

White Paper

Evolution of the access networks towards Ethernet-IP

The white paper outlines the necessity of migration to the convergent network. This is however at the moment being hampered because fixed line network operators have not yet completed changes in structures. But change will come because:

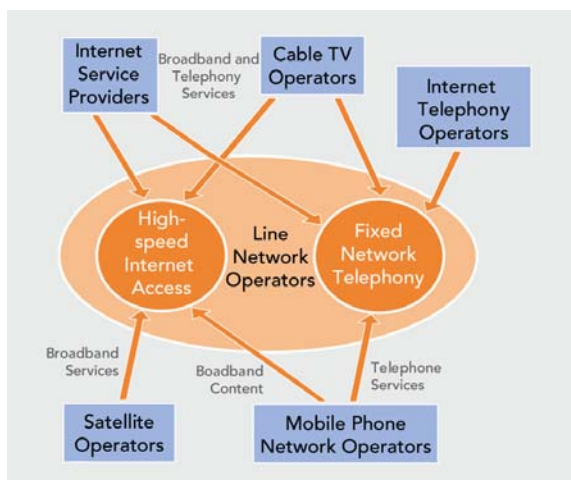
- ATM access networks are outdated
- The transmission technology of tomorrow is Ethernet-IP
- Ethernet-IP already fulfils the quality demands placed by the network operators

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1 Challenges to fixed network operators: Continuity of services and Next Generation Networks

Are fixed network operators an endangered species? The traditional fixed line network business is coming under pressure from several directions at one time. This applies in both market segments of telephony and fast internet access (high speed internet access.) Over the last few years, new, extremely dynamic rivals have entered these two sectors, which were previously the fixed network operators' key markets. New providers, such as for example Internet service providers (ISPs), cable TV and mobile telephony providers, are flooding the traditional providers' most lucrative segments of the market and undercutting each other by offering new rock bottom prices.



Graphics 1: The fixed network operators' business is at risk

The telecommunications market is undergoing radical changes. The turnover and margins in voice services are decreasing, but at the same time data and mobile telephony turnover is showing a slight increase due to a growth in the number of subscribers. Where there used to be just one provider for fixed line telephony in many markets, nowadays cable TV providers, mobile telephony providers and also Internet

service and Internet telephony providers are wooing end and business customers. IP telephony is become an ever stronger force in vast sections of fixed line operators' business sectors and is ruining the traditional margins. According to market researchers, nowadays approximately 20 percent of companies already use IP telephony, the rest uses traditional fixed network telephony. As the German Association for Information Technology, Telecommunications and New Media (BITKOM) reported in summer 2006, there are now more mobile phone lines than people living in the country. Instead of using the fixed network line, a rising number of people use mobile phones. All over Europe this translates to some 15% of all households, but just 5% in Germany. As a result of all these changes, in the competitive environment the end user is more prepared to change provider.

As if that were not enough, the previous telecommunications monopolists (also referred to as Incumbent Local Exchange Carriers = ILEC) also have to compete on their home turf with new alternative carriers (Competitive Local Exchange Carrier = CLEC) and the regulatory authorities. In Germany this is the Federal Network Agency for Electricity, Gas, Telecommunications, Post and Railways, or the Bundesnetzagentur. All of these factors mean that fixed network operators' sales and profit are at risk and the traditional business model can no longer be maintained.

A three-pronged programme offers a way out of this gloomy situation.

1. Maintaining the continuity of traditional voice services:

Maintaining continuity of services is one of the key issues, because significant sales with telephony in fixed networks are still possible. According to estimations by BITKOM, about a third of all sales from telecommunications services are accounted for by fixed network voice services and therefore what are known as a legacy services.

2. Providing attractive new services: To exploit the convergence of voice and data, network technology has to be state-of-the-art. This is the foundation for providing attractive new services for private and business customers. These include for example services such as VPN and LAN-to-LAN-bridging via IP-/Ethernet for corporate customers, or Triple Play services for private customers. Such services comprise high-speed Internet, voice and video service products.

3. Reducing operating costs: The basis for reducing costs is the migration of TDM-based services to modern NGN platforms. This modernises the existing network infrastructure and makes it leaner, which then makes cost effective provisioning of attractive new services possible. In launching NGN platforms it is also advisable to cut the number of existing "old" platforms in the network. Which will lead to further savings in network operation. At the same time, it is vital to optimise operation, administration, maintenance and provisioning

(OAM & P) processes. An important factor in this case is a high level of automation in the provisioning and selection services using an Internet portal.

Implementing these three steps will make a significant contribution to increasing both the sales and the profitability of the established fixed network providers. A brief glance at individual services highlights the trends and opportunities provided by products for private and business customers. The existing services (POTS, ISDN S0/S2m etc) will exist as telephony services for some time to come. At the same time, VoIP-based services are becoming increasingly important, mainly due to the significant spread of broadband Internet. As far as Internet access is concerned, dialling in via a modem is today becoming obsolete technology, however DSL (ATM-based) is being threatened with the same fate. The future belongs to DSL based on IP/Ethernet, above all in connection with Triple Play services.

At the same time, optical fast and gigabit Ethernet will gain ground, above all as far as business customers are concerned. Nowadays there is already a wide range of data services. In this case, in the future even more old data services will be consolidated using IP/Ethernet technologies. However sales from existing services achieved by the fixed line network operators will continue to be a profit-making force still to be reckoned with for some time to come.

Please see the following table: "Services continuity and NGN services".

	Existing Services	NGN Services
Voice	POTS ● ● ISDN BRA ● ● ISDN PRA ● ●	VoIP ● ●
Internet Access	Dial-In ● ● DSL (ATM) ● ●	DSL (IP/Ethernet) ● ● 100BaseT ● ● 1 GbE ● ●
Data	PDH/SDH (LL) ● X.21 ... ● FR ● ATM ●	DSL (IP/Ethernet) ● 100BaseT ● 1 GbE ●

POTS: Plain Old Telephone System
 ISDN BRA: ISDN Basic Rate Access
 ISDN PRA: ISDN premium Rate Access
 PDH/SDH (LL): Plesiochronous/Synchronous Digital Hierarchy (Leased Line)

Relevant for private customers ●
 Business customers ●

Table 1: Services continuity and NGN services

The crucial question is: Will NGN services actually live up to the sales expected? A glimpse at current forecasts by the Gartner Group sheds some light on the subject. The market researchers forecast a strong decline in the income from telephony services. Whereas in 2005, approx. 60% of the sales achieved by fixed line network operators were due to voice services, they estimate this will only be about

40% in 2010. That is still the largest piece of the pie and continues to highlight the enormous commercial significance of this segment. Sales of broadband and NGN data services will continue to thrive. In 2005 they had a market share of approximately 30%. According to forecasts these should increase to around 44% in 2010.

2 Telephony migration

In the medium and long-term, the migration of telephony means that there will only be a single platform in the operator's access network. This is underpinned by intelligent Ethernet/IP access technology, which takes over the conversion to the existing POTS and ISDN terminal equipment. Four alternatives are presented below (see also graphic 2.).

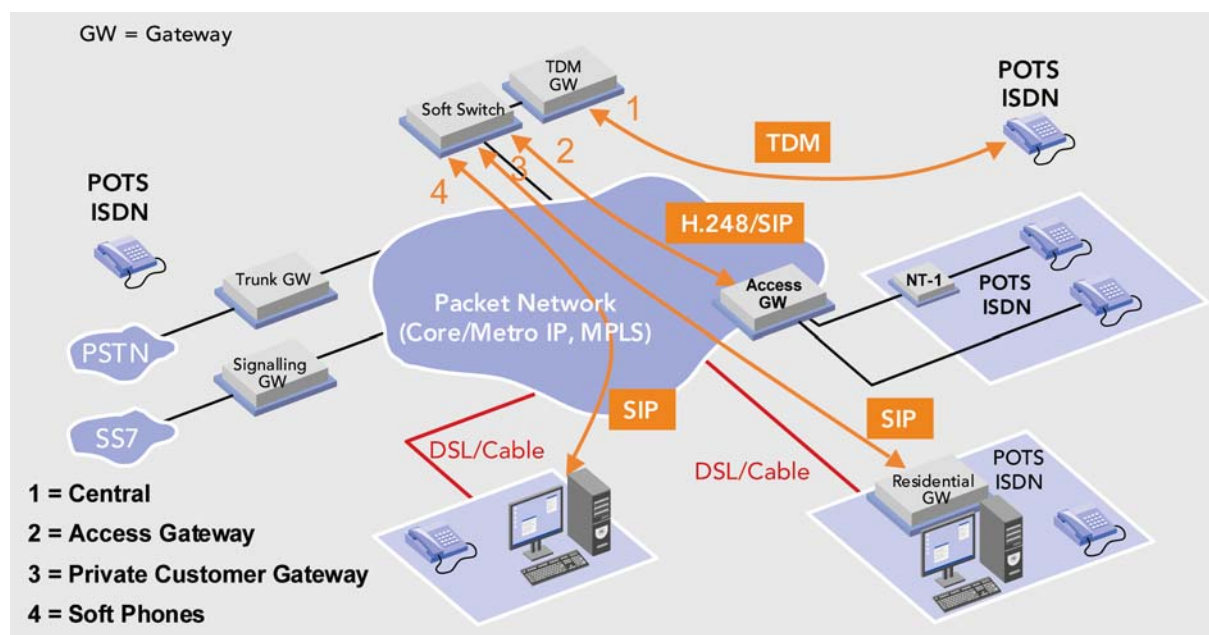
One possibility is to use a central VoIP gateway that creates a direct connection to the VoIP call control unit. In this centralised solution the

existing TDM network can still be used in the access network.

The second alternative is an access gateway spread throughout the access network, which combines POTS and ISDN connections and forms the interface to the VoIP network. In this case only traditional POTS and ISDN voice data is still found on the copper line. The entire transmission network on the other hand already functions on an IP/Ethernet basis.

In this case fixed network operators can make huge savings in operating costs in comparison

to existing technology.



Graphic 2: Alternatives for provisioning NGN voice services

The third alternative consists of implementing the POTS and ISND services entirely with one gateway to the end customer and carrying out network access entirely on a packet basis. This means that ISPs above all have the interesting chance of not just offering high-speed Internet access via DSL, but also marketing POTS and ISDN services too.

POTS and ISDN have no role to play in the fourth alternative. This includes complete migration to Voice over IP. In this case end

customers must have VoIP-capable phones, or PC-based applications such as Soft Phones can be used.

The great benefit of the first three alternatives from the users' point of view: In the future, they can use their normal terminal equipment, like for example DECT telephones, or ISDN private branch exchanges and with new additional service options are prepared to pay more than if they converted entirely to VoIP.

3 Migration of leased lines

Much more complex than voice migration is the migration of leased lines. In this case the starting point is today's PDH/SDH networks, in which direct connections for leased lines are for example available on an X.21 basis. In the future, Circuit Emulation Services over Packet Switched Networks (CESoPSN), or TDM over IP Services will be able to carry out the same

function more cost effectively. So fixed network operators can also easily transmit slightly out of date services via a packet-based network, which cuts down on the variety of different systems in transmission technology.

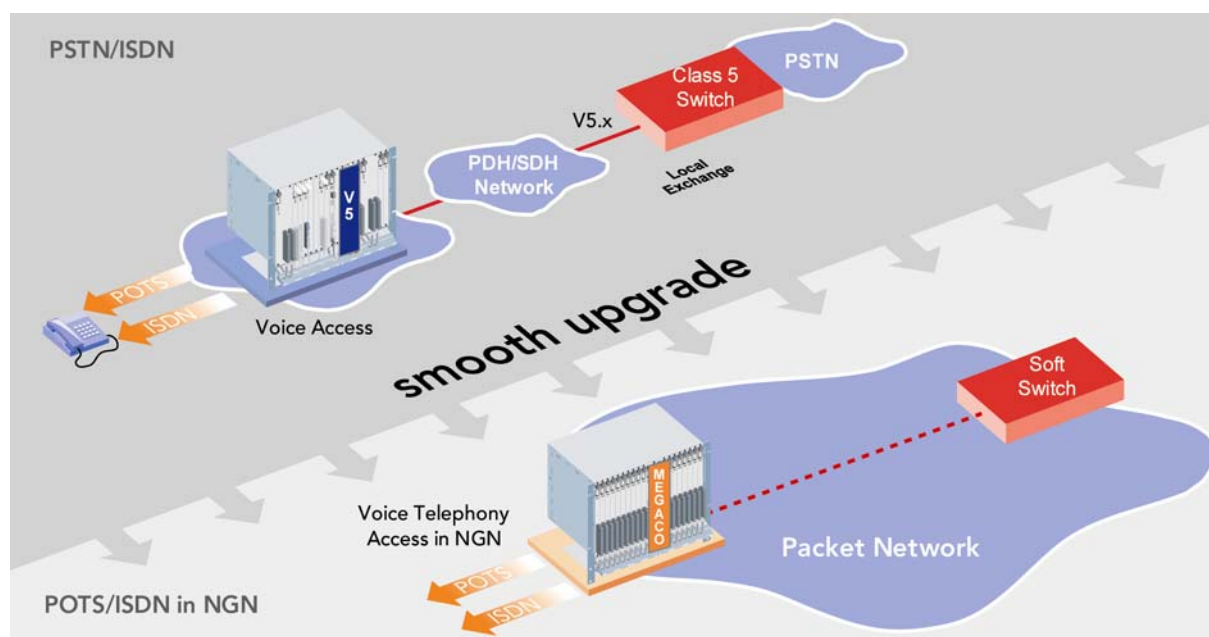
This migration path already complies to a great extent with generally accepted standards. For

example, the IETF (Internet Engineering Task Force) has already certified the SAToP technology (Structure Agnostic TDM-over-Packet, unstructured). CESoPSN (structured) is on the other hand, still in the planning stage. The same applies to TDM-over-IP. These services however require higher quality Ethernet networks than are often available nowadays. Quality-of-Service includes parameters such as "Low Delay Variations" and a "Low Packet Loss Rate" – and not just in the access, but also in the key sector of the network.

And synchronisation should also be mentioned. Packet-orientated networks are not innately

designed for synchronisation. In order to achieve synchronised transmission anyway, there are two possibilities: Firstly a clock generator can be installed on both sides, or secondly an algorithm-driven clock recovery procedure can be implemented for the synchronisation process. This is however an extremely complicated and complex procedure. In other words, the migration of leased lines is very demanding and therefore costly too. For this reason, fixed network operators will only carry this out gradually over the next few years.

4 Migration scenarios



Graphic 3: Migration scenarios

At the beginning the question is always which network section should be migrated first: service node, transport, access platform or the services platform. The service control platform is often migrated first. Then it is the turn of the transport network, then the access platform

and the services platform. In practice there are more aspects to be considered. Migration must take into account the mixture of services and the distribution of individual services. And then of course the existing network and line infrastructure (copper or fibre glass) and the

operational condition of the individual network elements must also be borne in mind. This is different from network to network. In the majority of cases there are parallel infrastructures, where operation has to be continued during the migration process.

An integral part of migration scenarios in the access network is a Multi Service Access Node such as MileGate from KEYMILE. MileGate implements Triple-Play services (telephony, High-Speed Internet and TV services) in a single compact NGN platform. In this way, network operators can continue to support conventional telephony and broadband services and at the same time migrate to the NGN. With its robust and compact design, the MileGate product range can be used in outdoor cabinets and for central installation.

The guaranteed data throughput per connection is a key factor in setting up a profitable differentiation with services that entail extra value. MileGate supports a wide range of interfaces, from ADSL to ADSL2plus, SHDSL right up to VDSL2 and therefore provides plenty of bandwidth. As we know, the performance of DSL depends significantly on the length of the subscriber line – at increasing distances, the band width is reduced. In order to avoid restrictions in ranges and to supply as many subscribers as possible, in the future it will be beneficial for DSL access nodes to move nearer to the customer. A COMBO card solution in the access network node for example, reduces the provisioning costs for traditional telephony and broadband services.

A key component of Next-Generation networks is the evolution towards packet-orientated networks. To do this the MileGate platform provides Carrier-Grade VoIP Gateway functions.

It is quite simple: Apart from supplying DSL for the Internet, POTS and ISDN-BA interface boards supply the end subscriber with traditional telephony services. In MileGate's media gateway, the TDM voice signal is converted to VoIP data packages. For signalling, protocols such as H.248/MEGACO (Media Gateway Control Protocol) or SIP (Session Initiation Protocol) are used. This means that traditional telephone connections can be implemented in a VoIP-based soft switch environment.

As network management system, UNEM is an important part of the KEYMILE NGN solution. Amongst other things, UNEM implements display of the network topology, error descriptions, alerts, inventory directories, configuration, performance monitoring and security information. Standardised interfaces (such as SNMP, CORBA, CLI, etc.) make integration to superior management and provisioning systems possible. All this is an excellent basis for gradual continued development of the telecommunications network towards a Next Generation network.