The Internet Telephony Report

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1. Internet telephony report

1.1 The quiet revolution

A major change in telecom networks is underway that will deliver new benefits of ease of use and new applications to businesses and consumers alike. Yet few people are as yet taking steps to build on the opportunity. The attention grabbed by the Internet and IP connectivity services has masked the real opportunities that are becoming possible as telephony and the Internet converge.

Most carriers have been compelled to deploy more transmission and routing infrastructure in response to the consumer boom in Internet services. The buzzword of today is "bandwidth explosion" yet this is having little impact on people who currently are not Internet users. Their main contact with telecom services is for telephony. For these people to change their usage of communications, the network must offer facilities that improve their day to day lives without significant additional complexity or cost.

The foundation for this change is being laid today. IP is increasingly driving carrier network planning as the volumes of data traffic have exceeded voice in a number of countries. Western Europe is forecast to be generating 1700Gbit/s of international IP backbone traffic by 2005, of which less than 50Gbit/s is forecast to be voice traffic. The figure of 1700Gbit/s in 2005 compares with 41Gbit/s in 1999. It will be increasingly uneconomic for operators to maintain separate core transmission to support circuit switched voice networks. At the same time, it is becoming possible to deliver high quality voice over an IP infrastructure. New technical developments will improve the ability of the IP network to transport and switch voice calls. Next generation switches will become an established part of the network infrastructure, with over 1600 installed in Europe by 2005, generating annual sales revenues of $350-$450M.

These two trends are drawing the IP and circuit switched voice worlds ever closer together. Yet this in itself is not enough to create user demand. The old cliché that "users buy services" holds true and the new IP infrastructure must support and provide access to the voice and data services that are today provided through separate switching platforms in the carrier network. Here too, technology is starting to provide a bridge. The trials and early deployment of ADSL will grow to a installed base of over 11 million by 2005. These will provide the access capacity for a range of new services.

All of the strands of technology change are building rapidly in momentum although it is easy to fail to notice the broad perspective of change amid all the IP hype. Soon, the distinction between voice, data, video, Internet and Intelligent Network services will be rendered irrelevant by technical change. This is a revolution in the network that creates new challenges for carriers worldwide. The best carriers will ride the wave of change and emerge with new service portfolios that leverage the converged network. The worst will ignore the new opportunities and dissipate their resources by continuing their traditional service development models. The investments are high: BT expect to invest £600M pounds in their new Spanish network; pan-European network operators have declared investment plans of more than £5000M in the initial phases of their networks.

European incumbent carriers must act now to assess the implications for their networks and product portfolios. Recent experience in the carrier market shows how aggressive new entrants can cream off business services and then attack general service revenues. All carriers should examine the opportunities afforded to them by the new technology to launch innovative services. Incumbents have the added advantage of existing local loop infrastructure which they should exploit now before local loop unbundling gives new entrants a further boost.

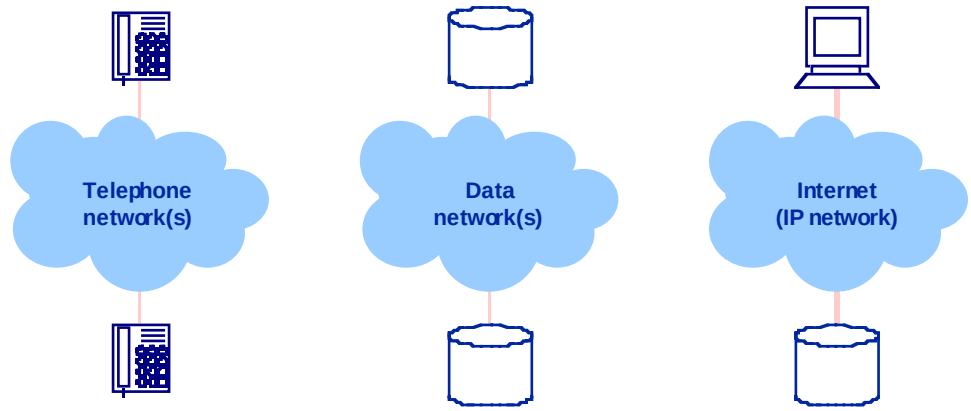
1.2 What is IP telephony?

There are many definitions of "IP telephony". For most people, the term is associated with the cheap, low quality, international phone calls offered by carriers that are exploiting the opportunities for arbitrage in international connectivity prices. This is a transient market that will become much less attractive as bandwidth becomes commoditised and regulations for international interconnect change. The term "IP telephony" is also used in enterprise networking to refer to building a private IP network that integrates PBX and data traffic.

The take-up of Internet telephony is dependent on the protocols being able to deliver quality of service performance. As these standards are integrated into new platforms, so the use of the technology will increase.

A more significant and lasting opportunity is the integration of the PSTN with the data and Internet networks operated by a carrier. Today, shown in Figure 1.1, carriers build separate networks for each type of service.

Figure 1.1: Current carrier networks



These networks have different quality and technical attributes. They also have separate service management and billing environments. IP networking will unite these networks over a common IP backbone whilst not compromising the quality or features of any of them.

The technical requirements for this change are:

- Broadband core and access technology
- IP backbones with traffic management capabilities
- Interworking and ultimately integration of the switching and IN platforms used in the PSTN and IP networks.

Much has been written about broadband core and access technologies but they are only a small part of the story. The challenge for IP telephony lies in unifying the different design goals of PSTN switching and IP routing.

Interworking of the PSTN and IP networks is becoming possible now through new technology that is coming to market from established vendors and startup companies. It will be a lasting change since it supports integrated service access and encompasses other forms of IP telephony seen to date.

1.3 Why is change happening now?

Interest in IP telephony is increasing because of a number of factors relating to competition and technical advance. It is particularly strong in the US where the Telecommunications Act has introduced local loop competition and forced restructuring and re-alignment of the carrier industry.

A common trend in developed markets is the explosion of demand for Internet services. This has spurred the development of international fibre backbones and led carriers to invest heavily in router infrastructure. Most carriers have chosen to underpin their router networks with ATM for its traffic management benefits. The scale of demand for corporate

and consumer IP connectivity has become such that the data traffic volume in several carriers' networks has exceeded the voice traffic volume.

We are seeing rapid growth in the Internet and corporate data networking. It is frequently argued that voice bandwidth will soon look like 'noise' riding a vast continuum of data bandwidth. A general model traffic growth shown in Figure 1.2. In the period August 1998 to August 1999 the traffic through the London Internet Exchange grew by 300%. This is shown in Figure 1.3.

Figure 1.2. Comparative growth of voice and data traffic

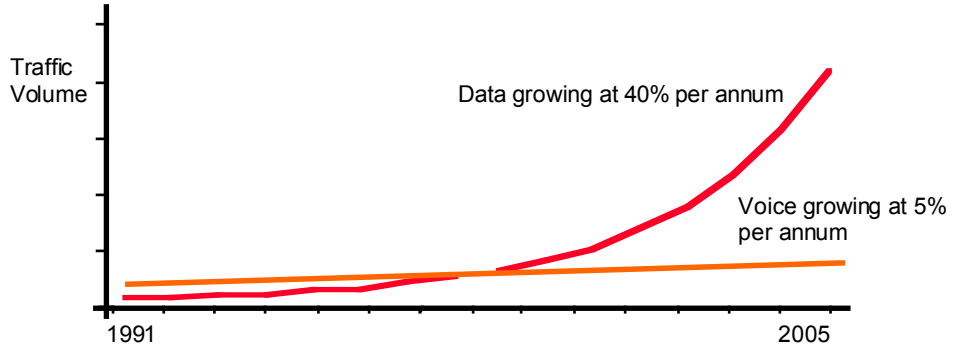
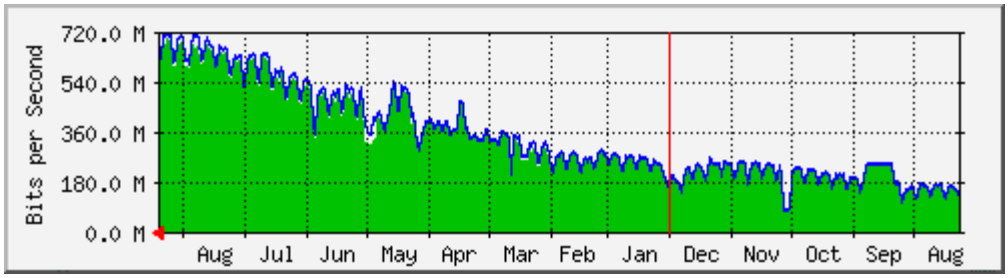


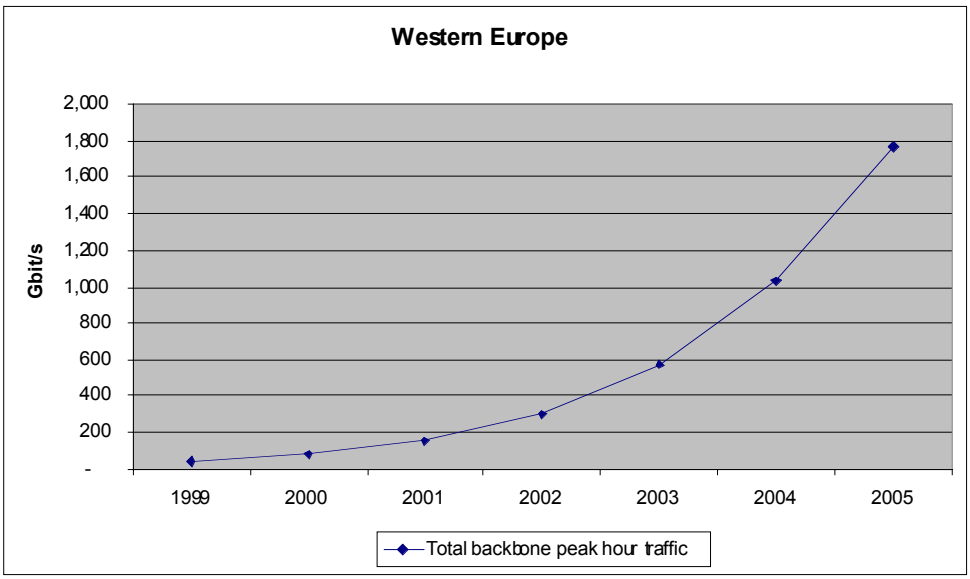
Figure 1.3. Growth of Internet traffic through the London Internet Exchange



Source: LINX N.B. Data is presented from right (1998) to left (1999).

Ovum forecasts that the IP international backbone traffic in Europe will grow to 1700Gbit/s by 2005, from a figure of 41Gbit/s in 1999, as shown in Figure 1.4. With this scenario of traffic growth, it makes sense for network operators to shift the priorities for network design and implementation towards building for IP rather than circuit switched voice.

Figure 1.4. European international backbone traffic growth 1999 - 2005



Many broadband applications have fallen by the wayside because of the lack of a broadband local loop. A fast connection is essential to support multimedia traffic - particularly so in the absence of traffic management capabilities within IP. Lack of traffic management means that only the provision of a large overhead of capacity can guarantee adequate latency performance for multimedia. The development of ADSL promises to provide the capacity needed in the local loop.

The last two years have seen tremendous leaps in the cost-effectiveness of ADSL as well as local loop deregulation. This enables new entrants to launch services based on IP without requiring dedicated leased circuits. Cable companies can also compete in the market through the use of cable modems to deliver broadband access. Although most are focused on Internet services today, leading carriers intend also to support voice.

The introduction of ADSL is essential if the expected growth is to be achieved. Within Western Europe, Ovum forecasts that by 2005 over 11 million premises will be connected to ADSL services, each with the capacity to deliver up to 6Mbit/s or 1.5Mbit/s bandwidth, depending on whether ADSL or ADSL 'lite' is used.

1.4 Key benefits for businesses

Services derived from IP telephony platforms are competing in a crowded market of established communication services that have proven their effectiveness. The rate of take up of new IP services, at least in the early days of the market, depends on how businesses will adopt them as a replacement for current infrastructure.

Businesses buy communication services to support their internal and external communications. In Europe and Asia, businesses are cautious about adopting new technology and services for their internal communications unless there is a clear financial case for change. They are also conservative with respect to quality and security. This is clear from a major study of Internet users conducted by Ovum.

In a major survey of European Internet users, Ovum found that 11 percent of users had no concerns about using the Internet. Figure 1.5 shows the concerns felt by the other 89%.

Users are principally concerned about protecting themselves from hackers into web sites. The second largest concern is about the quality of service received. There are several components of service quality that concern users:

- latency on the Internet

- excessive numbers of connection attempts
- poor customer service from the ISP.

We asked users what developments are needed to help them make better use of the Internet. The responses are shown in Figure 1.6.

Figure 1.5. Major concerns of European Internet users

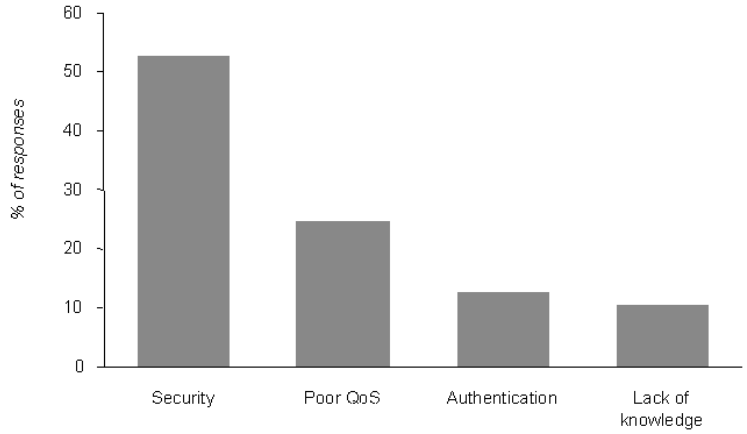
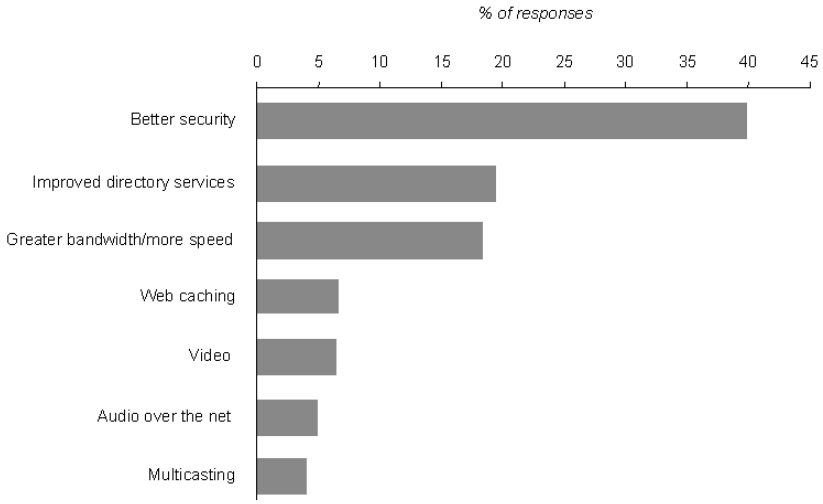


Figure 1.6. Network improvement sought by Internet users



Although today's Internet and some IP services may look good from a cost perspective, they usually fail to meet the quality and security tests. This is a fundamental problem for IP that is being addressed through improved engineering. When these limitations are removed, integrated service access through IP could bring businesses great benefits though rationalisation of access alone.

The immediate opportunities for IP telephony are associated with those applications that are concerned with external communication or which can leverage the ubiquity of Internet access. These have benefits that cannot be realised cost-effectively over an alternative network.

Ecommerce and Web marketing

Many companies are finding that the Web is an effective additional sales channel. The cost of developing it is relatively easy to measure as are the returns from sales. This can make it easier for a business to justify investment in communications services.

Most Ecommerce today is impersonal with the buyer simply surfing around a Web site until he or she finds the information needed to make a purchase decision. If it is necessary to seek advice from a company then a phone call is needed. Next generation networks remove the barrier between the Web and the phone making the Ecommerce experience better for users. The growth of Ecommerce, will like other IP services, depend on the availability of the infrastructure.

Road warriors

The ubiquity of the Internet is a boon for "road warriors" whether they are travelling all the time or occasional business travellers. Access to the Internet through a local phone call gets round the problems of the high cost of long distance phone calls. The next generation network will improve the transparency of access to voice and data services for road warriors. They will be able to access the full range of voice and data services they obtain from the public telephone or corporate network using IP over any PSTN line.

SMEs

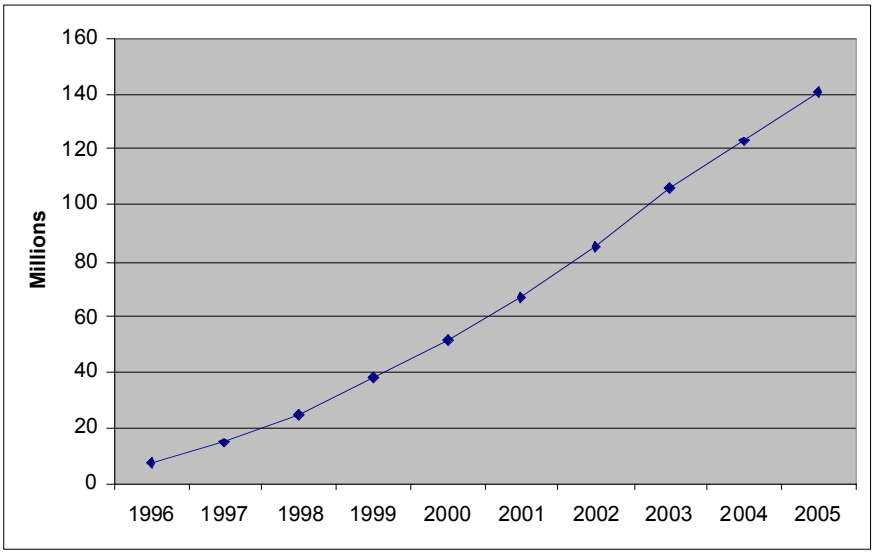
Today, many small or medium sized companies (SMEs) use the Internet for their data communication needs. They can exchange administrative and process related information with their customers and suppliers using Email. They are regular users of the Web and can have their own Web sites. Yet this class of user has been very difficult for carriers to target with new services since they are usually not interested in technology and are cost conscious.

The Internet has raised technology awareness in SMEs and provided them with a new sales channel. The opportunity for carriers is to package voice services and Internet connectivity through a single broadband IP access for these customers.

1.5 Key benefits for consumers

Internet access is growing rapidly and Ovum expects the number of Internet users in Western Europe to grow from 38M in 1999 to 150M in 2005 as shown in Figure 1.7.

Figure 1.7. Internet users in Western Europe



The residential consumers will be prime candidates to take advantage of IP telephony and the next generation network. Some of the benefits are common to business customers. Areas in which particular benefit will be obtained are:

- Savings in connectivity costs via integrated services delivered over a single broadband access
- Improved Ecommerce services that leverage IP telephony.

Today, consumers are buying separate packages of telephone, entertainment and Internet services. The provision of broadband access to the home enables these services to be offered through a single access. Before then, the addition of a single phone line makes it possible for consumers to make use of web enabled call centres.

1.6 Service opportunities

With each new generation of communications technology it's very easy to go in search of the mythical "killer application" and to try and build a service around it. The history of networks shows that most success for carriers is built from simply extending the reach of communication services or making them easier to use. However, the history of communication network implementation is of building separate and often unconnected networks for data, voice, value added services, Internet and IN services. The result is that features are duplicated within the carrier network and between the carrier network and the enterprise network.

We believe that the new opportunities for services fall into three classes:

- Access services - integrating the access to all of the current services through one broadband IP pipe. This brings economic benefits for the user and carrier alike
- Interchange services - adding value through supporting enhanced voice and data communication between enterprises
- Application services - new applications that leverage integration between the PSTN and IP environments.

Let's look at the classes in more detail.

Access services

Although unified network access can be as simple as providing access to all the current carrier services for voice and data through a single broadband IP pipe. However, the greatest benefits will accrue in the long term once unification proceeds beyond the access and also includes the service platforms operated by carriers today.

For example, voice messaging can be provided within the carrier fixed and mobile networks, or through an Internet service. Each network can claim to offer unified messaging but for the user with more than one carrier service the result is very "dis-unified" messaging since the networks rarely interwork. Equipment being developed for IP telephony can link these platforms together holding out the promise of unifying messaging across them all.

By 2006, Western Europe will account for $9 billion revenues from unified messaging services which are forecast to exceed $31 billion worldwide

For the consumer market, integrated access is a compelling proposition. Studies carried out in the US have shown that the most lasting competitive advantage for a carrier is obtained by using an ADSL access to deliver web, voice telephony and entertainment. Other carriers offering a smaller service package will certainly be less profitable.

Interchange services

Carriers need to develop new interchange service packages for businesses and consumers. The most promising opportunities in the business market are:

- IP VPN
- IP Centrex.

Today's IP VPN services are limited and are mainly adopted by businesses as a substitution for parts of their networks that do not carry mission critical information. IP and its surrounding technologies is improving and this will enable the development of VPN

services that are secure enough for all business data needs as well as being able to carry voice and video.

Centrex services will receive a boost from IP. Today, Centrex is not widely adopted in Europe as a result of the presence of many competitive service offerings. The change to integrated IP access will enable carriers to market Centrex services either stand-alone or as a complementary part of an IP VPN.

Application services

Application services are extensions of current services that leverage the power of gateways from IP to the PSTN. Examples include:

- Multimedia conferencing
- Web-based call handling/messaging
- IP-enabled call centres.

Many more application services will be defined as IP telephony matures and its full potential is realised.

It is difficult to arrange multimedia conferencing today because of the cost of bandwidth and CPE needed. In the future, integration of IP and the PSTN will enable conferences to be set up from the Web to end points either on the conventional carrier network or the Internet.

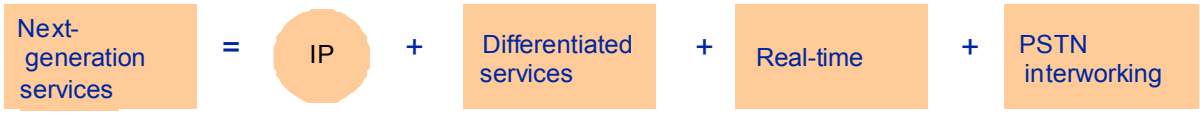
Web based call handling and messaging provides the basic facilities needed to set up a call from the web. Early examples of these services have already been introduced. They also provide a means whereby a user of the web can be notified of events from the PSTN - such as a waiting call.

IP enabled call centres build on web based call handling to enhance the range of options for customer interaction that are available at a call centre. A customer may dial in using a button on a web page. The call could then proceed as normal. However, the customer service representative may find it useful to download information to the caller's PC or to send a Web page to the remote PC for discussion. The call then involves elements of Web communication and voice interaction at the same time. Equally, conferencing in another participant may be useful and could be achieved with the technology.

1.7 Enabling the change

Delivering the services we've described requires broadband accesses, enhancements to current IP protocols and the development of new gateway devices that link the PSTN to an IP network. Figure 1.8 summarises the changes required.

Figure 1.8. Technologies that deliver next generation services



Delivering broadband IP requires high speed local loops using ADSL, cable modem or leased circuit infrastructure. As far as handling voice and priority data are concerned, IP isn't quite ready for prime time yet. It is a best efforts protocol which needs to be enhanced to enable differentiated qualities of service to be delivered for voice and data.

Differentiated services

Carriers need a rugged, predictable, IP service platform in order to deliver IP VPN and voice telephony services. Today, that is best delivered over an underlying ATM network. In effect, ATM provides the traffic management that is lacking in IP and which enables the carrier to offer its customers service level guarantees.

Work is progressing in the IP community with MPLS and Diffserv which aim to provide IP networks with differentiated quality of service. MPLS builds on ATM so that it can

transparently route IP packets. In its second release, due in the year 2000, the protocol will address the provision of different levels of service quality and IP VPN. Diffserv provides a class of service specification mechanism which will allow carriers to offer services with abstract service classes such as "premium data", "best efforts data" or "real-time voice".

By 2005, we expect more than 90% of broadband IP network connections to operate with MPLS capability.

Control standards are essential for widespread carrier implementation of IP telephony and business critical applications. They are key to delivering high quality services to users and guaranteeing end-to-end service delivery. Users must be convinced that service levels can be maintained in the face of rising network usage. If IP based services are to take over from existing voice and data services then they must be able to offer a performance that is comparable to the PSTN and other data networks, such as frame relay.

With these developments, users can buy the IP service class they need and be sure that the network will deliver it reliably and securely. However, as with all standards developments, there is still a way to go before the participants in standardisation agree the final specifications.

Once these standards are agreed and implemented, carriers can control IP traffic without having to over dimension networks to ensure delivery. A common set of standards will be essential for trans-network traffic, both for continued traffic control and translation of network service class information.

PSTN interworking

Interworking between the PSTN and IP will be enabled by equipment enhancements for the current Class 5 (local) and Class 4 (large local, tandem or trunk) circuit switching equipment or by new gateway equipment. This will provide two important functions:

- Conversion and transport of the SS7 signalling used in the circuit switched voice network and IP based signalling
- Media conversion between voice compression formats used in the circuit switched and IP worlds.

An application running on IP will be able to interact with the voice platform to setup calls and query databases found within the Intelligent Network. Ultimately, a service creation and switching platform on IP will replace conventional circuit switches entirely within the carrier network. One of the goals of change is to reduce the time it takes a carrier to implement a new service from the current 18 months to 6 months.

The cost of the complete IP alternative to a conventional circuit switched network is widely estimated at 50% of the capital and operational costs. The argument for change is so compelling to carriers that AT&T has already announced plans to cap its investment in Class 5 switches.

1.8 Next generation networks

Figure 1.10 shows the structure of a next generation IP telephony network. This diagram shows a pair of gateways interconnecting PSTN segments and providing IP telephony services. It is possible to use the gateways singly as interconnect devices but, in a large carrier, several will be needed.

The key element in the figure is the gateway. This includes a signalling gateway and a media gateway. The signalling gateway has connections on the PSTN side to the voice trunks and to the SS7 signalling network. On the IP side, it accepts packetised voice and control packets that use the new MGCP (Media Gateway Control Protocol) protocol. In operation, the gateway will receive call requests from either side. It will then pass this request to its controller using MGCP. The controller will then guide the gateway to complete the call issuing further signalling requests to the PSTN or IP sides as required.

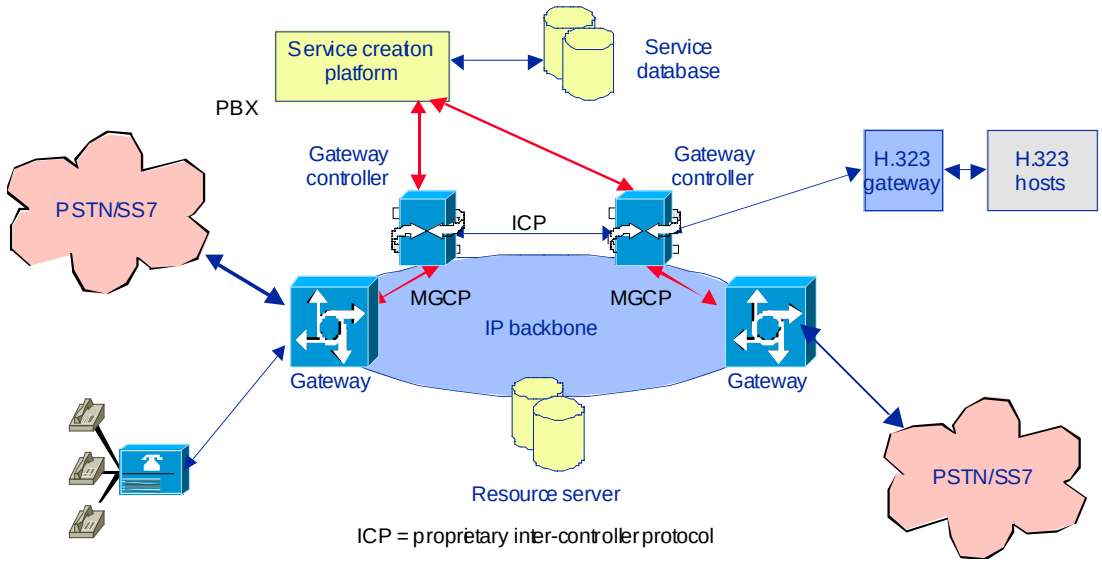
A gateway can be realised either as a stand alone device or as an enhancement to an existing Class 5 or Class 4 switch. Startup vendors are focusing on the stand alone solution whereas the vendors of the existing Class 4/5 equipment produce equipment for both options. This gives a carrier a wide range of choices in how it plans migration to IP telephony.

By 2005 we forecast that over 1600 media gateways will be installed by 2005, as shown in Figure 1.9.

Figure 1.9. Media gateway forecast – installed base

	2000	2001	2002	2003	2004	2005	2006
Western Europe	4	66	312	710	1,170	1,649	2,088

Figure 1.10. Next generation IP telephony network



The gateways are controlled by gateway controllers (also known as Call Agents) which provide the call processing logic. This will include basic call setup. It can also include the querying of remote databases in the PSTN IN in order to obtain number translation or redirection information. In the latter cases, the gateway must support the SS7 component protocol TCAP as well as ISUP and possibly INAP. A gateway controller has access to resource servers which store voice prompts needed during call establishment or during a call.

In common with the IN, the next generation IP telephony network has a service creation environment. However, carriers want this to be as open as possible in line with their goal of rapid service creation. It will be built on a commercial distributed processing environment such as Corba or DCOM. The service database contains user profiles or policies as well as information related to call rating and routing.

Clients - H.323 or SIP?

Most IP telephony developments to date have used the H.323 protocol for calls. However, opinion is divided as to whether this remains the best choice. All the vendors of gateways support it but it is known to have limitations for large scale use. In essence, it has excess complexity and its peer to peer model is not ideally suited to signalling from CPE to a Call Agent. These issues are being addressed within the H.323 committee at present.

SIP (Session Initiation Protocol) is a protocol that originates from the IETF and which is much simpler than H.323. It can be used with a companion protocol, SDP (Session Description Protocol) to set up multimedia calls. It is a very simple protocol and hence has the advantage of being inexpensive to implement in CPE. Many leading players in the network industry are evaluating the use of SIP at present.

A further boost to SIP and MGCP has come from their adoption by the US cable industry as the signalling protocols of choice. These protocols will be used from set top box equipment to provide access to telephony and multimedia services.

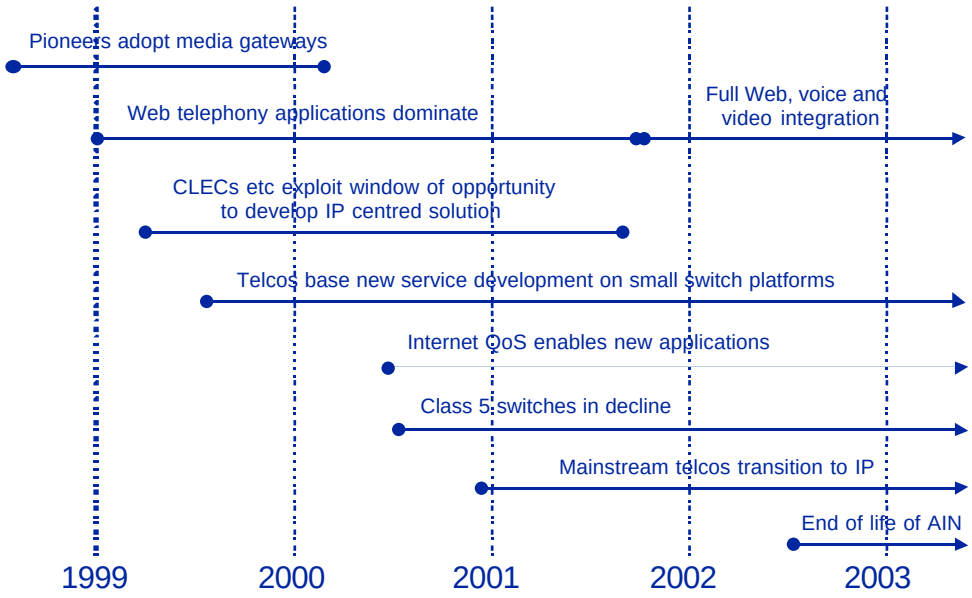
1.9 How fast will technical change occur?

Change to the next generation of IP telephony is already underway as shown in Figure 1. 11. This is a development scenario for the US market. We expect development in Europe to lag by up to 18 months depending upon the scale of competition in the market.

Pioneers are already trialling gateway equipment in the network. The first companies to adopt them in "live" applications are the new entrant Competitive Local Exchange Carriers (CLECs) and IP backbone specialists in the US. These companies have a particular interest in the gateway as a means of PSTN interconnect or as the prime voice switch. Mainstream carriers will be more cautious towards the technology. They will adopt it first to offer enhancements to existing services and then migrate their core networks to a complete IP telephony solution.

The key issue affecting integration of voice, video and data is the provisioning of quality of service control for IP. Without it, carriers will need to provide advanced services from dedicated IP backbones where they can manage traffic to acceptable performance bounds. Although the technologies to deliver QoS will become available in the year 2000, we expect that it will take a further 18 months before they will be deployed on a scale that makes it possible to deliver good quality multimedia services outside the bounds of carefully managed network segments.

Figure 1.11. Timeline for technical change



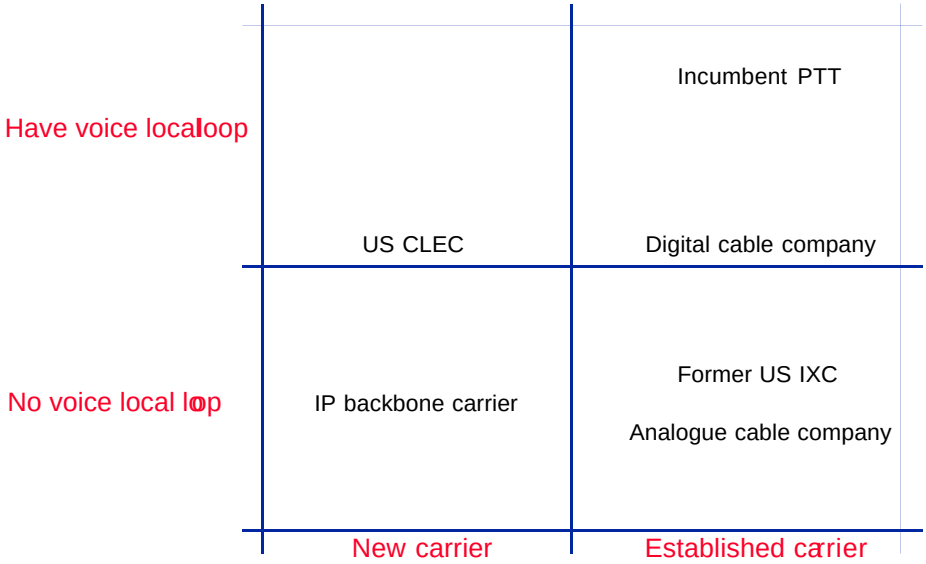
Based on this scenario, it is possible to estimate the proportion of the voice lines in a carrier network that will be within the reach of a gateway and hence able to gain access to the advanced features of the next generation network. Our calculations show that, in the year 2006 this could be as high as 80% of lines in the US and about 60% of lines in Europe.

1.10 Impact of IP telephony on carrier competition

Next generation networks affect the competitive landscape for carriers dramatically. They lower the entry point for voice services and enable carriers to plan round IP. Incumbents that have separate service platforms face competition from new entrants that offer integrated services and which can innovate in services more quickly.

The pace and extent of change depends on the regulatory framework in each country. In the US, which leads in the adoption of IP telephony, change has been considerable since the Telecommunications Act of 1996. Figure 1.12 shows the competitive landscape.

Figure 1.12. Competitive landscape for carriers



The key market differentiators between carriers today are whether or not they own a local loop and whether or not they have legacy network equipment. In the US, the CLECs and new entrants such as Level 3 are focusing on IP infrastructure which they intend to use to support voice accesses. Unbundling of the local loop helps carriers that do not own local loop plant by making ADSL a viable technology for IP service delivery.

Cable companies also own local loop facilities although these are not always easily adaptable to carrying two way IP traffic. Where the upgrade is made to cable it can be used by the cable company to deliver integrated voice, video and data using IP. In the US, AT&T, which was a long distance carrier only, has acquired cable companies (TCI and MediaOne) to provide it with a broadband local loop that it can use to compete in the local telecom market.

1.11 Carrier strategy alternatives

The key strategy elements for carriers are determined where they are positioned within Figure 12, i.e.:

- New entrant carriers that have a local loop need to leverage IP to deliver a full range of voice, data and Internet services through an integrated access
- New entrant carriers that are focused on the backbone (eg Level 3, Qwest) need to work with other local loop providers. They need gateway equipment to provide PSTN interconnect with other carriers and to support customers requiring legacy connectivity
- Incumbent carriers need to build on the network coverage advantage that they have with IP services that leverage the combined benefits of their PSTN and Internet networks
- Established carriers that do not have their own voice local loop need to acquire one. They can then leverage IP in much the same way as other incumbents.

In Europe, the major battle in the short term will be between the incumbent PTT and new entrants. Incumbent carriers can't afford to be slow in the adoption of the new technology. Experience in the UK market has shown how a new entrant with a sound business strategy can erode business market share from the incumbent carrier very quickly.

IP telephony systems lower operational costs for new entrant and incumbents alike. The development of the new technology provides an opportunity for carriers to encourage their customers to outsource to IP VPN and IP Centrex services. These services will prove attractive to both large customers and SMEs.

Although the first wave of gateway products are primarily allowing new entrants to compete on basic telephony, they also enable all carriers to innovate in services. This is a major opportunity for incumbents. There are already examples of incumbents using small switch platforms to supplement existing IN services. Gateway equipment enables them to continue this trend. IP telephony technology can enable a new service to be launched in a matter of months.

1.12 Actions for incumbent carriers

To avoid being "wrong footed" by competitive carriers incumbents must position themselves to react to potential threats to their high value customer base. They must provide feature rich IP overlays quickly and evolve services on an integrated service base.

Initially IP infrastructure needs to be provided in key business areas to satisfy existing requirements and to develop new services where required. This implementation must be used as a proving ground to assess scalability and reliability of IP based services. The opportunity must also be taken to create and assess a range of value added services, which carriers can sell to a growing sophisticated customer base.

Incumbent carriers should address external markets and attack these using IP infrastructure, (e.g. BT in Spain). This will give valuable operational experience that can be applied to a domestic network. It will also give a valuable insight into the actions of competitive carriers at home.

Finally, IP offers a brave new world of telecoms. The technology is there to provide ubiquitous communications, offering applications limited only by the imagination of the service provider. Incumbents must be pro-active and lead the way by forging ahead with new networks and new ways of working to enable this to happen.

1.13 Actions for new entrants

New entrant carriers must make sure that access to the customer is well planned and use innovative technologies to reach the customer when necessary. Minimising the cost of customer connection will be a key requirement to supply cost effective services and carriers must use alternative access methods (such as wireless) if interconnect does not offer the best connection solution.

Competitive carriers wishing to succeed in the IP services market must establish the market to be served carefully and work out a strategy to offer services to defined business and residential market segments. They must target customers with a specific usage profile to fit in with business plans and network build. Failure to identify the correct market will be costly and carriers will fail if they do not establish their market carefully.

Carriers must offer IP service flexibility to customers by providing value added services quickly. Specialised features will differentiate the carrier. Services must be set up so that a customer will find it difficult to transport these to another service provider. The ability to offer innovative services will lock in the customer base.

New carriers entering a green field environment can offer service from a growing number of integrated IP platforms, which provide a lower cost route to market. Carriers going down this route must ensure that there is full access to a circuit switched environment as full access to the PSTN/SS7 network will be required now and in the future.

All competitive carriers must continue to evolve their networks. There will be significant developments in the future. New features and switch services will become available quickly which may offer a key competitive advantage.

2. Pan-European operators

2.1 State of the market

Pan European operators represent the predatory carriers that are stalking Europe. Operators such as WorldCom (MFS) and COLT have honed their skills in the US and/or highly competitive UK business services market. They have proved they can deliver high quality, resilient, lower priced services. They have become the operator of choice for high volume metropolitan users.

The ability to offer a guaranteed controlled network for business critical applications is a key selling point of these organisations. While they must continue to offer traditional managed services, they must also develop an IP integrated network. With increasing use of lower priced broadband access, (e.g. ADSL) it will become feasible to bring smaller companies onto these networks and offer seamless IP carrier services.

Some ISPs and new entrant international IP service providers, such as PSINet, UUNet (Worldcom), U-Net, EasyNet etc., are offering IP integrated solutions on a European basis. They are rolling out IP networks to offer VPN type services to business customers.

2.2 The players

Major pan-European network operators, with existing networks or declared plans to develop networks are listed in Table 2.1.

Figure 2.1 **Major Pan-European networks**

Operator	First traffic	Estimated cost $M
BT/Concert	Mid-1999	115
Cable & Wireless	End 2000	300
Carrier 1	End 1998	n/a
COLT	Mid-2000	800
France Telecom/ Deutsche Telekom	Mid-1999	594
Global Crossing (pan-European Crossing)	End 1999	850
GTS Carrier Services (formerly Hermes)	Early 1998	450 initially
iaxis	Early 1999	240
Interoute (1–21)	Early 2000	1,500
KPNQwest (Eurorings)	January 1999	1,850
Level 3	Mid-1999	n/a
MCI WorldCom (Ulysses)	July 1998	n/a
Viatel (Circe)	March 1999	720
TOTAL		>7400

N/a = Not available.

Esprit Telecom was awarded a public telephony licence in 1998 and currently operates in 19 European countries and has over 30k customers. It supplies services in the United Kingdom, The Netherlands, Germany, Spain, France, Belgium, and Italy and was recently acquired by GTS. GTS operates CLECs in Prague, Budapest, Kiev, St Petersburg and Moscow and claims to be the largest CLEC in Europe. GTS CLEC operations offer switched, non-switched and IP-based services. GTS plans to build an additional 12 CLECs in Europe by year-end 2001. The acquisition of Esprit Telecom will help accelerate this process through existing licensing and interconnect agreements

COLT is a major pan-European operator. Colt operates networks in 18 cities in 9 countries across Europe, including: London, Frankfurt, Munich, Hamburg, Berlin, Paris, Zürich and Brussels, Madrid and Milan, Barcelona, Cologne, Geneva, Lyon and Vienna. It operates a fibre-rich pan-European IP-based network and plans to launch services in Marseilles and Rotterdam by the end of 1999. Plans are also under development for a further 4-6 city launches in 2000.

Europe Railtel - Hermes - (HER) styles itself as a Carriers' carrier and provides high-speed cross-border managed transmission services to operators and providers of telecommunications services across Europe. A member of the Global TeleSystems Group, HER is a major independent pan-European carrier.

WorldCom has established itself as a local, facilities-based competitor in large number of countries including, France, Germany, Italy, The Netherlands and the UK, offering both local and long distance services.

2.3 Timeline for change

Pan-European service providers will play a major role in the European corporate communications market but will not affect the majority of residential customers or SMEs. They concentrate on dealing with large telecoms volumes and providing private networks, with a contract usually won on price, network location and SLA. The growing popularity of VPNs and worldwide Intranet solutions means that the ability to offer a global or pan-European integrated IP network to corporate customers will become attractive. IP integration has already begun for many of these pan-European and trans-global service providers and will accelerate with user demand.

2.4 Recommendations

Pan-European and global operators must continue to develop an IP integrated network to offer services to their client bases. They must capitalise on the ability to deliver a guaranteed SLA to customers.

Smaller pan-European service providers, such as growing ISPs must move to offer a fully integrated network solution, including IP voice to gain a complete telecoms portfolio. The falling price of trans-border bandwidth and reducing local access costs where LLU is being implemented in a favourable regulatory environment means that they will be able to grow their markets quickly.

3. Germany

3.1 Regulation

Germany achieved full deregulation for all services at the beginning of 1998. The regulator is the Regulierungsbehörde für Telekomunikations (RegTP).

Germany has local loop unbundling, although Deutsche Telekom is permitted to charge rivals more to use the local connection than its own residential customers pay. The regulator requires Deutsche Telekom to offer both voice frequency and ISDN bitstream services (ADSL is not currently covered).

There are two types of licence issued. A class 3 licence is the right to operate transmission lines for other operators, and a class 4 licence, which is the right to offer public voice telephony.

3.2 Market situation

Deutsche Telekom currently dominates the market, with incessant arguments about interconnect fees to other operators. Deutsche Telekom's policy of high pricing encourages more operators to enter the market where high profits can be made.

WLL licences have just been issued to Viag Interkom, Mannesmann Arcor and 10 other operators. Viag Interkom says it has won enough frequencies to offer wireless services to 65% of the population and expects to begin services as soon as October.

Deutsche Telekom is continuing to roll out its ADSL service, which will put it in a strong position to mop up the early adopters of high speed Internet access. The introduction of ADSL services means that Deutsche Telekom is well placed to offer innovative data services to its customer base, providing the pricing is right. If it gets the pricing wrong it will be an easy task for other operators, such as Mannesmann to clean up this new market – providing it can provide the local access or use an unbundled local loop.

Mannesmann is the number 2 operator in Germany (after acquiring o.tel.o). It is aggressively reducing tariffs and has introduced flat rate tariffing with a reduction is 54% for long distance calls in Germany.

Competing operators are still building their networks to offer broadband services to customers. The more even distribution of population in Germany means that a national network is more important as business sites are likely to be more evenly dispersed throughout the country.

3.3 The players

Up to August 1999, there have been 179 Class 3 licences and 174 Class 4 licences issued. Major operators include:

- Deutsche Telekom (State 48.8%, Kredianstalt fur Wiederaufbau 23.8%, France Télécom 2%, others 2%)
- Mannesmann Arcor (Mannesmann consortium 74.9%, Deutsche Bahn 25.1%)
- o.tel.o (Mannesmann 100%) – it has a comprehensive service portfolio including frame relay, voice and Internet access. It traditionally targets SMEs
- Viag Interkom (Viag 45%, BT 45%, Telenor 10%) – now rolling out its own fibre network
- Mobilcom (Fixed and mobile operations) – claimed 10% of long distance market after the first year of liberalisation
- COLT – has built metropolitan networks in Frankfurt, Hamburg, Munich and Berlin

There are also a number of regional city operators offering services to major conurbations. These include:

- ISIS Multimedia
- EWEtel

- Net Cologne
- HanseNet - Hamburg
- VEW Telnet (e.g. Dortmund, Bochum, and Münster)
- M"Net - Munich

3.4 IP developments

Deutsche Telekom is offering ADSL services under the name of T-DSL. There was a pilot trial in 1998 in North Rhine and by the end of 1999, Deutsche Telekom hopes to offer ADSL in 43 local areas. It plans full ADSL coverage by 2003. Its T-Online service has over 2 million customers.

o.tel.o is using the Columbus network (Cable TV) to provide multi-media services to business and residential customers. Its Gelsenkirchen project offers high-speed Internet access, video on demand and content.

3.5 Cable

There is an extensive cable TV network in Germany, with an almost 60% cable penetration. The second largest cable operator is Tele Columbus, which is a subsidiary of o.tel.o, with a >70% take up of its services with ~1.7 million customers.

Deutsche Telekom has come under pressure from the EU to divest itself of its cable TV interests. Tenders have been received for 75% stakes in 9 regional networks.

3.6 Timeline for change

The demand for telecoms in Germany, coupled with LLU and the quality of the competitors will mean that IP integration is likely to happen quickly. Cable TV companies will lag behind, as franchises still have to be awarded, although when in place progress will be rapid. A timeline for change for mainstream operators is shown in Figure 3.1.

Figure 3.1 Timeline for change

IP voice integration for business users			
IP infrastructure migration			
	1999	2000	2001

3.7 Recommendations

Deutsche Telekom will lose market share if it continues its policy of high pricing. It must develop innovative services and lower prices to keep its existing customer base.

It must defend its position and strive to lever off its economies of scale. IP network integration will be an opportunity to consolidate a wide range of business services and to innovate new services to corporate clients.

Competitive carriers must differentiate services from Deutsche Telekom, as well as price, to offer something new. Adoption of an integrated IP approach will offer a strategic advantage in the race to grow the market and secure corporate customers.

4. Italy

4.1 Regulation

In July 1997 the Telecommunications and Broadcasting law was passed to establish the Italian regulatory body Authorita della Garante nelle Communicazione (AGC).

The Italian market is now fully deregulated.

4.2 Market situation

Telecom Italia is still the dominant carrier with a de facto monopoly in the local loop. Competitive carriers have only had their operating licences since 1998 and are still developing infrastructure and a customer base.

The business communities in Italy will ultimately be well served by alternative service providers, but the lack of a viable alternative local loop is an issue, which will tend to maintain high service tariffs..

4.3 The players

Major carriers in Italy include:

- Telecom Italia – as well as a voice network it also provides Itpac, the public switched data network
- Infostrada (51% Olivetti, 49.9% Mannesmann) – It is the main competitor to Telecom Italia and offers a range of voice VPNs, CUGs, I*net services and outsourcing. It is building its own fibre network and will have >4,000 km of fibre by 2000. It has an agreement with the state railway which allows it to install track fibre. A focus on business customers but residential are also served via directly connected service or prefix dialling.
- Wind (Ensel 51%, France Télécom and Deutsche Telekom 49% – offers Centrex, VPN and I*net services
- Albacom (Albacom Holdings 45.5%, Mediaset 19.5%, ENI 35%) – originally set up to handle portfolio of Concert services – primarily corporate service provider. ENI transferred Nuova Societa di Telecommunicazioni fibre network to the company giving it an additional 2,400 km fibre, used to construct loops in 8 cities
- Autostrada Telecom (Autostrada 100%) – plans to have 5,000 km of fibre by 2000
- COLT, Worldcom – installing fibre rings in major Italian cities, e.g. Milan

4.4 IP developments

Telecom Italia (Italy) began a technical trial of ADSL trial in Turin in 1997 and is deployed in 15 central offices so far. ADSL implementation is underway and Telecom Italia is planning for over 5 million connections by 2000.

4.5 Cable

Italy has a low penetration of cable. The only major operator is Telecom Italia, which offers services via its Stream subsidiary. There has been scant improvement in the network as Telecom Italia's rollout of its HFC project (Socretes) is proceeding slowly. By the end of 1998 Socrates had only passed 1 million households in 58 cities (70K customers). This has led Telecom Italia to doubt the commercial viability of the project.

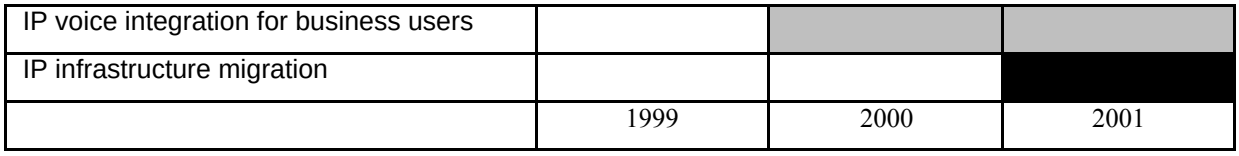
4.6 Timeline for change

Because of the dominant position of Telecom Italia, and the short time for competitors to build an alternative infrastructure, a transition to an integrated IP environment may be slow. However, Telecom Italia is implementing ADSL services, and if LLU is introduced, lower

cost, high-speed customer access will encourage the development of multimedia IP business services.

Competitors will be looking for ways to usurp Telecom Italia's dominant position and are likely to introduce IP integration at the first opportunity in an attempt to win customers. A timeline for change is shown in Figure 4.2.

Figure 4.2 Timeline for change



4.7 Recommendations

Telecom Italia's main competitors are still in the process of rolling out their networks, which gives it some time to consider its competitive position. It has built up considerable resentment in Italy because of what is considered high pricing. This pent up frustration will manifest itself in migration to other services when they become available.

Telecom Italia must now concentrate on offering lower price innovative services if it is to prevent wholesale migration away from its network. IP integration will help to provide the range of services and help to reduce costs. Its ADSL programme will add to its ability to offer a range of innovative multimedia services.

Until LLU is available, competitors are at a disadvantage as there is no viable alternative access to Telecom Italia. Competitors must therefore build out their own metro networks (e.g. COLT, Worldcom) and concentrate on accessing the corporate market with lower cost innovate IP services over an integrated network.

5. The Netherlands

5.1 Regulation

The Netherlands is fully deregulated. A licence is not required to offer services. An operator only needs to register with the regulator. Operators with a market share greater than 25% must offer third parties access to their infrastructure (i.e. KPN). This has caused a rush on the KPN network by other operators, which has caused KPN severe capacity problems and has meant a major network upgrade.

OPTA is the Netherlands Regulatory Authority for the Telecommunications and Postal sector. OPTA is an independent body that commenced its activities on the first of August 1997.

In April 99 OPTA, announced a new scheme for local loop unbundling, which will start at cost-based prices and move to commercial pricing over five years.

5.2 Market situation

There are the usual complaints from operators that KPN interconnect charges are too high. In 1998 interconnect fees were lowered, following complaints from competing operators.

KPN is facing competition both from conventional telco companies, such as Telfort, and cable companies offering services, such as Priority Telecom.

The smaller geographical size of The Netherlands means that it is reasonable for new operators to build an alternative national network. This, coupled with the high penetration of cable TV gives many different access alternatives.

Business networks are growing at around 15% pa, which puts pressure on the KPN network and encourages the entry of other competitors. Cable operators are busy rolling out and upgrading networks to offer telephony and high-speed Internet access services to compete with KPN for residential and business customers.

5.3 The players

Operators providing their own facilities licence include:

- KPN Telecom The state holds a 45% share of KPN Telecom, the incumbent telco. KPN in investing in a considerable network upgrade during 1999
- Enertel (100% Worldport Communications)
- Telfort (BT 50%, Nederlande Spoorwegen 50% - one of)
- Tele2 (SEC 100%) – service start in October 1997
- Priority Telecom (UPC 100% - cable network operator)
- Versatel (NeSBIC Venture fund 39.4%, Cromwilld Ltd 32.4%, Telecom Founders 28.2%

5.4 IP developments

On 1 January 1998, KPN Telecom, NOB Interactive and SURFnet began trialling ADSL in Amsterdam. It has been decided to continue the Snelnet test until December 31, 1999.

KPN claims that its World Access/Planet Internet services makes it the largest ISP in The Netherlands. In 1997, it launched Het Net and has now moved its multimedia services to a separate Telecommerce division.

Sonera is also active in The Netherlands, having teamed up with UTH to offer Sonera's QuickNet fast Internet access service. Palet Kabelcom also offered fast Internet access.

5.5 Cable

The Netherlands has a high penetration of cable services (>85%), with over 6 million households connected.

There are over 100 cable operators in the Netherlands. From these, 5 make up VECAL the Dutch cable association, which accounts for 99% of all cable customers.

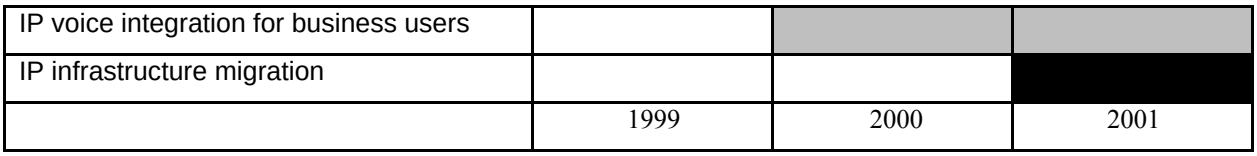
Cable operators are now upgrading older cable infrastructure to offer telecom services. Major players include:

- UTH (~1.5 million cable TV customers. Began offering telephony services since 1999 and planning to offer Internet services)
- NV Casema (France Telecom 100% - cable and Internet services)
- A2000 (UPC 50%, MediaOne 50% - a subsidiary of UPC currently upgrading its network with HFC to carry 2-way interactive services)

5.6 Timeline for change

KPN may take the opportunity of expanding its network and move towards IP integration to counter the threat of cable companies. Cable companies may move rapidly down the IP integration route, especially as they are developing 2-way interactive services. There could be significant development of IP integrated solutions starting in the year 2000. A timeline for change is shown in Figure 5.1.

Figure 5.1 Timeline for change



5.7 Recommendations

KPN must expand its network rapidly to supply the requirements of other telecoms operators and its own service market. It must take action to offer innovative services at the right price or it will end up building a network for its competitors!

It must use its network expansion programme as an opportunity to install IP enabled network equipment to increase its service offering.

Competitors must continue to press KPN for network access and to use the current network confusion to implement integrated IP service solutions. This will enable rapid service development and greater access to an added value customer base. Cable operators in particular must seize the opportunity to offer integrated IP access over a cable infrastructure.

6. France

6.1 Regulation

Regulation is under the control of the Director General of Posts and Telecommunications (DGPT). The Authourité de Régulations des Télécommunications (ART) was set up at the beginning of 1997 and is responsible for day to day to day operational matters and making recommendations for change. France is fully deregulated, with business network services open to full competition since July 1996.

French cable operators must be licensed by Conseil Superieur de l'Audiovisual (CSA). In July 1997, the French regulator granted cable operators the right to offer ISP services.

6.2 Market situation

By December 1998, 58 fixed line licences had been issued, although 16 of these relate to operators providing services over leased lines. 30 of these licences were full facilities based licences, 4 were alternative network licences and 8 were for experimental networks only.

France Télécom is coming under increasing competitive pressure, with a 14.4% reduction in interconnect charges for 1999. France Télécom is also reducing the cost of calls, especially for high volume users, worth up to 30%. LLU is also being discussed. ART is developing an LLU policy.

France Télécom is coming under increasing threat by well specified competitors, such as Cégétel, COLT and Worldcom. Its reliance on its corporate customers, with large groupings in the Paris area (its 20K+ corporate business produces 25% of its revenues) makes it vulnerable to predatory operators.

6.3 The players

The key competitor to France Télécom is Cégétel, a joint venture between Vivendi (44%), BT (26%), Mannesmann (15%) and SBC (15%). At the end of May, Cégétel 's Le7 fixed network had 900K customers. Other major players include Sirius (owned by Unisource), Worldcom, COLT and Esprit Telecom.

Companies with a facilities based licence include:

- France Télécom
- Esprit
- Cégétel.
- Télécom
- BT France
- Télé2
- Télécom Dévelopment

6.4 IP developments

Wanadoo is France Télécom's Internet service and it forecasts 1million customers by 2000. It is moving its Minitel customers onto its Internet access service and is trialing its Wanadoo Netissimo ADSL service, along with broadband satellite access. It received approval from the Government in July to roll ADSL service later in 1999. France Télécom says that it will spend ~2 billion FFr over three years installing the equipment.

France Télécom expects to increase its share of the Internet access market to 40% by the end of 1999. Through its Hébergemart subsidiary it offers I*Net services to industry, including web site hosting and electronic commerce.

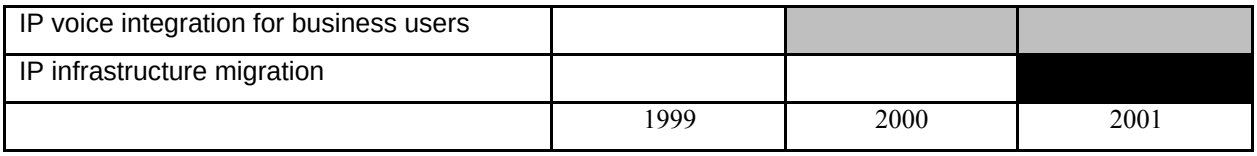
6.5 Cable

France Télécom built the cable TV network in the early 1980s under direction from the Government and plans to sell off parts of the network it does not operate to reduce losses. However, it will continue to hold a stake in the company that buys the network. It is expected that other cable operators will buy the network to offer Internet and telephony services over the cable infrastructure. Lyonnaise Cable is the leading cable Internet service provider.

6.6 Timeline for change

The development of ADSL by France Télécom will enable it to develop a high speed local loop and roll out innovative IP VPN type services to its customer base. This is set to begin during 2000. Once this has been established it is likely that France Télécom will begin to integrate voice using IP. This will be followed with limited migration to an IP infrastructure, especially for its business customers. A timeline for change is shown in Figure 6.1.

Figure 6.1 Timeline for change



Competitive carriers are busy building high-speed local loops, primarily aimed at business customers. They too will increase the offer of integrated IP services to businesses quickly, particularly to counter any initiative by France Télécom. The timescale is likely to be the same for competitive carriers as well as France Télécom because of the competitive French market.

6.7 Recommendations

France Télécom must develop innovative services to keep its existing customer base and attract new revenues. Its heavyweight competitors, with an increasing local presence means that competition will intensify.

It must defend its position and strive to lever off its economies of scale and to grow its business. IP network integration will be an opportunity to consolidate a wide range of business services, such as VPNs, and to innovate new services to corporate clients. Its planned roll out of ADSL will add and enhance VPN services, especially to SMEs, which may not have a dedicated business network.

Cégétel and other competitive carriers must differentiate services from France Télécom to offer something new, as well as offer lower priced services. Adoption of an integrated IP approach will offer it a strategic advantage in the race to grow the market and secure corporate customers.

7. Spain

7.1 Regulation

Spain is regulated by the Sectretaria General de Telecommunicacions (SGT), a unit of the Ministry of Development. In June 1996 the Commisión del Mercado de las Telecommunicaciones (CMT) was set up to oversee implementation and arbitrate on disputes.

Spain implemented full telecommuncations deregulation 1 January 1998.

7.2 Market situation

Even with deregulation, there is still little impression on Telefónica's market hold. In 1998, it held over 98% of the market, with 93% of the international and long distance market and 99% of local connections. Telefónica is modernising its network and wants to reach 100% digitisation by 2000.

The regulator reduced interconnect charges in 1998 to encourage competition and in June 1999 approved a 6.5% reduction in Telefónica's provincial tariffs. International and long distance charges were also reduced.

7.3 The players

Facilities based operators in Spain include:

- Retevisión (Telecom Italia 28.7%, Endesa (utilities) 28.67%)
- Unis2 (France Télécom 69%)
- Jazz Telecom (Management 44%, Institutional investors 56%)
- Euskatel (BBK 23.5%, Kutxa 18.5%, Telecom Italia 18%, Endesa 10%)
- Cableurope (BSCH 32.45%, SapinCom 32.33%)

Retevisión is the main competitor to Telefónica. Services are accessed by dialling the 050 prefix. It is building its own trunk network and has invested ESP130 billion. It also has access to its utility partners' networks (Endesa and Unión Fenosa). Out of its >1.5 million customers only 20-30K are directly connected, with most of these being business lines.

Euskatel is particularly strong in the Basque region and claims 25% of this long distance market. It also offers services over its cable TV networks, including telephony and Internet access.

Uni2 plans to have completed a national network by 1999, relying heavily on Telefónica leased lines. Offering mostly long distance services, it has over 490K customers.

Jazztel has no major telecoms backers and has relied on its own money and other institutional investors. It plans to invest ESP100 billion in network building and service provision.

7.4 IP developments

In May 1999, Telefónica began offering free Internet access via its Internet Teleline subsidiary. Retevisión launched a free Internet access service in June 1999 under the name of Alehop. It also offers paid Internet services, which has over 100K customers.

Some 30% of households in Spain have access to ADSL technology. The Ministry of Public Works and the Economy plans rewiring of the remaining 70% of households during 2000 and 2001.

BT has announced plan to build an IP network is Spain with Nortel and the lead equipment supplier. Telefónica has also announced plans for an IP network, choosing Lucent infrastructure equipment.

7.5 Cable

In 1995 cable legislation was introduced which split Spain into 8 main regions where Telefónica and a competitor would operate in each region to provide services. In 1996, this legislation was amended to give the competitor a head start of 16 months over Telefónica for audiovisual services and 2 years for telephony.

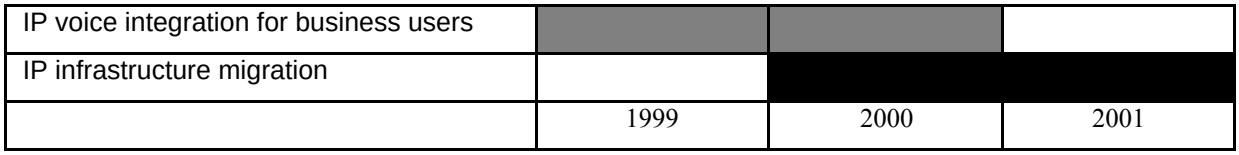
By August 1998 there were 7 franchises awarded. Cable telephony represents a major challenge to Telefónica in the longer term. Madritel (22.2% Telecom Italia) is the largest franchise holder, with over 1.5 million lines.

The major players in the cable market are Telecom Italia, Unidon Fenosa and Group Endesa (utilities) and Cableurope. These organisations are present in a number of franchises and had over 4 million lines by August 1998.

7.6 Timeline for change

Movement toward IP network provision will start imminently, particularly because of the BT action. Telefónica can be expected to watch BT carefully, and there is likely to be a knee jerk reaction in deploying an IP integrated network to serve business customers. Competitors will be forced to joint in the melee and ironically, Spain is likely to end up having the most advanced IP networks in Europe. A timeline for change is shown in Figure 7.1.

Figure 7.1 Timeline for change



7.7 Recommendations

Telefónica must become more competitive in the shorter longer term if it is to prosper. BT, who will press Telefónica hard and it cannot afford to drag its heels. It must go for a fast IP implementation and develop an integrated IP network using gateway and IP switch technology or it will lose out.

Cable providers can also attack Telefónica by offering telephony services. They should be considering faster access (e.g. ADSL) and offering integrated services.

Other competitors must continue to build out their networks and take advantage of any LLU if this is introduced. Possible JVs with cable companies should not be ruled out. An IP integrated network should be high on the priority list of competitors, particularly as there is limited legacy network equipment to consider. This will offer a fully integrated service portfolio, which will be required to compete with Telefónica and the new BT IP network.

8. UK

8.1Regulation

The Department of Trade and Industry is responsible for regulating telecommunications in the UK. Oftel (Office of Telecommunications) is responsible for administering the regulations and arbitrating disputes.

The UK was one of the first European countries to be deregulated and its regulatory model has been widely adopted throughout Europe and the RoW.

No licence is required to provide data services over leased lines. Only notification of service is required.

8.2 Market situation

The UK is a fully deregulated market with over 300 licences issued in the UK, with approximately 40 PTO licences, along with many simple resale licenses and over 100 International Facilities Licences (IFLs). The business market is far more competitive, especially for the corporate user, where heavy discounts can be negotiated.

BT still has over 80% of the local call market, although its national call share is declining below 65%.

In an attempt to drive competition and the development of high-speed data services U.K. telecoms regulator Oftel has resolved that BT must open up its local loop to competitors by 1 July 2001.

8.3 The players

Major operators in the UK include:

- BT
- C&W (C&W 52.8%, Bell Atlantic 18.59%, others 28.57%)
- Energis – now a plc, previously owned by power companies. Has a large frame relay/ATM network and carries large amounts of IP traffic for ISPs
- NTL – cable operator – active in communications and Internet service provision. Trialling cable modems and has launched interactive TV services
- Telewest – (29.9% Microsoft, AT&T 21.6%, others 48.5%)
- Kingston Communications (Kingston-upon-Hull 100%)
- WorldCom – metropolitan network in London ~20K business customers
- COLT – metropolitan networks in London and some other major UK cities

8.4 IP developments

After interminable trials and procrastination, BT will roll out its ADSL service to ten cities by March 2000. However, it will not supply customers directly but will sell these services via resellers (e.g. AOL).

BT can now offer broadcast services in 2001, a year earlier than originally promised. However, it may now decide to concentrate on IP multimedia services, rather than move into broadcasting which is now well served by terrestrial and satellite providers.

Cable companies are very aggressive. NTL is currently trialling cable modems and promises to roll this service out within its franchise areas if this trial is successful.

Kingston Communications has also launched an ADSL access service for Internet customers and plans to offer video on demand services during 1999.

8.5 Cable

90% of the cable market in the UK is in currently in the hands of three players offering telecommunications and entertainment services. These are:

- NTL
- C&W
- Telewest

However, C&W is in the process of negotiating to sell its cable interests to NTL, which will then make NTL the largest cable operator in the UK.

Much of the cable infrastructure in the UK is modern, having been installed over the past 10 years. It is based on fibre and co-ax with a separate telecoms copper pair overlay. This gives cable operators the option of either providing ADSL or high-speed cable modem connection.

8.6 Timeline for change

Because of the number of competitors and alternative networks offering services, IP network integration may be slower than in other countries. It may be driven not by the incumbent but by competitors, such as NTL and Energis who will want to differentiate services and attract additional corporate customers. A timeline for change is given in Figure 8.1.

Figure 8.1 Timeline for change

IP voice integration for business users			
IP infrastructure migration			
	1999	2000	2001

8.7 Recommendations

Although BT has given some thought to migrating to an IP infrastructure, it seems unable to move quickly in the marketplace. The long time to introduce ADSL is indicative of the inertia within the organisation. It MUST take a more realistic view of the market and behave as a market leader, modernising its network and generating new services. Failure to do this will mean it will follow its competitors in customer service innovation.

NTL is the company to watch. Its incredible acquisition spree will either see it at the top or bankrupt. Ultimately, it will be the cable companies that offer the most competition to BT. Cable companies must move quickly to introduce high speed IP access (NTL is already trialling cable modems) and move to a service led infrastructure. They must continue to introduce radical new services to upset BT's service and tariff complacency.