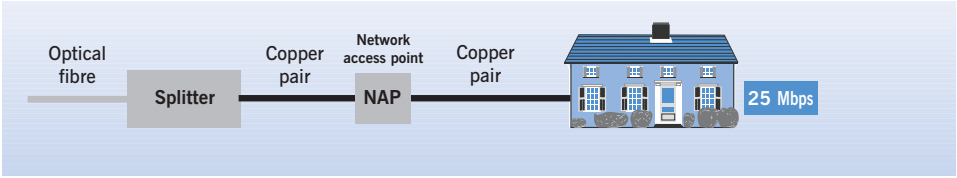
11 New issues

Technological disruption of a migration to fibre

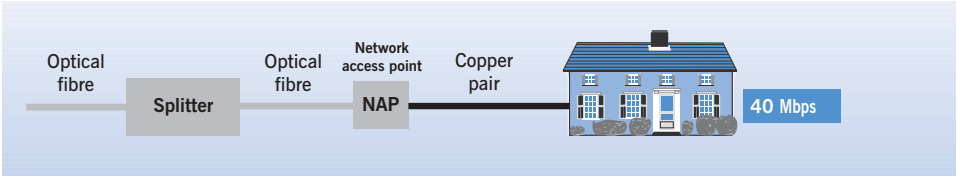
Broadband is becoming increasingly ubiquitous in France, thanks in particular to DSL technologies. With close to 12 million ADSL connections on 1 January 2007, France is among the top-ranking countries in Europe having nearly 40% of households equipped with broadband.

One of the most outstanding trends is the increase in transmission speeds on offer. The copper network does not have infinitely expandable capacity, however, which is why optical fibre is now becoming the technology of choice for delivering ultra-broadband solutions. Fibre to the home (FTTH) networks and, to a lesser extent, fibre to the building (FTTB) do indeed appear to be mature and durable solutions for providing a response to future needs. Furthermore, in certain countries such as the Netherlands and Germany, the density of the local copper sub-loop and the way it is engineered can justify the deployment of VDSL2 at the network access point level (referred to as fibre to the cabinet or FTTCab). Such does not, however, appear to be the case in France.

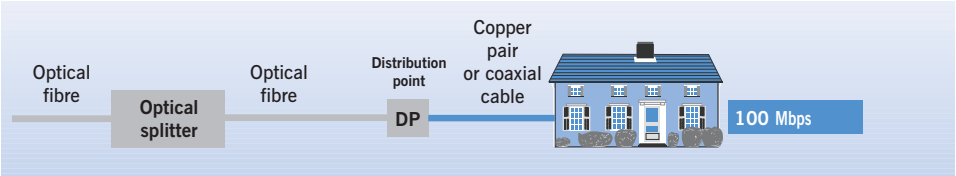
Unbundling



FTTCab



FTT Building câble THD



FTT Home

It is therefore likely that there will be a new wave of local loop deployment to serve end users directly. Around the world, it is Asia – and Japan in particular – which is making the greatest strides, with 31% of broadband connections now over optical fibre. The momentum in the United States is growing, driven by operators (Verizon, ATT) working to compete with cable providers – a trend which is helping to bring down equipment costs. Although fibre rollouts in Europe are fewer and far between, interest in ultra-broadband is growing steadily.

Large-scale fibre deployment will nonetheless require massive investment, particularly if the new local loop is designed to replace the existing copper loop, even in densely populated zones. There is also a good deal of uncertainty over the additional revenue that can be generated by the use of these new technologies, which can deliver speeds of around 100 Mbps (e.g. HDTV), at a time when the content sector is becoming increasingly concentrated.

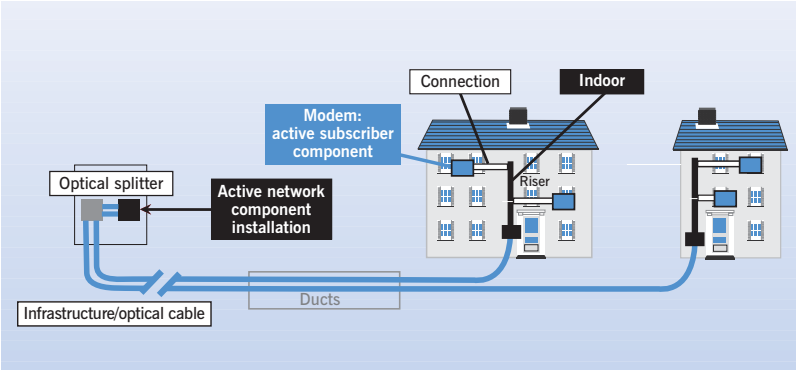
Amidst these issues arises the question of public authority involvement to encourage and facilitate the technological disruption of a migration to fibre.

A. Cost of deploying an FTTH network

An operator wanting to deploy a city-wide FTTH network, with the goal of providing to-the-home fibre optic access to an essentially residential clientele will shoulder:

- passive infrastructure costs, which correspond: 1) to civil engineering for the construction of infrastructure to support optical cables from the network core to the foot of each residential building; 2) optical cable supply and pulling costs; 3) indoor cabling in individual housing units, including the installation of risers and the equipment for connecting end users to the indoor network;
- the cost of active equipment located at the network headend and in subscriber premises (customer modem).

FTTH Network



An initial assessment of the costs involved in deploying an ultra-broadband network reveals that passive infrastructure represents by far the largest proportion (between 70% and 80% of the total cost). This is driven in particular by the civil engineering costs, which are over 50% of the total cost in urban areas (based on the hypothesis that the operator will need to dig trenches for the entire network), as well as the costs associated with the terminal portion of the fibre network (notably indoor cabling in residences). On the other hand, the cost of active equipment, which is already a more minor item, will continue to decrease as fibre optic reticulation becomes a mass market.

A high rate of passive infrastructure sharing (ducts, indoor cabling) will be crucial to enabling deployments beyond just the densely populated zones. This system of sharing could be implemented in one of two ways: either through the use of existing infrastructure, or by sharing the costs when infrastructure needs to be built.

B. Public authority support for ultra-broadband

Because of the very high costs involved, it is the Authority's view that the action taken by public authorities must be aimed at lowering the entry barriers for all of the players by encouraging in particular, shared investment for civil engineering and for the terminal portion of fibre networks.

At a press conference on 10 November 2006, the Authority announced that efforts in this direction had begun.

1. Role of local authorities

Local authorities enjoy a decisive form of leverage when seeking to develop telecommunications in their region given that, as managers of the public domain, they can provide incentives for sharing civil engineering and take more direct action through public-initiative networks.

This form of intervention has been much discussed by the public-initiative networks committee, CRIP (*Comité des réseaux d'initiative publique*)[1], within which a working group was formed to address the issues of fibre access (FTTx). A summary of the

1 - Cf. Part 9, Chapter 2.

group's initial efforts was published in 2007, and the Authority will be publishing guidelines for local authorities wanting to stimulate the development of ultra-broadband.

What are the main forms of intervention open to local authorities?

- sharing civil engineering when new construction is required. To start with, all roadwork activity must be coordinated (renovations, planning, new roads, burial of electrical or telephone cables, sanitation network renewal, etc.) to allow for shared investment. When awarding rights of way to an operator, local authorities can also encourage the installation of reserve capacity for third-party operators;
- the production of precise geographical information on the telecommunications networks and civil engineering elements in the area, and on their availability, to encourage better use of existing infrastructure. This could involve requesting the necessary information from the operators concerned, or a more direct policy of conducting an inventory of these installations;
- making ducts available to operators. These can be existing public ducts or underground galleries located in the public domain, such as the open access sewers in Paris. But it is particularly the various construction projects that involve opening up footpaths, streets and roads that provide opportunities to install reserve ducts for ultra-broadband, at a limited cost;
- the launch of public-initiative projects, in accordance with Article L.1425-1 of the local and regional collectivity code, CGCT (*Code Général des Collectivités Territoriales*). Compared to the other types of project implemented up to now (collection networks, business parks), this represents a much grander scale of investment. The European Commission has not yet ruled on the field of intervention open to local authorities in the area of broadband, with respect to the rules for State support.

2. Regulation and standardisation

The support that public authorities provide for ultra-broadband can also go by way of legislative or regulatory measures which seek to improve the economic equation. Incentives may also be used.

The inter-ministerial committee for the information society, CISI (*Comité interministériel pour la société de l'information*) on 11 July 2006 elected to form a working group dedicated to creating a "multimedia home" label – the goal being to improve access to ultra-broadband in households. Under the aegis of the Ministries of Housing and of Industry, with support from the general council for information technologies (*Conseil général des technologies de l'information*) and the general council for bridges and roadways (*Conseil général des ponts et chaussés*), this working group is comprised of telecom operators, property owners and builders, and local authority representatives. ARCEP is involved in this working group.

3. Regulation

Parallel to the work being performed with local authorities within the public-initiative network committee, CRIP, and its involvement in the working group dedicated to the "multimedia home" label, the Authority has identified two areas of focus for 2007: access to existing ducts and sharing the terminal portion of fibre optic access networks.

a. Access to existing ducts

As it stands, no single operator has built a large-scale fibre optic access network, which does not mean that all the players are on an equal footing. In particular, France Telecom may have access to a considerable quantity of reserve civil engineering ducts inherited from the former public monopoly. Given the importance of civil engineering in the economic equation of fibre rollout, this could go a long way in reducing the costs of FTTH deployment for France Telecom.

As a result, in 2007 ARCEP will be examining the relevance and feasibility of regulating France Telecom ducts by:

- assessing the availability of this infrastructure to measure the scope of a possible access offer;
- examining the technical and operational mechanisms that could be put into place as a result, particularly with respect to prior information;
- defining the legal framework adapted to this regulation.

b. Sharing the terminal portion of fibre access networks

Deploying a fibre access networks into users' homes and to the shared areas in collective buildings gives rise to a number of practical issues for operators, as well as issues for property owners and managers, particularly in collective buildings.

It seems unlikely that several operators will deploy their network in the same building. It is not even certain that property co-owners will allow a second operator access to the building, given the nuisance caused by the work to be performed. In addition, indoor wiring represents a set cost per building that a second operator would not necessarily be able to amortise.

As a result, there is the danger of all of a building's tenants having *de facto* dependence on the operator that is the first to install its equipment. Property managers and local authorities alike are aware of this danger, and want to implement a system that would guarantee all operators access to the network installed by the first entrant. This concern echoes the desire expressed by public authorities to share investments in passive infrastructure.

This system could take the form of mutual access agreements between operators. Should this not occur, standardisation and even regulatory measures will prove necessary.

Deregulation of fixed telephony retail markets

In 2006, ARCEP began easing the regulation governing fixed telephony retail markets. The first phase[2] put an end to tariff control applied to France Telecom offers in the residential calling market[3]. The Authority has planned two additional stages, the goal being to fully rescind regulation of fixed telephony retail markets.

2 - ARCEP Decision No 06-0840 of 28 September 2006.

This change to the regulatory mechanism will mark the transition from asymmetrical regulation in retail markets to symmetrical regulation (i.e. applying equally to all market players and no longer to just the SMP operator, France Telecom) re-centred around consumer protection. Naturally, ARCEP will continue to monitor these retail markets in which the competition authority (*Conseil de la concurrence*) will ensure compliance with common competition law. Wholesale fixed telephony markets will, however, continue to be regulated, while universal service will also continue to be supervised by the regulator.

3 - Cf. Part 7. Chapter 2.

A. Easing retail fixed telephony market regulation

In its market analysis decision[4], the Authority imposed several obligations on France Telecom in the wholesale and retail fixed telephony markets, to prevent certain practices and to allow for the development of effective competition. As a result, in retail markets France Telecom must: act in a non-discriminatory fashion, not practice unfair bundling, not charge excessive prices or create a price squeeze. To ensure compliance with these obligations, France Telecom is also required to submit its retail offers for prior approval, and perform cost accounting for its services.

4 - ARCEP Decision No 05-0571 of 27 September 2005.

In accordance with the principles of the new national and European regulatory frameworks, the Authority favoured imposing remedies in wholesale markets to prevent identified competition issues from occurring in retail markets. It nevertheless elected to impose obligations directly on retail markets, specifying in its market analysis decision that when regulated wholesale offers allowed alternative operators to create competitive and commercially innovative offers nationwide, the Authority would review the regulatory provisions governing fixed telephony retail markets.

ARCEP feels that the current state of competition justifies such a review. The solutions introduced in the wholesale market, such as carrier selection and wholesale line rental (*VGAST*), give alternative operators the possibility of competing effectively with the offers marketed by the incumbent carrier. Furthermore, the considerable development of IP telephony offers has also increased competitive pressure in the calling market to a significant degree.

The competition landscape is not the same in all fixed telephony markets, however: residential markets are far more transparent than business markets, in addition to benefiting from an operational wholesale line rental offer (*VGAST*) since spring 2006. In the same vein, competition in calling markets is fiercer than in access markets. The approach being taken by the Authority is based on a sequencing tailored to this heterogeneity of competition conditions.

B. A three-step approach

The Authority has opted to alleviate retail fixed calling market regulation in three stages, each one concerning a different segment of the market. The operational implementation of the process was submitted to public consultation on 25 July 2006.

1. Residential calling markets

The first of these stages concerns residential calling markets, and has already been implemented by the Authority[5]. These are the markets where competition is the most advanced, in addition to being the most transparent by nature. Most of the obligations imposed on France Telecom in these markets have been lifted. The incumbent carrier is thus no longer required to submit each of its residential calling tariff offers for prior approval[6]. For the meantime, the only obligations that have been maintained for these markets are non-discrimination and cost accounting, but they too could be lifted at a later stage.

5 - *ARCEP Decision No 06-0840 of 28 September 2006.*

6 - *This first stage of easing regulation does not concern bundled, access + calling offers, as the remedies applied to access markets have not yet been modified.*

2. Analogue access and calling offers

The Authority plans to extend deregulation to all analogue line calling and access offers, whether residential, business or corporate. Offers that combine digital and analogue lines will continue to be regulated. This second phase can begin once enough time has elapsed to allow the Authority to judge the impact of the *VGAST* wholesale line rental offer, and to ensure that the quality of this service in the business market is satisfactory. ARCEP plans on implementing this phase by the end of the first half of 2007.

3. Digital access and calling offers

The final stage of retail telephony market deregulation is expected to be the deregulation of all digital line services, both access and calls. These services concern chiefly the business and corporate segments for which a number of calls to tender have been issued and which, as a result, are more opaque. This last stage could be put into operation once the accounting separation obligation imposed on France Telecom has come into effect, which will make it easier for sectoral and competition authorities to monitor France Telecom activities. ARCEP plans to begin this phase in early 2008.

C. Monitored markets

The deregulation process will mark the transition from sector-specific regulation of retail markets to regulation focused on wholesale markets: once the process is complete, the Authority will no longer have the power to intervene *ex ante* in retail markets in cases of abuse of dominant position. This will be responsibility of the competition authority (*Conseil de la concurrence*), which is in charge of enforcing common competition law, thereby protecting market players against possible anti-competitive behaviour.

ARCEP will nevertheless continue to monitor retail markets closely, particularly in view of adapting the regulation governing wholesale markets. To this end, France Telecom will be required to submit to the Authority, for informational purposes, a description of its new retail offers before they are launched commercially. In addition, to ensure that players are better informed, ARCEP published an efficient alternative operator cost model for providing communication services in March 2006. The Authority will incorporate the costs of providing access services using the VGAST offer into the model, and will update it on a regular basis.

Furthermore, France Telecom services that fall under the scope of universal service (i.e. residential subscription for all calls made based on that subscription) will continue to be supervised by the Authority to ensure they are affordable. To this end, a multi-annual price cap was implemented in July 2006 for a range of calls included in the scope of universal service, taking into account a portion of the productivity gains and changes to external interconnection charges (voice call termination in particular).

D. Towards more symmetrical regulation

As the markets have now reached a certain degree of maturity, the players have access to adapted solutions. From hereon in, ARCEP thus hopes to accentuate the symmetrical regulation that it has brought to retail markets, to allow consumers to benefit from the positive effects of competition. ARCEP action will therefore seek to perfect the way the oligopoly market structure operates, in a manner that benefits consumers. In particular, it will continue its work on number portability and operator switching costs. All of these issues concern residential customers as much as large public and private accounts.

Fixed-mobile convergence

Now that both fixed and mobile telephony markets are reaching a new threshold of maturity – with mobile penetration rates having virtually reached their ceiling and the widespread availability of unmetered fixed calling offers – the need to renew and flesh out the service offer with new, higher margin products, the opportunity to develop the existing customer base, and the maturity of the technologies all create a propitious environment for the convergence of the service offers marketed in the historically autonomous segments.

Capitalising on this new environment, several fixed-mobile convergence offers were introduced in 2006, consisting either of simply marketing bundled fixed and mobile calling services or of actual technical convergence between fixed and mobile networks. These services offer end users a number of advantages, thanks to their simplicity (single invoice, single handset and often unmetered calling to fixed lines) and, for fixed operators, they could provide a growth outlet that will allow them to counteract the ongoing decline of their fixed calling revenue.

A. From simple bundling to a hybrid access offer

A convergence offer can be purely commercial, and not incorporate any technological advancement. From a functional standpoint, these offers therefore combine two services, one fixed and one mobile, using separate access modes and distinct handsets but which are marketed together – in some cases including single billing, discounts and an option of additional services in the bundle. These offers are already common in the business market, and are beginning to appear in the consumer market as well.

The next level of convergence makes it possible to offer new services as add-ons to fixed and mobile access offers, which nevertheless remain distinct. Cases in point include unified voice messaging, intelligent call forwarding from fixed to mobile lines, unified contact management, presence management, a private numbering plan for a business's fixed and mobile lines, etc.

There are also "virtual" convergence offers, such as cell-id services based on a purely mobile architecture and which, for the operator, consist of offering discounts on calls made from within the radio network cell(s) that correspond to the customer's home zone.

And, finally, in its most technologically advanced version, convergence can allow operators to market an entirely new type of service: a hybrid product based on both fixed and mobile networks, and not simply a juxtaposition of the two forms of access. Here, subscribers can make calls on their mobile phone using a fixed Wi-Fi local loop instead of the mobile operator's wireless local loop. As a result, they will enjoy preferential tariffs when calling from their mobile using the fixed local loop. There are several advantages for the mobile operator marketing this type of convergence offer: alleviating traffic on its mobile network (which can be particularly appealing in densely populated areas), and it may earn mobile call termination charges even though the call is terminated on the fixed local loop.

Most projects of this type are still in the trial or development phase. The concepts being used by the different players around Europe nevertheless appear to all have a common architecture at their core: a hybrid phone that enables access to mobile networks (GSM/UMTS) and which are Wi-Fi or Bluetooth compatible for connecting to a fixed broadband access point. Starting from this common base, the various players are working to achieve the perfect mix to then design an offer that combines:

- service availability for roaming customers;
- superior quality of service for fixed access at home or in the workplace, and possibly in public Wi-Fi hotspots;
- hybrid tariff schedule for calls depending on the network employed, competitive with current fixed and mobile offers;
- line of high value-added complementary services (single number, data option, multimedia services, etc.).

Worth noting is that the use of a dual-mode handset does not necessarily involve technically convergent elements, per se: some offers are not based on the integration of fixed and mobile networks, handover between GSM and Wi-Fi networks is not ensured and the alternative local loop can only be accessed via manual user selection.

In Europe, British Telecom has been a pioneer in fixed-mobile convergence with its *Bluephone* project, which was launched in 2003, and released commercially in 2005 under the brand name of BT Fusion. At the start of 2007, several operators in France (Free, Orange, Neuf Telecom) were marketing convergence offers, either bundles or technically convergent depending on their strategy, as well as "virtual" convergence offers (SFR).

B. Convergence and fixed-mobile substitution: two virtually conflicting strategies

Fixed-mobile convergence is clearly distinct from the pure fixed-mobile substitution strategies which mobile operators instituted from the start, and which are geared to increasing customer consumption, hence use of their network, to the detriment of fixed network usage.

The growing volume of mobile calls made from the home or the workplace is proof of their success. This mobile operator growth strategy is based on three elements. First, the introduction and faster generalisation of tariff structures encourages increasing consumption (switch to higher volume offers, development of unmetered calling, etc.).

Second, the historical gap between fixed and mobile call termination tariffs penalises fixed operators from a structural standpoint when designing their offers, and further fuels the fixed-mobile substitution trend. It is therefore more difficult for a fixed operator to market a flat rate or unmetered offer for fixed-to-mobile calls than it is for a mobile operator. The appeal of the offer for customers and, in turn, operator margins on this product, is extremely sensitive to the call termination differential and to the breakdown of customers' fixed and mobile calls.

And, finally, mobile calling goes hand in hand with the growing trend of individualised consumption and the personalisation of, and even identification with the mobile handset – which is diametrically opposed to the role of the fixed line which belongs to the entire household and not the individual. This individualisation is also adding fuel to the fixed-mobile substitution phenomenon.

As a result, convergence and pure fixed-mobile substitution are virtually conflicting strategies. Operators which enjoy presence in both the fixed and mobile markets, notably incumbent carriers, appear to be steering chiefly towards fixed-mobile convergence strategies. Meanwhile, other players with a stronger presence in the mobile market, and mobile pure players, appear ready to push their fixed-mobile substitution strategies even further.

This trend of growing fixed-mobile substitution derives from two factors: first, the increasing ubiquity of high volume voice offers as UMTS networks are deployed, and the resulting excess network capacity and, second, a favourable balance in call termination revenue for mobile operators between incoming and outgoing traffic.

C. Convergence and the dangers to competition

As fixed-mobile convergence develops, questions may arise over its impact on market competition.

The development of new offers by a vertically integrated incumbent carrier, which is the SMP operator in fixed telephony markets and controls an essential infrastructure, namely the local copper loop, and which in Europe (with the exception of the UK) enjoys a pre-eminent position in the mobile calling market, could lead to serious competition issues: predatory effects between the wholesale and retail markets, cross-use of fixed and mobile subscriber bases and abusive service bundling.

D. Lengthy maturation process for the technical components

Although offers are becoming increasingly numerous, their industrialisation and large-scale commercial release will take time, for both technical and commercial reasons. An impressive number of challenges still exist:

- integration of fixed and mobile networks which may be of different generations, at a time of migration to NGN;
- mastering continuity of service when handing over from one network to the other;
- mass production of hybrid handsets that continue to incorporate the features and autonomy of current mobile handsets;
- standardisation of the functional specifications of technical solutions, prior to any mass production.

The role of the FMCA[7] and its successful integration with various existing international forums – 3GPP SA1, CT1, 3GPP2, ETSI –TISPAN, IEEE and the Wi-Fi Alliance – could thus be decisive in shaping the future of fixed-mobile convergence.

And we must not overlook the fact that development of the offer needs to go hand in hand with a growth in demand, which will require operators to design a streamlined offer that manages to overcome the subjacent technical complexities, and to develop tariff offers that appeal to end users – while continuing to fulfil the promises to increase ARPU (average revenue per user) that were made when the start of the fixed-mobile convergence era was announced.

7 - The FMCA (Fixed-Mobile Convergence Alliance) seeks to promote fixed-mobile convergence, and particularly to accelerate the development of hybrid handsets. At the end of 2006 its membership included 26 operators.

The digital dividend

A. A decisive issue for telecommunications

New wireless systems are rapidly opening up a host of possibilities: evolution of UMTS, WiMAX, DVB-H (mobile TV), etc., and further innovations will undoubtedly emerge in the coming years, or even months. This powerful growth momentum of new wireless broadband systems cannot be sustained and develop unless the necessary frequency resources are identified and made available.

These resources will need to be tailored with a view to achieving full coverage: the number one priority for consumers. This means coverage not only in urban areas but nationwide, both outdoors and indoors.

Here, the frequencies that will be freed up by the transition from analogue to digital TV broadcasting represent an exceptional opportunity.

The upgrade of the terrestrial broadcasting service will increase the efficiency of spectrum use considerably, as digital broadcasting is roughly six times more efficient than analogue. This technical evolution will also make it possible to free up a sizeable quantity of spectrum: an increase in available resources referred to as the digital dividend.

This digital dividend is a particularly significant opportunity given that the bands involved are below 870 MHz, in other words in the most coveted portion of the entire spectrum, offering particularly attractive physical radio propagation characteristics, which enable both a long range and good indoor penetration.

These frequencies are currently used by analogue television, based on a frequency plan established some 50 years ago, at a time when little else employed these resources. The new wireless applications that have emerged since that time had to be introduced into the ever higher end of the spectrum – less suited to achieving widespread coverage and coverage indoors, and so making network deployment more costly.

As a result, second generation mobile (GSM) was first introduced in the 900 MHz band and then in the 1800 MHz band, and third generation mobile telephony (UMTS) is currently being deployed in the 2 GHz band, with an extension planned in the 2.7 GHz frequency band. The inability to access lower bands, and the ensuing sole option of using increasingly higher bands are clearly obstacles to the economic growth of new wide-coverage broadband wireless access systems. This means that 2.6 times fewer base stations in the 500 MHz band than in the 2.1 GHz band are needed to cover the same zone under equal conditions.

This is why the Authority feels it is important that Europe seize the exceptional opportunity provided by the migration of television to digital, and that the work being performed to identify and, if possible, harmonise all or a portion of the digital dividend for new wireless broadband uses when analogue is switched off, be completed in the near future.

Early and relatively harmonised identification of these frequencies would send out a strong message to European and French industry players, providing them with an incentive to undertake the R&D needed to prepare for the new generation of wireless ultra-broadband access systems.

This opportunity represents an economic and societal challenge that will shape the coming years, at a time when the content and network universes are converging more and more. Political authorities need to seize upon this opportunity straight away.

B. What structure and size for the digital dividend?

One of the issues that concerns the electronic communications sector is maximising the size of the digital dividend – in other words the quantity of spectrum that will be redistributed when analogue terrestrial broadcasting is phased out – and freeing up frequency sub-bands nationwide (i.e. a set of adjacent frequencies), harmonised at the European level if possible, particularly for the upstream channel of electronic communication services.

1. Freeing up a harmonised frequency sub-band

The 2006 Regional Radiocommunications Conference (RRC-06), which took place in Geneva, provided an opportunity to define a broadcasting frequency plan in view of the launch of digital terrestrial television (DTT). This led to an agreement (essential for cross-border coordination) wherein each country defined a certain number of layers. One layer consists of several frequency channels (each 8 MHz wide), assigned or allotted to all (or a sizeable portion) of the country, to enable the broadcast of a DTT multiplex.

Setting up adjacent frequency sub-bands at the European level which are dedicated to electronic communications is a necessary step for several reasons:

- from a technical standpoint, this harmonisation is geared to enabling the creation of services whose frequency planning is very different from the one employed for broadcasting. Electronic communication services require a sub-band that is harmonised across France, particularly for the upstream channel, i.e. for transmissions from user terminals;
- at the international level, this harmonisation needs to be coordinated with countries that share borders, to enable the coexistence of services between neighbouring countries;
- from an industrial standpoint, this harmonisation makes it possible to achieve economies of scale which, in turn, makes the marketing of equipment in these new frequency bands a viable undertaking.

The implementation of this sub-band will require an overhaul of the frequency plan defined in the RRC-06 agreements. This means that creating an appropriate digital dividend, particularly at borders where resources are the scarcest, will require the RRC-06 agreements to be re-examined and amended.

2. Optimisation and extension of the digital dividend

It is still difficult to say exactly how large the digital dividend will be. Current broadcast planning, by frequency layer, makes it a complex task to assess the digital dividend and to quantify it in terms of frequencies.

Experiences in the UK, Sweden and the United States nevertheless point to a digital dividend of just over 100 MHz. This is the objective that France must set for itself as well. To achieve this, efforts to establish a detailed estimate of the digital dividend must be undertaken as soon as possible.

This initial estimate must only be a lower bound estimate of the digital dividend. A number of channels will be freed in broadcasting frequency gaps, for instance. These "blank" spaces benefit from a low rate of frequency reuse by broadcasting services, compared to electronic communication services. They make it possible to generate a local digital dividend which could be used for developing local digital TV services, or for creating licence-free electronic communication services that use intelligent radio technologies.

Above all, the digital dividend could benefit from the spectrum optimisation enabled by compression technologies, such as MPEG-4, which seek to reduce the number of multiplexes needed to broadcast DTT channels. The use of leading edge technologies for broadcast planning, such as Single Frequency Networks[8], would also help bring down the number of channels required to produce an audiovisual layer. This could thus make it possible to create more layers than were planned in Geneva in 2006 and to thereby increase the digital dividend.

8 - A radio or TV broadcasting network that operates over a single frequency.

Lastly, the border issue requires special attention. The implementation of a digital dividend will be more difficult in these areas, and will require that future gains enabled by technologies be anticipated.

C. Frequencies for what type of content?

One of the challenges of the digital divide will be deciding which services will use these frequencies. Because of their properties, these frequencies are particularly well suited to covering large areas at little cost. They could, for instance, be used to expand mobile network coverage or for providing fixed and roaming broadband access, thereby helping to close the digital divide that exists between urban dwellers and those living in rural areas. The digital dividend would thus make a significant contribution to regional development.

Other services are also candidates, including personal mobile TV (PMT), high-definition TV (HDTV) and security services. It will be up to the Prime Minister, following consultation with the digital dividend Parliamentary Commission, to decide which services will be allocated the liberated frequencies.

D. 2007: a crucial year

1. World Radiocommunications Conference

At the end of 2007, the International Telecommunication Union (ITU) will be hosting the World Radiocommunications Conference (WRC) in Geneva. The current French position with respect to this Conference is to work to achieve the greatest possible flexibility in the digital dividend frequency bands, by allocating the 470-862 MHz band to the mobile service, on an equal footing with the broadcasting service. Wireless electronic communication services could also be deployed in this frequency band.

This would allow for the adoption of a resolution at WRC 2007 requesting the ITU to conduct studies devoted to identifying a harmonised frequency sub-band for mobile services, in time for the RRC in 2011. This resolution would give the different countries the freedom to harmonise these frequency bands themselves.

2. European harmonisation efforts

9 - Cf. Part 8, Chapter 1, A.

In Europe, the Radio Spectrum Committee[9] recently mandated the CEPT (European Conference of Postal and Telecommunications Administrations) to conduct technical harmonisation studies in 2007 in view of identifying the sub-bands for mobile and multimedia services (mobile TV) in the digital dividend bands. ARCEP supports this initiative. Identifying a harmonised sub-band at the European level for electronic communication services is in fact crucial to making the digital dividend a reality.

10 - Idem.

In addition, the Radio Spectrum Policy Group[10] has issued an opinion that seeks to encourage these harmonisation efforts at the political level, along with the definition of a European position in view of upcoming global conferences.

3. France must seize the opportunity provided by the digital dividend

The technical challenges involved in phasing out analogue terrestrial broadcasting must not prevent work on the digital dividend from starting immediately, particularly on the changes to frequency planning needed for its implementation. Quite the contrary, these planning revision efforts must begin as soon as possible so that the changes can be incorporated into the technical plan for the analogue TV switch-off. Here, it is imperative that work on identifying a sub-band begin in the very near future.

The national plan for reuse of the frequencies freed up by the migration to digital broadcasting must be established quickly to pave the way for national debates over the use of the digital dividend resource. In the short term, it will need to identify the initial quantity of the frequencies that will be liberated, then propose a reallocation plan and establish a technical roadmap for the implementation of the digital dividend – including, for instance, the creation of a sub-band of adjacent frequencies and the future cross-border agreements that will need to be established.

Furthermore, this work needs to be carried out with a European and global perspective in mind, which will shape a number of the critical choices made before the end of 2007, and for which France needs to be prepared.

Finally, the potential impact of new compression (MPEG-4, H265 and beyond) and broadcasting (e.g. DVB-T2 in the long term) technologies will need to be measured, as will that of planning techniques (Single Frequency Network). These technologies could help increase the size of the digital dividend. In the short term, the introduction of MPEG-4 compression technology could, for instance, go a long way to increasing the digital dividend. The Authority is thus in favour of broader adoption of this compression standard.

Gains in terms of compression and planning are in fact indispensable in the very short term for creating a digital dividend in border regions.

CSN and digital strategy planning for reuse of liberated frequencies in France

The digital strategy planning committee, CSN (*Comité stratégique pour le numérique*) is in charge of coordinating and steering the actions undertaken in view of terrestrial television digitisation, the switch-off of analogue broadcasting and the re-use of frequencies freed up in the process.

As concerns the digital dividend, CSN has the task of drawing up a national plan for reuse of the frequencies freed up by the migration to digital broadcasting. This plan must first define the exact quantity of the frequencies that will be liberated, then propose a reallocation plan and establish a roadmap to enable the effective liberation of frequencies from a technical standpoint. This plan must take into account the harmonisation work performed at the European and global levels, and will be approved by the Prime Minister, together with the national analogue switch-off plan.

CSN was formed in May 2006 on the order of the President of the Republic. Under the aegis of the Prime Minister, it includes:

- the Minister responsible for audiovisual communication;
- the Minister responsible for electronic communications;
- the Minister responsible for regional development;
- three qualified members: Jean-Michel Hubert (Deputy Chairman and former Chairman of ART), Ghislain Achard (former President of France Télévisions) and Francis Beck (former CSA consultant).

The Chairmen of the French broadcasting regulatory body, the *Conseil supérieur de l'audiovisuel* (CSA) and ARCEP act as permanent associates in the work performed by CSN.

Impact on the telecommunications market of VoIP software vendor services

IP telephony software vendors…

Software companies have been forging themselves a presence in the telecom market in recent years with software solutions that enable voice calls using IP telephony and broadband technologies. Although some players were already involved in telecoms (phone cards, telecom operator subsidiaries), a great many of them come directly from the IT and Internet sectors (Microsoft, Yahoo!, AOL). Instant messaging (IM) specialists began offering Internet-based voice services very early on which softphone specialists, such as Skype, later adapting them to create dedicated solutions.

The stunning rise of VoIP usage (over broadband using multi-service modems such as ISPs' service boxes) and the tremendous increase in the number of households equipped with computers and broadband, are all elements that led ARCEP to examine the impact that VoIP software providers have on the telecommunications market. In 2006 in France, VoIP services marketed by software vendors accounted for between 2% and 3% of residential traffic (compared to close to 30% for voice over broadband), a share which is expected to increase to between 3% and 5% in 2007.

The Authority commissioned an independent firm to study this topic. The issues identified by the report helped contribute to ARCEP's examination of the growing convergence between networks and players.

A. Potential for demand substitution

The technological approaches and business models employed by IP telephony software vendors are different from the ones used by telecom operators, but there is a potential for demand substitution for voice services.

VoIP software vendors market voice and messaging services over a single application that can be used on different devices (most often a computer), without being subject to any of the obligations imposed by an electronic communications regulatory framework. Telecommunications operators, on the other hand, need to declare themselves to ARCEP, and the services they provide are governed by the restrictions imposed by symmetrical regulation.

While some software vendors target specific national markets, most develop global strategies via their various services:

- **PC-to-PC calling** allows free voice calls between two users of the same application, but rarely to users of another application (low level of interoperability);
- **PC-to-phone calling** allows calls from the client software to a fixed or mobile telephone subscriber;
- **Phone-to-PC calling** lets phone subscribers make calls via the VoIP application.

With their pre-paid formulas and, more rarely, flat rate offers for PC-to-phone calls, a few IP telephony software providers have positioned themselves as direct rivals for traditional operators, by adopting their revenue model: customers pay for use of the service based on the length and type of the call (national, long-distance, mobile). The PC-to-PC service acts as a loss leader to attract users to chargeable PC-to-phone or phone-to-PC products.

All of these offers have the potential to compete with fixed telephony by offering very different services (presence, unified contact) and prices (free, low-cost). Most VoIP software players employ different business models, however, relying on advertising and intermediation ("click-to-call": free connection to a service representative). These models benefit from the "club" effect (attracting advertisers, experts) which favours the largest players and the first entrants to the market. These were in fact the models that formed the basis of the biggest success stories on the Internet (Google, Yahoo! and MSN/Windows Live for advertising, eBay for intermediation).

B. Defensive strategies for telecom operators

The fierce competition in the fixed telecom market in France could limit VoIP software vendors' growth potential. Bundled offers that include Internet access and unmetered national voice calls have been adopted en masse by consumers, and are based on a service box that allows users to make VoIP calls over their regular phone. To strengthen the appeal of these service bundles operators are adding new services to the mix on a regular basis, in many cases without increasing the price, such as full unbundling which lets subscribers do away with their phone subscription. They have

also reacted to the growing worldwide popularity of IP telephony software providers by including unmetered calling to a number of countries in their basic subscription.

Operators may also block VoIP software vendors' traffic on their network. In the case of convergent software/mobile offers in particular, the mobile network operator may filter traffic, arguing that VoIP solutions would prevent optimal use of the radio resource. This type of reaction harkens back to the net neutrality debate, as network operators could, further up the Internet value chain, discriminate against and/or differentiate themselves from the competition by controlling the information exchanged via their network.

Another strategy could be the creation of co-branding agreements between software providers and telecom operators to take advantage of the synergies between the two types of player. These agreements can involve the software provider, which is supplying a service, sharing its ad revenues with the operator, which controls and supplies access to customers. A case in point is the agreement between Microsoft and Orange for offering MSN instant messaging services to Orange subscribers.

Operator Neuf Cegetel has chosen an alternative strategy that consists of owning its own client software thanks to its subsidiary, Wengo, which has access to its parent company's PSTN (public switched telephony network) gateways and softswitches. Most VoIP software vendors have invested only in the PC-to-PC components (servers, client software), and few have their own PSTN gateways and softswitches – relying frequently on telecoms wholesalers to manage all of their traffic. This means that, should the need arise, shutting down their service would be a relatively simple affair.

Annexs

Glossary of technical terms and abbreviations

2G, 2.5G: mobile systems predating 3G. For 2G, they include GSM, and for 2.5G, GPRS and EDGE.

3G: third-generation mobile system. The gradual introduction of packet switching technology into mobile networks allows 3G networks to provide access to a wide range of new services, particularly high-speed Internet access.

Access network: network to which users directly connect their terminal equipment in order to access services. (See "Core network".)

Accounting rates: system establishing the pricing principles to be used in interconnection agreements between international operators so that an operator in the country of origin and an operator in the country of destination may share international call revenue when cooperating to route international traffic. For calls to a given international destination, the operator in the country of origin sets the price charged to users (the retail price), which is called the collection rate. At the same time, this operator and the operator in the country of destination negotiate a per-minute accounting rate. Revenue is shared based on this rate according to a sharing formula that determines the portion (settlement rate) accruing to the operator in the country of origin and that accruing to the operator in the country of destination. This portion usually is equal to half of the accounting rate.

ADSL (Asymmetrical Digital Subscriber Line): ADSL is part of the xDSL technology family. It is designed to enhance the performance of access networks and in particular the subscriber's copper pair in the conventional telephone network. Use of two modems, one at the subscriber premises and the other on the subscriber line termination at the MDF allows for a significant improvement in the network bit rate, to reach speeds up to 70 times faster than with a conventional analogue modem. The principle underlying ADSL involves reserving one part of the bandwidth for voice transport, another for data transport in the direction of the core network (upstream data), and more importantly yet another part for data transport toward the subscriber (downstream data). Filtering at both ends of the line ensures acceptable voice quality by removing the unnecessary parts of the signal. ADSL technology is particularly well suited to the local loop since the throughput it supports diminishes with distance. It is relatively inexpensive and therefore is an attractive solution for broadband Internet access.

AFA (*Association des Fournisseurs d'Access à Internet*): French association of Internet service providers.

AFORST: French association of telecommunications network operators and service providers.

AFUT: French association of telecommunications users.

ANFr (*Agence Nationale des Fréquences*): agency responsible for managing the radio frequency spectrum, allocating frequencies to the various government departments and independent authorities that assign them (ARCEP, CSA, the Ministry of Defence, etc.), handling interference, and conducting international spectrum negotiations.

ARPU: Average Revenue Per User.

Asymmetrical regulation: a form of regulation that imposes certain obligations only on SMP operator(s) in a given market (e.g. France Telecom in the fixed telephony market), to enable the development of lasting competition.

ATM (Asynchronous Transfer Mode): technique for the asynchronous transfer of digital broadband communications using short, fixed-length packets. ATM allows for superfast data transmission and the optimal use of line capacity, and is particularly well suited to broadband multiservice networks. This type of transmission is especially useful for optimising the core network. Using ATM in the core network is attractive because the technology responds to increased traffic levels by optimising allocated resources and offers a guaranteed quality of service.

Bandwidth: this denotes the *transmission capacity* of a transmission link. It determines the amount of information (in bps) that can be transmitted simultaneously. In computing, it is often confused with the *transfer rate* of a communication link, expressed in bits per second.

BAS (Broadband Access Server): equipment whose function is to manage ATM data transport for ADSL-based Internet access offerings. Each BAS in the France Telecom network aggregates ATM traffic from about ten DSLAMs. Thus, a BAS manages traffic for all ADSL lines in the coverage area of the DSLAMs to which it is connected. France Telecom calls the area covered by a BAS a *plaque* (coverage area). Two ATM circuits, one "upstream" and the other "downstream", are established between each connected customer and the BAS serving that customer.

Beauty contest (comparative selection): method of operator selection to award scarce resources. It is different from an auction in that it allows candidate selection to be based on multiple criteria and not just on price offered.

Bitrate: amount of data transiting a network within a given timeframe.

Bitstream: refers to wholesale offers which may be used by alternative operators to market retail residential and business offers in zones where they have no broadband equipment of their own installed (sites which are too small or too far from their collection network). From a technical standpoint, France Telecom activates the copper pair to the end user with its own broadband access equipment, then routes the Internet stream up to the nearest connection point between its collection network and the alternative operator's collection network.

BSC (Base Station Controller): GSM base station controller. Equipment that controls one or several BTS and manages radio resources.

BTS (Base Transceiver Station): GSM equipment comprising transmitters and receivers and constituting the interface between the BSC and mobile terminals.

Bulk mail: mail items produced in mass quantities by computer – at least 400 items per mailing – such as invoices, bank statements, addressed advertising and periodicals.

CAA (*Commutateur à Autonomie d'Acheminement*): local exchange (exchange to which subscribers are connected) on the France Telecom telephone network. The structure of the France Telecom network is hierarchical and the *CAA* is the lowest-ranking exchange in the network. Thus, there are two types of exchange: subscriber exchanges (the *CAAs*) at the bottom of the hierarchy to which subscribers are linked via a subscriber line unit (called a *unité de raccordement d'abonné* or URA), and transit exchanges (*CTs*) at the top of the hierarchy.

Cable networks: audiovisual distribution networks that offer electronic communication services.

Call-back: a calling process that operates as follows: the user dials a number in the country operating the call-back; since the call is not actually set up, there is no charge; an automatic device calls back the user, setting up the call on an international line; the user then dials the number of the called party; the call is billed at the tariff charged by whatever foreign operator is selected. This system thus enables users to take advantage of tariffs in the called country.

Carrier selection: option given to customers to choose among multiple carrier operators. Carrier selection applies to all calls (local, national long distance and international long distance). It can be exercised per call or by subscription.

CCR (*Commission Consultative des Radiocommunications*) and CCRSCE (*Commission Consultative des Réseaux et Services de Communications Electroniques*): Respectively, the Consultative Committee for Radiocommunications and the Consultative Committee for Electronic Communication Networks and Services, which are advisory committees to the telecommunications minister and the Authority.

Circuit: bi-directional link between two terminal units over which a connection-mode service can be provided.

Collocation: under France Telecom's standard interconnection offer, physical interconnection is possible using three different techniques:

- collocation: The operator installs its equipment at France Telecom's premises.
- interconnection link: France Telecom installs its equipment at the operator's premises.
- in-span interconnection: a solution halfway between these methods of connection, where the connection point is located, for example, in the public domain.

For purposes of local loop unbundling, collocation consists of supplying the space and technical resources necessary to host and connect the technical equipment of alternative operators.

Convergence: convergence of the broadcast and telecommunications sectors, made possible by technological advances that allow different media (cable networks, terrestrial or satellite wireless networks, computer terminals and television sets) to be used to transport and process all types of information and services involving sound, images and data; since it derives from technological disruption (the digitisation of information), convergence has both economic and regulatory implications. (*See also Fixed-mobile convergence*).

Core network: the core or backbone network, consisting of all transmission and switching infrastructure beginning with the local exchange.

CPCE (*Code des Postes et des Communications Electroniques*): French postal and electronic communications code.

CRIP (*Comité des Réseaux d'Initiative Publique*): a committee reporting to the ARCEP Executive Board. It comprises local government representatives and operators and is charged with defining success criteria for local authority projects focused on digital development in the regions.

CSA (*Conseil Supérieur de l'Audiovisuel*): French national broadcasting authority.

CUG (Closed User Group): a CUG is an independent network for shared or private use. When the network is reserved for the use of the individuals or corporate entities that established it, it is called private, and when it is reserved for the use of multiple individuals or corporate entities organised as one or more closed user groups for purposes of exchanging communications internal to the group, it is called shared. The Authority has clarified this definition by indicating that a CUG is understood to be a group based on a community of interest that is stable enough to be identifiable and which predates provision of the telecommunication service. The notion of a "closed user group" is not limited to independent networks but is used also to define, for example, a virtual private network on a public network.

Direct interconnection: also known as call termination service. For an operator, this consists of terminating a call to a France Telecom subscriber. The call is routed by the operator to the interconnection point; from that point, it is carried by France Telecom over the France Telecom network to the subscriber's customer premises equipment.

DSLAM (Digital Subscriber Line Access Multiplexer): one of the devices used to convert conventional telephone lines into ADSL lines for broadband data transmission, particularly for Internet access. The DSLAM is installed on the main distribution frame of the local operator's network. It combines several ADSL lines onto a single medium, which routes data to and from these lines.

DTT: Digital Terrestrial Television.

DVB-H (Digital video broadcasting handheld): a digital terrestrial broadcasting standard geared to enabling audiovisual content reception on a mobile handset (mobile TV).

EDGE (Enhanced Data rate for Global Evolution): EDGE is a third-generation mobile standard allowing data to be transferred at 384kbps. It evolved from the GSM and American TDMA standards.

E-SDSL (Extended symmetrical digital subscriber line): technology enabling symmetrical bitrates, but with a shorter range than classic ADSL.

Exchange: switching equipment permitting calls to be directed to their destinations by establishing a temporary connection between two circuits on a telecommunications network or by routing information organised as packets. France Telecom's network comprises a hierarchical system of switches. The higher the exchange is in the system, the greater the number of subscribers it serves.

Fixed-mobile convergence: also known as FMC, and which involves the convergence of the fixed and mobile telephony technologies used and services offered. FMC opens up the possibility for operators to offer all users the same services, regardless of the technology or network being used.

Flat-rate interconnection: denotes an offer for interconnecting third-party operators with the France Telecom network. Under it, the fees that third-party operators pay for the collection of local loop traffic are fixed on a per-circuit basis rather than billed per minute.

FTTB: Fibre to the building.

FTTH: Fibre to the home.

Full unbundling: or fully unbundled access to the local loop, which consists of making all of the frequency bands of the copper pair available. As a result, the end user is no longer connected to the France Telecom network, but rather to that of the new entrant operator.

GPRS (General Packet Radio Services): packet switching system (see “Switching”) enabling enhanced data rates over GSM networks.

HDSL (High-speed DSL): bi-directional symmetrical transmission technique conceived primarily for business applications. This technology achieves bit rates of 2Mbps over distances of up to 2500m.

HLR (Home Location Register): central database of permanent subscriber information for a mobile network.

HSCSD (High-speed Circuit Switched Data): circuit-switched data system (see “Switching”) allowing improved bit rates on GSM networks.

HSDPA (High speed downlink packet access): a 3G technology that can deliver downstream speeds of up to 1.8 and even 3.6 Mbps (N.B.: also referred to by some as 3.5G).

HSUPA (High speed uplink packet access): 3G technology derived from HSDPA that makes it possible to increase upstream bitrates (and not only downstream rates, as is the case with HSDPA).

IMT-2000 (International Mobile Telecommunications 2000): third-generation mobile systems supporting enhanced mobility services thanks to the introduction of new functionality. The ITU selected five terrestrial radio interfaces for third-generation mobile systems under the designation IMT-2000. UMTS was one of the five.

Indirect interconnection: also known as call-collection service, in which an alternative operator collects a call from a France Telecom subscriber. The subscriber dials a prefix to select the operator and the call is then carried by France Telecom from the subscriber's customer premises equipment to the point of interconnection, where the call is then carried by the alternative operator.

Insured item: a service that consists of insuring a postal item for the value declared by the sender against loss, theft or damage.

Interconnection: the linking of various telecommunication networks so that any subscriber of one operator may communicate with any subscriber of any other operator.

Interconnection agreement: private contract negotiated and signed by two operators to determine, on a case-by-case basis, the terms and conditions of interconnection between them. Generally, agreements signed with an operator that has significant market power are based on that operator's standard interconnection offer. Otherwise, the conditions are determined without reference to a standard interconnection offer.

Interconnection interface: the set of technical specifications necessary for the operational implementation of interconnection based on establishing dialogue between networks. It defines physical interconnection arrangements, services and advanced functions accessible by the networks concerned, the ordering mechanism for these services, and associated billing and operating arrangements.

Internet: a group of variable-sized networks interconnected by the Internet protocol (IP) over which a wide range of services can be provided.

Interoperability: also called interworking. Service interoperability refers to the seamless functioning of various services on different networks. With respect to interconnection, the technical functionality available at the interconnection interface determines partly whether a service will interoperate between different operators.

IP (Internet Protocol): telecommunications protocol that is used by the networks that support the Internet. It allows information to be packetised for transmission and the various packets to be addressed, transferred independently of one another, and reassembled into the original message on arrival. The switching technique therefore is referred to as packet switching. For Internet use, it is associated with a data transmission control protocol called TCP (Transmission Control Protocol); it is therefore known as the TCP/IP protocol.

ISP: Internet Service Provider.

Items of correspondence: postal items addressed to households and businesses. Includes both domestic items and items sent from abroad.

LLO (Local loop operator): telecommunications company that operates subscriber lines.

Local loop unbundling: local loop unbundling, also known as unbundled access to the local network, consists of allowing new operators to use the incumbent operator's local copper-pair network to serve their subscribers directly. The new entrant of course pays the incumbent for use of the local network.

Local loop: the wired or wireless facilities between the subscriber terminal and the local exchange to which the subscriber is connected. The local loop therefore is the part of an operator's network that provides direct access to the subscriber.

Long distance carrier: telecommunications company which transports national and/or international long distance communications.

Main distribution frame (MDF): apparatus that connects subscriber copper pairs to the cables that connect to the local exchange. It allows several subscriber lines to be concentrated onto a single cable.

MSC (Mobile Services Switching Centre) and VLR (Visitor Location Register): on GSM and/or UMTS networks, the MSC is the exchange that manages incoming and outgoing circuit-switched calls. The switch is linked to a database (VLR) containing a copy of the user profile and terminal or handset location information.

MVNO (Mobile virtual network operator): unlike mobile network operators (Orange France, SFR and Bouygues Telecom in Metropolitan France), MVNOs have no frequency resources of their own. To provide end customers with mobile services, they therefore use a mobile network operator's radio network.

Narrowband Internet: also referred to as dial-up. Internet access from the France Telecom public switched telephone network, which is used for routing conventional telephone calls.

NAS (Network Access Server): equipment used by operators to provide Internet access services over the switched telephone network. An NAS converts telephone calls into IP data streams and thus provides the interface between the switched telephone network and the IP data transport network.

Network: totality of telecommunication resources employed including all switches and transmission links, whether wireline (metallic pair or cable or fibre optic cable) or wireless (terrestrial or satellite using electromagnetic waves).

***NRA (nœud de raccordement d'abonnés)*:** subscriber connection point. A term used by France Telecom to designate the main distribution frame (see "MDF").

NRA: national regulatory authority.

On-net and off-net calling: respectively, calls between two customers of the same mobile network and between two customers of different mobile networks.

PMR (Professional Mobile Radio): mobile radio networks for business users. In France the following distinctions are made:

- 3RP (*Réseaux Radioélectriques à Resources Partagés*): trunked private mobile radio network.
- 3RPC (*Réseaux Radioélectriques à Resources Partagés Commerciaux*): trunked public access commercial mobile radio networks using 3RP technology;
- RPN (*Radiocommunications mobiles Professionnelles Numériques*): digital trunked Professional Mobile Radio networks using Tetra or Tetrapol technology.
- 2RC (*Réseaux à usage partagé à relais Commun*): trunked private mobile radio networks for commercial purposes.
- 3R2P: 3RP networks operated for the user's private purposes.
- RPX: local trunked networks (new category of network).
- RPS (*Radio Professionnelles Simplifiées*): Short-range business radio.

Point-to-point: a type of fibre optic network architecture. It allows several operators to install their own, possibly different, equipment in the customer premises (dedicated fibre).

PON (Passive Optical Network): a type of fibre optic network architecture. It is a tree architecture whose active equipment is all managed by the same operator. Unlike point-to-point technology, it cannot be "unbundled".

Radio interface: system enabling a mobile terminal to communicate with the network. Standardisation of the UMTS interface was the subject of numerous discussions within ETSI during 1997. On 29 January 1998, the SMG (Special Mobile Group) committee adopted the UTRA (UMTS Terrestrial Radio Access) standard for the terrestrial interface (as opposed to the interface for satellite).

The UTRA standard is a compromise between two originally competing standards: WCDMA and TD/CDMA. UTRA was adopted by the ITU in March 1999 as a radio interface standard for IMT-2000.

READSL2 (Reach Extended Digital Subscriber Line): a technique that makes it possible to increase the range of the ADSL signal by injecting more power into certain frequency bands. Its chief purpose is to provide minimum service to subscribers located just outside the farthest reach of the normal ADSL coverage zone.

Registered item: a service that guarantees flat rate compensation for the loss, theft or damage of the postal item and which, when so requested by the sender, provides proof of deposit of the postal item and/or its delivery to the recipient.

RFID: Radio Frequency Identification technology which takes the form of chips or electronic tags that contain information on the product in which they are inserted, and which are equipped with readers that make it possible to query the tags remotely (within a range of several meters).

***RIO (relevé d'identité opérateur)*:** operator identity statement. A unique identifier which is attributed to a mobile phone line and the customer contract associated with it, enabling better identification during the number portability process.

SCS (*Société de commercialisation de services*): a term specific to the mobile sector, designating a mobile communications service provider, a company that sells and manages mobile subscriptions on behalf of an operator.

Shared access: or partially unbundled access to the local loop, which consists of making the "high" frequency bands of the copper pair available to third-party operators, on which they will be able to build an ADSL service, for instance. The low frequency band (the one used traditionally for telephony) continues to be managed by France Telecom, which thus continues to supply subscribers with its telephone services, without unbundling having any effect on the service.

Short messages or SMS (Short Message Service): text messages which are transmitted over the GSM mobile network signalling channels and have a maximum length of 160 characters. Transmission of these messages on the GSM network is standardised. A short-message server integrated into the mobile network provides the interface between the mobile and fixed-network environments.

Signalling: on a telecommunication network, the signalling function performs the exchange of information internal to the network for purposes of call routing. Just as road signs on a roadway network direct the movement of vehicles, signalling information directs the movement of communications on the telecommunications network. This could involve, for example, the information necessary to recognise the caller for purposes of setting up call billing or displaying the calling number. This function can be provided directly by the network transporting the subscriber call. Thus, it is generally integrated into the switches. It can also be performed by a separate network, called the signalling network.

SIM (Subscriber Identity Module): smartcard inserted into a mobile terminal and containing the subscriber data required to authenticate a user on the network (GSM standard).

Single piece mail: mail items sent by individuals, businesses and high volume issuers, which are not subject to any special preparation. They are deposited in the collection boxes on the public thoroughfare or adjacent to sorting centres, or in La Poste points of contact.

SMP (significant market power) operator: an operator has significant market power (SMP) if, individually or jointly with others, it commands a position equivalent to a dominant position, i.e., it has considerable ability to behave without regard to its competitors, its customers and ultimately, consumers.

SMS (Short Message Service): see "Short Messages".

SNG: satellite newsgathering, refers to ground stations for temporary satellite video links.

Standard interconnection offer: also known as the interconnection catalogue. Technical and commercial interconnection offer that operators designated by the Authority as having significant market power, pursuant to Article L.3-8 of the CPCE (the French postal and electronic communications code), are required to publish annually so that other operators may establish their own commercial offers and prices. The standard interconnection offer also sets forth the conditions governing physical interconnection between the SMP operator and other operators.

Switching: in a telecommunications network, switching allows temporary traffic connections to be established between two or more network points. This is carried out by equipment, called switches or exchanges, located at different points in the network. The basic structure of a telecommunications network therefore comprises transmission links interconnected by switches. Packet switching and circuit switching are two switching techniques used in telecommunication networks. The first is used by Internet (IP) networks for example and the second by traditional switched telephony networks.

Symmetrical regulation: a form of regulation that imposes the same obligations on all the operators in a given market in order to guarantee consumers network interoperability, a minimum quality of service, adequate information and streamlined operator switching procedures which, in turn, allow users to take the utmost advantage of market competition.

Terminal equipment: equipment allowing a user to send, process or receive information (e.g., telephone, fax, modem etc.).

Third-party billing: service by which new operators may entrust the incumbent operator with billing for the services they offer their customers via interconnection. In the case of special services, third-party billing can be used for charged services only (not for services that are free to the caller). As this market develops, third party billing becomes essential for effective competition.

Third-party collection: in the context of interconnection, a service enabling a network operator to collect traffic from the incumbent's network on behalf of an operator that has no infrastructure in the geographic area concerned. This service is used particularly by telephone operators who wish to provide their service over an extended area without deploying a network.

Transmission: in an electronic communication network, the transmission function transports information from one point in the network to another. The infrastructure supporting transmission may consist of copper or fibre optic cables or may be wireless. (See "Switching".)

Triple Play: a bundle of three services (broadband Internet access, unmetered calling and TV) delivered over an electronic communications network.

***URA (Unité de Raccordement d'Abonné)*:** on the France Telecom network, this is the subscriber line unit, the part of the telephone switch where subscriber lines connect and information is digitised.

UWB (Ultra wide-band): a wireless modulation technology for transmitting large amounts of digital data over a wide spectrum of frequency bands, but with very low power to prevent interference with other signals.

VDSL (Very high speed digital subscriber line): xDSL technologies enabling better performance on local copper loop access networks, the goal being to supply higher speeds than classic ADSL.

***VGAST (vente en gros de l'abonnement téléphonique)*:** a wholesale line rental offer marketed by France Telecom which includes not only the subscription as such and services which are traditionally associated with the telephone subscription (caller display, incoming call signal, etc.) but also all person-to-person calls, calls to special numbers and narrowband Internet access. It is compatible with the simultaneous use of the high frequency band, notably in the case of wholesale broadband offers delivered at the regional or national level and shared access, regardless of the operator employing this high frequency band.

VPN (Virtual Private Network): a virtual private network involves the shared use of one or several public networks for the internal purposes of a closed user group, which is defined "as a group based on a community of interest that is stable enough to be identifiable and which predates the provision of the telecommunications service". It responds to a need for both internal communication (communication within the user group) and external communication (communication with public network users). It allows businesses with widely distributed sites to use the operator's network for emulated private network access that employs a numbering plan internal to the company: this emulation provides businesses with the functionality of a private automatic branch exchange (PABX) without requiring the investment.

VSAT (Very Small Aperture Terminal): satellite telecommunication service supporting two-way information exchange at low or medium speed via a small transmitter-receiver terminal that uses a narrow part of the total satellite bandwidth.

WAP (Wireless Application Protocol): standard that adapts the Internet to mobile telephone constraints, in particular by employing a suitable content format. This communication protocol is a component of the process for gradually migrating GSM mobile networks to the Internet.

WAPECS (Wireless access policy for electronic communications services): an initiative launched by European Union countries aimed at facilitating swift access to spectrum for new technologies, in a bid to promote competitiveness and innovation (by eliminating all of the obstacles impeding market momentum), and to ensure consistent licensing mechanisms, while upholding the principles of technological neutrality for services.

Wi-Fi (Wireless Fidelity): generic commercial name for IEEE 802.11b wireless local Ethernet network (WLAN) technology operating at 2.4GHz.

WiMAX (Worldwide Interoperability for Microwave Access): label certifying the interoperability of IEEE 802.16-standard equipment from different suppliers.

Wireline network: network based on metallic or fibre optic cable infrastructure.

WLAN (Wireless Local Area Network): wireless network operating over a limited area.

WLL (wireless local loop): local loop employing radio technology rather than the copper wire used in today's networks, thereby allowing for greater flexibility in infrastructure deployment.

WRC (World Radiocommunication Conference): its purpose is to ensure international coordination in matters relating to radiocommunication. This coordination is essential because frequencies cross borders and it is simpler to have the same types of services in the same bands. Organised by the ITU, this conference is held every three or four years. The results, once incorporated into radiocommunications regulations, constitute international treaty. Each WRC conference is preceded by a meeting of the Radiocommunications Assembly and is followed by a conference preparatory meeting (CPM), where the groundwork is laid to prepare for the next conference.

ZAA (*Zone à autonomie d'acheminement*): local exchange area. In the France Telecom network, every category of switch is associated with a technical service area which indicates the number of subscribers served by one or more switches at a given level of the network. The ZAA (*Zone à autonomie d'acheminement*) corresponds to the CAA or local exchange, and the ZT (*Zone de transit*) corresponds to the CT or transit exchange (*Commutateur de transit*).

ZLT (*Zone locale de tri*): local sorting area. The local loop operator sends calls to the carrier designated by the calling party only when the calls are destined for called parties outside of the ZLT; it keeps and routes calls internal to the ZLT regardless of the way in which the calling party dials the call. In France, the ZLT generally corresponds geographically to a *département*.

ZT (*Zone de transit*): transit area. (See "ZAA").

Dividends of competition: estimated consumer gains of € 10 billion between 1998 and 2005

In several instances[1], this annual report refers to the changes that took place in the market between 1998 and 2005, and to the roughly 30% decrease in prices during that period, parallel to a consumption rate that increased by two and a half times. This has led to consumer gains of more than 10 billion over the course of those seven years.

1 - Cf. Part 1 (p. 36) and Part 6 (p.227).

This annex provides details on the method used for this assessment.

A. Basic data

Observatory

In 1998, ARCEP created a statistical Observatory of the electronic communications market. The Observatory has compiled market indicators on both volume (physical quantity) and value on an annual basis since its creation, and on a quarterly basis since 1 January 2000.

These indicators are established based on an exhaustive survey of operators, and seek to depict the state of the retail market, in other words of end-user consumption. This is why, for instance, turnover figures for mobile telephony correspond to user spending on mobile telephony and not to mobile operator revenues – as the latter would also include call termination income, for instance.

The following table, from the latest annual Observatory publication, lists the primary components of the electronic communication services market.

Table 1
End-user electronic communication service revenue

€ Millions	2000	2001	2002	2003	2004	2005
Fixed telephony	14,631	14,375	14,030	13,509	12,629	12,072
Internet	922	1,413	1,753	2,418	2,767	3,145
Mobile services	7,789	10,028	11,788	13,243	14,868	16,203
Total telephony	**23,342**	**25,816**	**27,571**	**29,170**	**30,264**	**31,420**
Value-added services	1,842	1,810	1,856	1,900	2,166	2,501
Directory assistance services	161	244	256	275	216	223
Leased lines	2,113	2,328	2,261	2,272	2,160	2,117
Data transport	1,551	1,853	2,191	2,284	2,104	2,478
Total revenue	**29,009**	**32,052**	**34,135**	**35,902**	**36,910**	**38,738**

Selected segments

The market assessment for 1998 to 2005 is based on the portion of the market that comprises “telephony”, i.e. the first three lines of the above table.

The components that are not factored in correspond to markets which are more difficult to interpret (value-added service revenue in fact includes remuneration of content), more marginal (directory assistance services) or aimed at businesses (leased lines, data transport).

The first three components, on the other hand, correspond primarily to the mass market: calls originating on the fixed network, Internet in the broadest sense of the term – including narrowband and broadband access – and mobile services in the broadest sense of the term: i.e. voice and text messaging.

The revenue generated by these three components can be broken down into 11 principal segments, as depicted in the following table.

Table 2
Revenue for the principal segments

€ Millions	1998	1999	2000	2001	2002	2003	2004	2005
Fixed line subscriptions	4,091	4,650	4,898	5,124	5,156	5,265	5,224	5,452
Fixed national calls	6,669	6,014	5,014	4,520	4,192	3,850	3,567	3,264
Fixed international calls	1,139	961	897	871	850	819	673	632
Fixed-to-mobile calls	1,716	2,253	2,728	2,895	2,919	2,758	2,425	2,065
Public payphones and phone cards	945	965	848	720	643	577	525	460
Internet connection calls	162	344	638	811	955	955	768	507
Broadband subscriptions	–	–	194	448	653	1,314	1,732	2,404
Mobile national calls	3,554	5,173	7,076	8,681	10,219	10,942	12,029	12,653
Mobile international calls	121	203	269	323	424	437	535	608
Roaming out mobile calls	107	161	394	492	450	745	881	1,013
SMS (and MMS)	–	–	151	395	639	915	1,102	1,358
Total for these segments	**18,504**	**20,724**	**23,106**	**25,283**	**27,098**	**28,578**	**29,462**	**30,416**
Total telephony and Internet market	**18,973**	**21,065**	**23,342**	**25,816**	**27,571**	**29,170**	**30,264**	**31,420**
Segments' share of the market	97.5%	98.4%	99.0%	97.9%	98.3%	98.0%	97.4%	96.8%

Price and volume

This table reveals significant growth over the seven-year period. Consumption revenue went from €19 billion to roughly €31.4 billion, in other words increasing at an average annual rate of 7.5%. This growth is partly due to changes in prices but also (and especially) to a physical increase in consumption levels, particularly for mobile services and broadband Internet.

How can we obtain an exact measure? Fortunately, it is possible to associate each of the segments in the previous table with a physical activity unit that measures consumption: average number of subscriptions, annual number of minutes consumed or text messages sent. These quantities are listed in the following table.

Table 3
Physical unit

Million units or minutes	1998	1999	2000	2001	2002	2003	2004	2005
Average number of telephone subscriptions	33,741	33,872	33,951	34,048	34,103	34,016	33,810	33,704
Fixed-to-fixed national calls	111,719	109,139	104,838	100,624	94,144	89,536	86,149	86,838
Fixed-to-mobile calls	3,764	4,057	4,454	4,610	4,808	4,907	4,281	4,116
Fixed international calls	3,811	5,600	7,649	9,384	10,498	11,365	11,638	12,227
Calls originating on public payphones or phone cards	5,605	5,233	5,008	3,863	3,007	3,124	3,033	2,994
Narrowband Internet connection calls	4,976	12,617	26,841	52,446	66,831	71,779	54,687	38,233
Average number of broadband subscriptions	–	–	0,123	0,399	1,128	2,612	5,065	8,016
Mobile-to-fixed and mobile-to-mobile national calls	9,748	20,278	34,824	43,343	50,622	62,009	72,304	79,619
International mobile calls international	134	293	498	692	713	805	959	999
Roaming out mobile calls	85	128	318	385	509	655	985	1,093
Number of SMS and MMS sent	–	–	1,471	3,508	5,523	8,188	10,414	12,862

B. Price and volume trends

Based on the previous set of components, we can establish the revenue growth generated by the increase in the physical volumes by applying the price evolution that occurred during the period. This approach appears a legitimate one, given the homogeneity of the segments (a correlation is made between the amount spent on carrots and the number of carrots sold).

Price trends

For each of the 11 segments a first, rather summary model seeks to explain the growth of revenue based on volume increase, using two parameters: the average initial price P_0 (in 1998) and its annual evolution a which is considered to be constant over the period: $\widehat{R}_t = p_0(1+a)^t.q_t$. We then perform adjustments on parameters p_0 and a to minimise the standard deviation between modelled revue $\widehat{R}_t$ and observed revenue R_t.

Individual analysis of the quality of the adjustment for each of the segments reveals possible areas for improvement. We can indeed note a price trajectory that translates, for instance, into a less dramatic price evolution late in the period than in the early part.

To take this situation into account, we introduce a third trend parameter b into the annual price evolution: $P_{t+1} = p_t.(1 + a.\exp(b.t))$. The result, expressed as annual price evolution, is detailed in the following table.

Table 4
Average annual price evolution

	1999	2000	2001	2002	2003	2004	2005	7-year average
Fixed line subscriptions	10.7%	6.5%	3.9%	2.4%	1.4%	0.9%	0.5%	**3.7%**
Fixed national calls	-10.4%	-8.3%	-6.6%	-5.3%	-4.2%	-3.4%	-2.7%	**-5.9%**
Fixed international calls	20.6%	-14.1%	-9.7%	-6.7%	-4.6%	-3.1%	-2.2%	**-8.9%**
Fixed-to-mobile calls	-9.9%	-10.7%	-11.5%	-12.5%	-13.4%	-14.5%	-15.6%	**-12.6%**
Public payphones and phone cards	6.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.9%**
Internet connection calls	-36.9%	-24.4%	-16.2%	-10.7%	-7.1%	-4.7%	-3.1%	**-15.6%**
Broadband subscriptions	–	–	-44.9%	-35.5%	-28.0%	-22.2%	-17.5%	**-30.3%**
Mobile national calls	17.7%	-13.4%	-10.1%	-7.7%	-5.8%	-4.4%	-3.3%	**-9.1%**
Mobile international calls	0.1%	0.1%	0.3%	0.6%	1.3%	3.0%	6.8%	**1.7%**
Roaming out mobile calls	8.6%	-7.8%	-7.0%	-6.3%	-5.7%	-5.1%	-4.6%	**-6.5%**
SMS (and MMS)	–	–	-1.4%	-1.7%	-1.9%	-2.3%	-2.7%	**-2.0%**
Overall price evolution	**-7.0%**	**-6.6%**	**-6.4%**	**-5.9%**	**-5.2%**	**-4.8%**	**-4.2%**	**-5.7%**

The overall price evolution (last line in yellow) is obtained by calculating the total annual price evolution per segment, weighted by revenue – which constitutes an orthodox approach.

Volume trends

No distinction is made between the evolution in prices for the market as a whole and overall segment price changes. This makes it possible to "flatten" the observed evolution of gross revenue, and to highlight volume growth for the market as a whole. This provides us with an "apples and oranges" calculation of the volume growth, i.e. the definition of volume used by economists.

These various evolutions can thus be presented as follows:

Table 5
Annual evolution

	1999	2000	2001	2002	2003	2004	2005	7-year average
Revenue (total market)	11.0%	10.8%	10.6%	6.8%	5.8%	3.7%	3.8%	**7.5%**
Prices (11 segments)	-7.0%	-6.6%	-6.4%	-5.9%	-5.2%	-4.8%	-4.2%	**-5.7%**
Volume (total market)	**19.4%**	**18.6%**	**18.2%**	**13.5%**	**11.6%**	**9.0%**	**8.4%**	**14.0%**

The average annual revenue growth for the period (7.5%) is therefore analysed as the result of an annual average decrease in prices of 5.7% (or a roughly 33% decrease over seven years) and an average annual increase in volumes of 14% (or two and a half times in seven years).

C. Consumer gains

Starting in 1998, using conventional values for volume and price (while mindful of ensuring that the product of the two reconstitutes financial consumption), we can then create the following series, producing the two consumer spending components for the market as a whole.

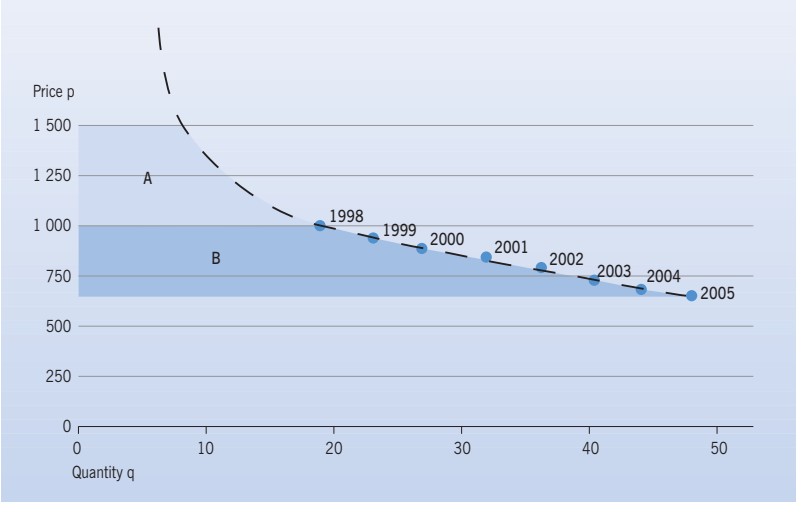
Table 6

	1998	1999	2000	2001	2002	2003	2004	2005
Quantity q	19.0	22.8	27.3	31.9	36.3	40.4	43.7	47.1
Price p	1000.0	930.2	869.0	813.3	765.6	725.6	690.7	662.0

Note: conventional units; the product, qxp is in million euros.

A classic representation (x axis = volume; y-axis = price) provides an elementary view of consumer gains between 1998 and 2005.

Calculation of consumer gains and their evolution between 1998 and 2005 (current euros)



It is reasonable to presume that the successive points (q, p), which correspond each year to a balance between price and quantity, are reflective of the utility curve for consumers.

In 1998, surface A located between the blue curve and the average price level, p – which was 1,000 that year – represents the consumer surplus: this is the difference between what consumers are willing to pay and what they actually pay. But calculating this a risky affair.

On the other hand, it is much easier to assess the increase in consumer gains from 1998 to 2005: depicted by surface B.

Quantity B is analysed as the sum of the price decrease between 1998 and 2005, multiplied by the volume for 1998, and of the rise in volume between 1998 and 2005, weighted by half of the price decrease. This calculation gives us the sum of €10.6 billion.

Réalisation graphique : Studio Guy Bariol

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