadband networks in view of the European objectives set by the EU 2020 agenda and the current situation concerning the Italian spread of electronic communications networks and services.

The infrastructure "cadastre" of the above and below ground is a tool that can improve the efficiency of use of existing infrastructure and reduce costs and obstacles in the implementation of new civil engineering projects. A decisive tool for the rapid and wide deployment of high speed electronic communications networks on the Italian territory.

The "cadastre", developing widely, foster the emergence of a useful and important tool not only for the dissemination of ultrafast broadband technology but also for land management by the authorities, both central and local.

The realization, defined by Decree 133/2014 and coordinated within the National Strategy for the spread of Ultrafast broadband, will be consistent with the goals of the EU 2020 agenda and is consistent with the indications of the European Directives 6/2007 (Inspire) and 61/2014, also in order to be harmonized with the immediate actions taken in other Member States