



White Paper Voice over Internet Protocol (VoIP).

Optimizing business processes
using modern communication.

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1. Introduction.

Voice over Internet Protocol (VoIP) involves the transmission of telephone conversations using data connections that transmit packets of data based on an Internet Protocol (IP). The fundamentals of this technology have been around since the mid-1990s. Since then, VoIP (also known as IP telephony) has been one of the most important trends of the future for the telecommunications industry and for years has been the subject of numerous reports in industry and business media. While the heralded communications revolution initially took almost a decade to arrive, it has undoubtedly been picking up speed since around 2005.



By 2011, almost all the major European companies will have completely migrated to VoIP.

In fact, some industry analysts are predicting that by 2011 almost all of the big companies in Europe will be using VoIP for all of their telecommunications needs¹. This trend is being boosted following announcements by network and telephone system providers that they are no longer developing commonly used ISDN technologies and will continue to support existing implementations of traditional technologies for only a limited period. Countless corporate customers are therefore inevitably faced with taking a new direction – ultimately a VoIP solution.

Carriers are also faced with huge upheaval: A transition to what are known as Next Generation Networks (NGN) is apparent in telecommunications companies on an industry-wide and worldwide basis in which a standardized IP-based infrastructure for voice and data is replacing conventional provider networks. Carrier companies are interested above all in saving costs as they make this move towards NGN. But providers in the carrier equipment sector have also announced that they are no longer supporting conventional technologies, making a changeover unavoidable.

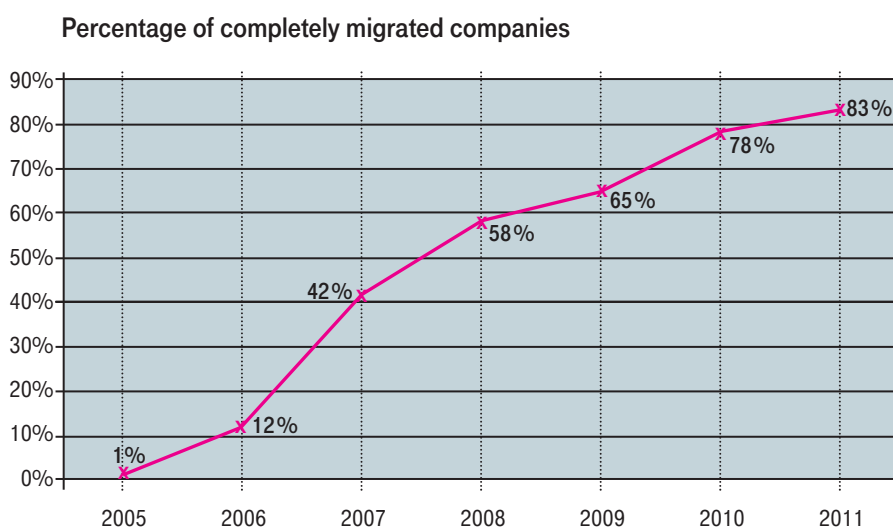


Fig. 1: Expected date for complete migration to VoIP in Europe, source: Forrester 2006

Yet despite the prevalence in the media of Voice over IP, there are not very many providers who have an in-depth knowledge of VoIP technologies and the opportunities offered by these technologies. Among corporate users, the predominant view is, as before, that VoIP will be primarily a way of saving money. Other potential benefits are, for the most part, not up for discussion.

The objective of this White Paper is therefore to clarify the most important terminology relating to VoIP, ranging from the most commonly used VoIP variants to applications and benefits.

¹ (2006) Enterprise IP Telephony Plans in 2006, Forrester

2. VoIP variants.

The transmission of voice data in packets over data networks, known also as Voice over IP (VoIP), forms the basis for numerous applications and a variety of related deployment scenarios. The following variants are particularly significant:

1. VoIP backbones in telecommunications companies
2. VoIP in the local corporate network, i.e. in the LAN (Local Area Network)
3. VoIP in a company's wide area network, i.e. WAN/VPN (Wide Area Network/Virtual Private Network)
4. VoIP on the last mile via a QoS-(Quality of Service) secured network access point
5. VoIP over the public Internet

Telecommunications companies have been transmitting voice conversations over IP networks for years – it's just that end users are not aware of the process. IP is used here mainly for reasons of cost. With the transition to the Next Generation Networks (NGN) mentioned previously, continuing effects are expected to impact on user companies.



VoIP creates convergent voice and data networks.

With the replacement of conventional telecommunications systems – even Private Branch Exchanges (PBX) – by IP-based systems (IP PBX), Voice over IP can also be used in the local network (LAN) of a company. Unlike in the past, it's no longer necessary to operate separate networks for voice and data. Telephone extensions are being replaced by IP phones. Like PCs, servers and other data terminals, these phones use the existing corporate data network. Due to the standardization of the infrastructure on one network, savings are to be expected in operational and maintenance costs. Depending on the company's situation, it should also be possible to optimize fixed network, mobile telephony and roaming connection charges. By far the greatest savings can be made in companies' business administration costs (relocations, organizational changes, productivity increase for end users). General comments on costs are usually not very meaningful. We recommend an intensive, company-internal analysis is conducted to evaluate the stated cost savings potential in converting to IP.

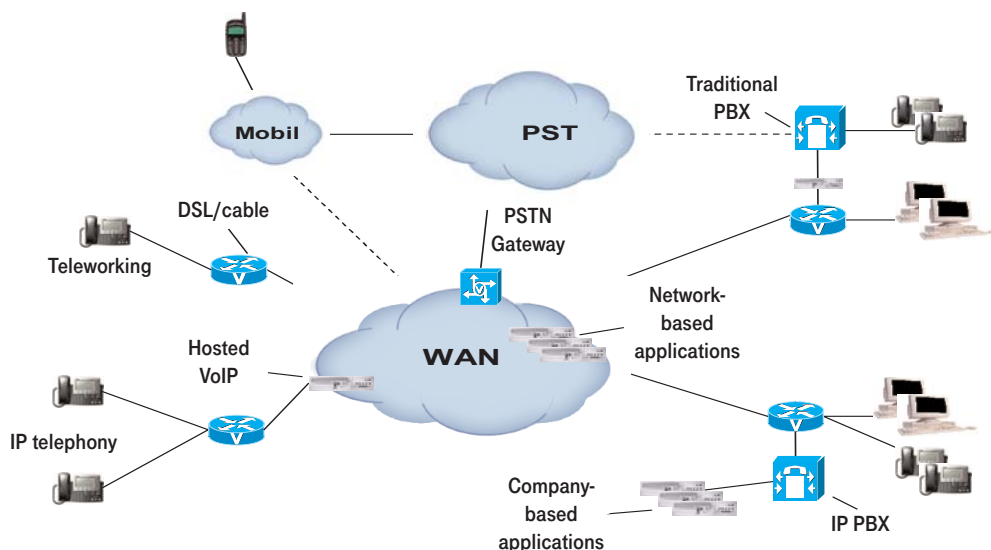


Fig. 2: Using VoIP in the LAN/WAN, source: T-Systems

Voice over IP is also already being deployed in many cases between various company sites. It means that phone calls can be made between the various locations without having to conduct the conversation over the public telephone network. The corresponding call charges therefore do not apply. Even if the corporate customer is still using traditional telecommunications systems, their sites can still be linked using VoIP if the appropriate networking is in place. Such networking requires gateways, which allow systems to be connected over IP. If, in a company, Voice over IP is deployed in both the local network (LAN) and in the wide area network between the various sites (WAN), the telecommunications system function can also be concentrated at one site provided there is an adequate network structure in place (typically at the company's head office or their own data center). Transmission to the conventional telephone network can then be implemented either at a central location or again at local level. If necessary, it is also possible in this way to route calls within a corporate network at the most cost-effective demarcation point to the provider's network (for instance, over the corporate network to the company's closest international office in the case of an international call). Voice over IP can be used alone internally as a telecommunications technology in the LAN and/or WAN and does not necessarily require the use of VoIP as an external transmission technology, i.e. for connecting between the company and the telecommunications provider. However, from a company perspective, it's generally useful to use VoIP for all external calls that go outside the company and represents an obvious addition to the internal use of VoIP.



VoIP means free telephone calls between company sites.

For connecting to the carrier, the ISDN or S2M (primary multiplex) connections previously used are replaced by a direct VoIP connection with the telecommunications provider. This is known as IP trunking or SIP trunking (SIP according to the commonly used transmission standard for Voice over IP). New IP-capable telecommunications systems can be linked directly with the service provider in this way. However, existing corporate telecommunications systems built in the traditional way can also be connected to the carrier by means of IP/SIP trunking, once the appropriate adapter is used.

Irrespective of whether internal VoIP is deployed, the transmission is made to the traditional telephone network with the provider when IP trunking is used, if this is necessary and if the contact can't be reached directly by IP connection.

A quality-assured connection to the provider via their Quality of Service (QoS) capable infrastructure is crucial in the successful deployment of IP/SIP trunking. "QoS-capable" means that the voice data is prioritized over other data traffic, i.e. it is dealt with preferentially compared with other data such as e-mails and downloads. Even in cases where there is a high level of utilization of data connections, the time-critical voice transfer is guaranteed to function without interruptions or delays.



A Quality of Service (QoS) capable infrastructure is crucial.

Services that use the public Internet as a carrier medium operate using a similar concept. In such cases, the connection is made between the service customers and the service providers over the user's or corporate customer's existing broadband connection to the public Internet. The telephony provider supplies only an Internet-accessible switching platform including central transmission to the conventional telephone network. The public Internet is used as a carrier medium between companies and service providers. Even if the available broadband connection between the customer and service provider is generally sufficient (a benchmark here would be around 100 kbit/s per simultaneous telephone call) the lack of prioritization of the voice transfer compared with the other data packets to be transmitted, together with negative operational impacts, such as a temporarily high line utilization, must be taken into consideration. In addition, these types of solutions usually do not have an option to dial through to individual extensions – Direct Dial In (DDI) – comparable with the ISDN system connection.

On the whole, these types of service offerings are therefore limited only to corporate applications. Numerous providers propagate this model – also known as Voice over Broadband (VoBB or VoB) – on the basis of SIP standards, particularly for use in a private and SOHO (Small Office Home Office) environment. In these cases also, it is used less as a replacement and more as an addition to the traditional fixed network (as an additional or second line). These types of VoBB services are in some cases offered by Internet providers themselves but mainly by providers who specialize in VoBB telephony and who do not have a business relationship with the network operator.

A special type of voice transmission over the public Internet, and one that is often discussed in the media, is “peer-to-peer” telephony. In a peer-to-peer infrastructure all endpoints operate simultaneously as customers and service providers and are therefore constantly playing an active role in the infrastructure. On a global scale, “Skype” is seen as a pioneer of peer-to-peer technology in the area of voice transmission over the public Internet. Skype delivers a proprietary software solution, i.e. one that is incompatible with the usual standards, for the transmission of voice data over public networks and supplements this service with functions such as instant messaging and audio/video conferencing. Provided that the services are used only over the Internet, they are free of charge. The user is only charged for calls (incoming and outgoing) to and from the conventional telephone network, and add-on functions like voice mail. The algorithms and transmission protocols on which the Skype software is based are not public. Similarly, there are only rudimentary functions available for managing multiple accounts, as would be required in a corporate environment for example, as Skype is targeted only at individual users. The use of Skype in the business customer market is not recommended for security reasons. Numerous companies have therefore prohibited the use of Skype in their security guidelines.

3. VoIP in the company.

The provision of a telephone switching function is particularly interesting when VoIP is used in a corporate environment. In Central Europe, this task has mostly been performed by telephone switching systems, known as telephone systems or Private Branch Exchanges, which are installed and operated at corporate level. North American companies tended to favor solutions in which the switching function was made available by the provider at network level as a Centrex (Central Office Exchange) service. VoIP implementations for companies come in a variety of shapes and sizes. This means that various technical versions are available and also different levels of outsourcing.

According to analysts at the market research company Ovum, the range of Voice over IP solutions can be summarized as in the following diagram²:

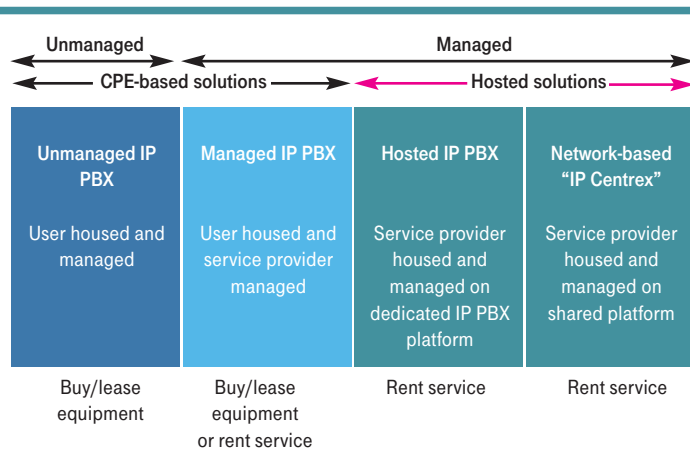


Fig. 3: Range of VoIP solutions, source: Ovum

3.1 Unmanaged IP PBX.

In the model described by Ovum as "Unmanaged IP PBX", the corporate customer operates the telecommunications system, which is located on its own business premises. The company can access the IP PBX features using an IP telephony infrastructure at the end users' sites. The PBX belongs to the company and is managed by the company itself. The equipment is purchased or acquired as part of a leasing agreement. The most important benefits of this model are the level of control that the company typically has, as it owns the solution, plus the option of customizing the system to meet the company's business requirements, such as connecting it to existing systems. The main disadvantages are the level of investment required and the need to train and retain technical staff.

3.2 Managed IP PBX.

This version is an "IP telecommunications system located on the business premises that is partially or completely managed by a service provider". This equipment can be purchased (or leased) by the customer or remain the property of the service provider; in the case of the latter, payment is made on the basis of a service agreement. According to the information provided by Ovum, mixed forms of system management, with the involvement of the corporate customer, are also possible.

² Hall, P. (2006) Hosted IP Telephony Services in Europe, Ovum

The most commonly used management functions include the following:

- Managed Administration
- Managed Performance and Capacity Monitoring
- Managed Security
- User Helpdesk

These services are offered in addition to the usual basic maintenance services for hardware and software. This scenario provides a route to IP telephony that offers the same advantages as those outlined under the previous section entitled “Unmanaged IP PBX” in terms of control and access to the IP PBX features and the connection to existing business applications. However, responsibility for operating the system and providing routine patches and updates lies with the service provider in all cases. The corporate customer itself does not need to have an in-depth technical knowledge of the system. Depending on how the contract is structured, however, the basic risks of an outsourcing contract apply with this model. However, these risks can be effectively limited by drawing up an individual contract.



Guaranteed access to the latest updates without additional investment.

3.3 Hosted IP Voice/Hosted IP PBX.

Operating a hosted VoIP solution constitutes a fundamentally different approach to VoIP. The telephone system solution is operated on the service provider’s system platform, generally in its data center. With hosted IP PBX services, the core infrastructure for IP telephony is owned by the service provider and operated at its site instead of on the customer’s premises. The service is usually delivered on the basis of a tailor-made usage agreement. The provider is responsible for managing the system.

For many companies, such a solution, hosted by a service provider, is an attractive alternative to owning and managing their own VoIP infrastructure. As the service provider is contractually responsible for the infrastructure and management of the system, the customer is guaranteed access to the latest hardware and software updates, without incurring the cost of additional investment.

Market research company International Data Corporation (IDC) describes this situation as follows³:

“Companies today usually operate a fragmented telephony environment of varying size involving multiple device generations that consist of a mix of the telecommunications systems, core components and telephones from various manufacturers and suppliers that can be found on their premises. Access paths and transmission equipment for voice services are a mix of rented lines, traditional phone services and conventional Centrex, ISDN, Internet and data networks. Agreements and invoices emanate from a variety of phone companies, maintenance firms and hardware suppliers.

Hosted VoIP provides an opportunity to standardize redundant infrastructures, i.e. to manage all voice and data communication over one single Internet network with a single provider and to provide the same telephony solutions in all branch offices.”

³ Wall, J. (2007) Western Europe Hosted VoIP Services Forecast, 2006-2011, IDC

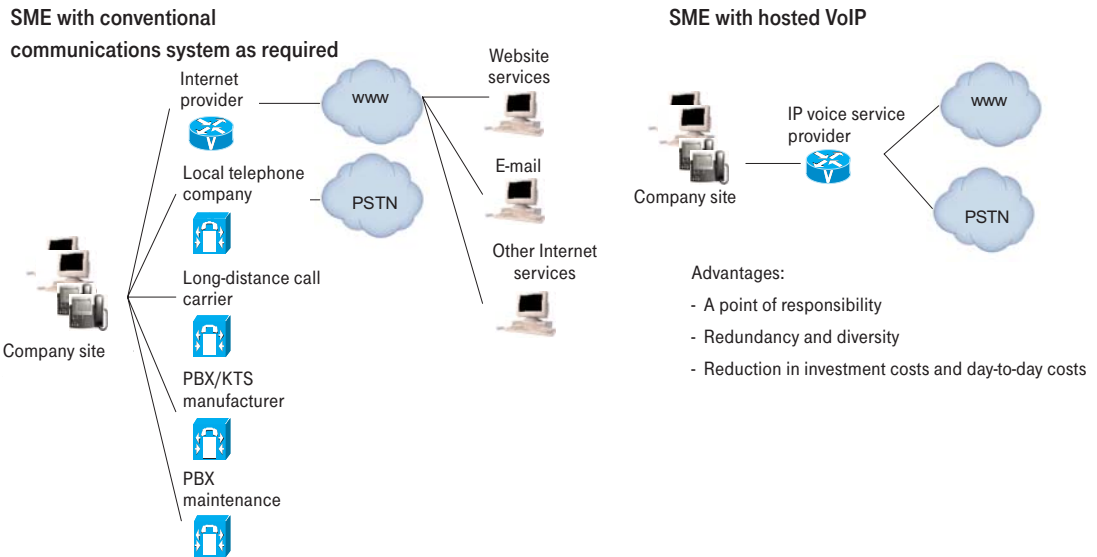


Fig. 4: Standardized communications infrastructure with VoIP for SMEs

The most frequently cited reason for migrating to a hosted VoIP corporate solution is the desire to reduce the overall cost (Total Cost of Ownership). The initial cost of investment is generally avoided when a hosted model is used (depending on how the agreement with the service provider is structured). Because management and maintenance are outsourced, these costs only need to be paid as part of the service fee and the company is not required to bear the cost of maintaining a staff of specially trained employees. By concentrating on one single provider, better overall terms can generally be expected than if a number of service providers are commissioned to deliver partial services (as shown in the above diagram). It is hard to generalize however whether, in a specific scenario, a hosted solution is actually more cost-effective than a self-operated one or than an application delivered by a provider at the customer's premises. A clearer understanding of the costs involved can only be gained by conducting a complete TCO analysis based on a comprehensive costing.

The disadvantages of hosted VoIP solutions are possible restrictions in connecting the telephony solution to corporate applications. In addition, the WAN connection to the service provider must be available at all times.

IP Centrex systems are another option to hosted VoIP solutions. This model is also operated in the service provider's system environment but the telecommunications system functionality is provided for several customers on one platform. This is addressed in greater detail in section 3.4.

3.4 IP Centrex.

Definitions for IP Centrex vary when it comes to the details. Market research company Ovum⁴ defines it as a completely managed and hosted IP telephony service on which softswitch and feature server technology designed for the network operator is built. An IP Centrex service offers functions similar to those offered by an IP PBX although the functional elements are sometimes more limited than those that are normally available in an IP PBX provided by a major manufacturer. The softswitch and associated technologies are usually accommodated in the network operator center or data center of a service provider. The main feature of an IP Centrex solution is its multi-client capability. This means that this type of platform can provide telecommunications system functionality for dozens, hundreds or if necessary even thousands of companies simultaneously. The data owned by the individual companies (numbering plans, access points, call data, etc.) is securely separated.



Multi-client-capable platform with low usage costs.

This is the most important difference vis-à-vis hosted IP PBX solutions, which are normally offered on an individual basis depending on the requirements of an individual customer.

Potential users of IP Centrex services should know that very few of the service offerings available on the market, in which this technology is used, actually contain the word “Centrex” in the product name or description. The word has negative connotations in Continental Europe due to operating times that are not very user-friendly. Compared to North America, market penetration is not as pronounced and consequently there is not an in-depth understanding of the concept. Instead, the services are described more generally as “managed VoIP”, “hosted VoIP”, “net-based”, “in the cloud services” or something similar. It should be said however that the perceived or actual disadvantages that may have been associated with TDM Centrex no longer apply to IP Centrex. For example, while TDM Centrex users often had to wait days for a service provider employee to make simple changes to the configuration (e.g. adding a new user), this can now be done by the company itself, generally just by clicking a button on a simple, web-based user interface.



Previous disadvantages of traditional Centrex solutions no longer apply.

All software solutions currently available on the market for IP Centrex provide such a web-based service portal, mostly with a sophisticated privileges and roles concept that provides end users and company administrators with extensive configuration rights. By using centrally provided features, companies can control communication paths and accessibility for corporate telephony promptly and securely. This is an important advantage, particularly when it comes to crisis scenarios.

A very important advantage of IP Centrex services is the fact that, of all VoIP options, it requires the least amount of investment. IP Centrex is essentially purely a service offering. Usage costs are often lower than those of a hosted IP PBX because of the outsourcing of the service to a multi-client capable platform.

According to a study carried out by market research company Gartner⁵, potentially restricted flexibility and adaptability to specific company requirements constitutes a major disadvantage. Here also, there must be a WAN connection to the service provider at all times.

⁴ Hall, P. (2006) Hosted IP Telephony Services in Europe, Ovum

⁵ Munch, B., Willis, D. A. (2006) How to select the right approach to VoIP: Communications-as-a-service solutions, Gartner

4. IP telephony applications.

Business applications are, from a cost perspective, the driving force behind successful technology innovations as companies can use them to improve productivity. If a company's core business is affected, business applications have a major effect on the productivity and profitability of any company. A variety of applications are connected with IP telephony systems. Studies carried out by Gartner indicate that the following applications are currently the most commonly used⁶:



VoIP increases productivity and profitability.

4.1 Unified messaging.

With unified messaging, end users have the option of receiving and accessing various forms of communications – voice messages, e-mails, faxes – via a single access point (for example an Outlook inbox). This “standardized inbox” is particularly convenient for mobile employees.

4.2 Presence management.

Presence management is an application that informs system users of a particular employee's availability or lack thereof (e.g. available, on a call, in a meeting, unavailable, etc.). It means that users can ascertain whether a colleague is available, for a spontaneously arranged conference call, for instance, or some other form of communication. This concept was originally borrowed from the environment of instant messaging applications. Presence management has however become a component of practically all major VoIP implementations.

4.3 IP contact center.

IP-based networks are meanwhile widely used in contact center environments. This goes back mainly to the better routing, reporting, monitoring and management functions, in particular in cross-site call center implementations and in the integration of agents working from home.

Essentially, there is an option to support every agent at every location with an IP connection as if they were working at the company's head office. Routing schemes and reporting tools can be effortlessly used by all parties irrespective of location. IP contact centers can also be acquired from the service provider as a hosted service offering.

Web integration also offers special forms of IP contact centers. The call center agent can, together with the caller, visit a web application and give him or her instructions there. The call function can also be integrated into the website itself.

4.4 Remote office.

Instead of providing a separate telephone system at every location, the customer's smaller offices can share the telecommunications system functions provided at headquarters by means of an IP connection. The branch office does not need to maintain its own telecommunications system. This also means that standardized phone numbering plans can be implemented.

4.5 Road warrior.

Using a suitable software solution, employees who travel can access corporate networks and functions throughout the world from locations such as hotels or hotspots at airports, train stations, cafés or gas stations and also make use of the company's VoIP implementation functions, including the extension functionality mentioned in the previous section.

⁶ Costello, R., Lassman, J. (2005) IP Telephony for Corporate Networks: Technology Overview, Gartner

4.6 Teleworkers.

Teleworkers can access corporate networks from home and also use voice services if they have a suitable Internet connection and VPN solution. Even if the employee is working from home, he or she can be reached at their office extension number and can also use the system functions. Calls are typically managed via the user interface of an IP softphone software package on the computer; another alternative is an IP phone.

4.7 Routing calls within a corporate network.

If a company is using IP telephony to integrate multiple sites, the first benefit to be gained is that phone calls between the various sites, previously charged for by the telecommunications provider, are free of charge. But savings can also be made on the cost of calls that extend beyond the company if intelligent routing is deployed within the corporate network. The most cost-effective point of demarcation to the public telephone network for the call destination is then selected. This means, for example, that a call to be made from the customer's headquarters in Munich to Orly in France is routed over the corporate network to the customer's office in Paris and via the network access point there directly into the French fixed network.

Some of the aspects mentioned above, such as avoiding fees by routing in the corporate network have direct measurable effects on costs. However, other factors, which can't be easily measured, strongly influence a decision in favor of a VoIP solution. Consequently, functions such as unified messaging and presence management ensure that employees can better manage their working environment and be more productive. While this is difficult to measure, it illustrates that a purely cost-based view of VoIP obscures the potential that can be derived in the associated applications.

5. Advantages and disadvantages of a VoIP implementation.

According to analysts, the following advantages apply to companies that wish to implement IP phone systems and networks⁷:



VoIP reduces costs, improves communication and establishes a flexible architecture.

Advantages:

- Flexible architecture.
- Lower costs in relation to supporting branch offices over an IP LAN or WAN from a central office instead of providing a separate phone system for each remote location.
- Lower operating costs for international calls and faxes over IP networks compared to conventional long-distance calls.
- Better use of broadband for calls, faxes and messaging which helps to minimize data backlogs on LANs and WANs in the corporate network.
- Lower corporate investment in infrastructure and reduced costs for network management/support as a result of the following: easing the burden on staff, using web browsers to perform administrative tasks from any network location and to unite separate voice and data networks in one single communications infrastructure.
- Improved communication between the networks at the customer's headquarters and the branch offices.
- Lower system management costs for companies with regard to transferring, adding and changing end users. It's estimated that, compared to a conventionally designed telecommunications system (TDM) savings of between € 40 and € 80 can be made per IP phone for each transfer, addition or change.

The same source warns of the following risks:

- Before providing an IP telephony solution, it should be determined whether the data network is capable of processing voice traffic. Equally important is an assessment of any costs that would be incurred if the data network had to be updated in order to guarantee what is known as "VoIP readiness".
- The introduction/use of VoIP does not automatically result in cost savings in the telecommunications budget. In terms of total costs, the expenditure could be equal to or even higher than the costs involved in operating a conventional telephone system.
- Potential security risks should be addressed at an early stage.
Companies that continue to run separate departments for voice and data services cannot gain optimum advantage from VoIP. VoIP requires the organizational integration of all tasks affecting the convergent infrastructure.

⁷ Costello, R., Lassman, J. (2005) IP Telephony for Corporate Networks: Technology Overview, Gartner

6. VoIP migration.

Companies that are considering migrating to a VoIP application are faced with a variety of technologies and service options. A previously installed infrastructure, existing agreements with service providers, availability of the necessary expertise in the company and specific corporate requirements are just some of the variables that determine the correct way to proceed for the relevant company.

A VoIP implementation can be seen at all times as a project and as such can be divided into a series of phases :



A VoIP implementation can be divided into 4 phases.

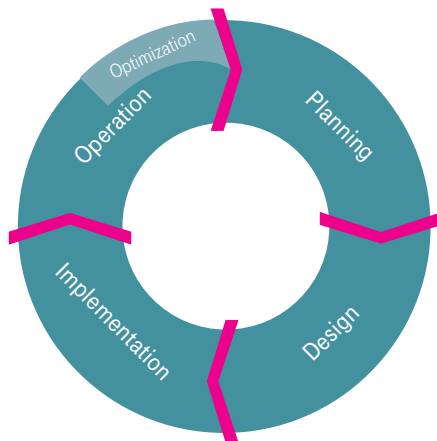


Fig. 5: Phases of VoIP implementation, source: Computerwoche

Based on the variety of options outlined above, a company attempting to migrate from its existing system environment to a VoIP system can use a phase model as an aid, just like in any other IT project. In the case of a VoIP project, the following arrangement may be helpful:

- Planning
- Design
- Implementation
- Operation
- Optimization

6.1 Planning.

During the planning phase, requirements should be surveyed as precisely as possible. Focusing solely on replicating the status quo using VoIP, for example basing the requirements definition on the function list of the old system, is simply misleading. Only features that are actually actively used should be taken into consideration.

The central issue should however focus on the prospects of IP telephony for the company. Depending on the company, this might include an ERP/CRM integration or support for mobility.

If a provider is already involved at this stage, there is a strong risk that this provider will attempt to influence which requirements are determined with an eye on its own product portfolio and in doing so deprive the customer of important opportunities. If there is a lack of in-house expertise, it is highly recommended that a neutral party is included in the planning process.

⁸ Köhler, T. R. (2007) VoIP im Mittelstand, Webcast, Computerwoche [VoIP in SMEs, Webcast, Computerwoche]

To be consistent, this planning phase requires an infrastructure check. A fundamental security policy plus requirements for the minimum system availability to be achieved should also be defined during this initial phase. The basic workflow involved in transitioning from the old to the new system is also planned at this point.

Ideally, it will also be possible during the planning phase to separate suitable concepts from unsuitable ones and to draw up a very precise call for tenders, which reflects the company's actual requirements and allows the provider to submit a precise and complete tender.

6.2 Design.

The design phase starts off logically with a review of the solution proposals currently at hand and evaluates these with regard to the functional and financial aspects and according to the expected acceptance by the user. Visiting a provider's demo center or test installation can help to clarify things at this stage. Almost all providers allow for a function test to be performed in one or other of these ways or at least provide reference installations for inspection. Once a provider is selected, it is a case of refining the solution design, in particular the changes that must be made in the network infrastructure up to workstation level.

6.3 Implementation.

The new VoIP solution is rolled out during the implementation phase. The solution is generally installed and configured on a "step-by-step" basis or location by location. This phase also includes producing and/or providing user documentation and putting together a support team that can be quickly reached and is permanently available during the transition to the new telephony world. The scope of and demand for training should also be tailored to the needs of the users, and particular consideration should be given to future administrators and key users (such as secretaries/assistants to management staff). Following successful tests, the old system is also phased out at this point.

6.4 Operation.

Once the implementation hurdles have been overcome for every site, the VoIP installation now proceeds to the operational phase. Reporting, ongoing technical support, required changes including backups of the configuration (!), the installation of patches provided by the manufacturer/supplier and the replacement of faulty hardware are central to this phase.

This is the last point where any customer locations, that were once running separated IT and telecommunications before the start of the project, should now be fully integrated.

6.5 Optimization.

While the activities in the operational phase are geared towards maintaining the status quo, the tasks carried out during the optimization phase are concentrated on further developing the VoIP environment. This includes evaluating new software releases with regard to their suitability for supporting corporate goals and, depending on the decision, installing updates. The corporate network environment is now "fine-tuned" using performance data. Security audits/assessments are some of the tasks included in this phase.

A variety of courses of action and rapid technological development make a VoIP project a challenge for every company. It is essential to retain control of the migration process at all times in order not to inadvertently become dependent on a particular provider, as frequently happens in the traditional telecommunications system market.

7. Case study: A successful conversion to VoIP.

For Alstom, a global supplier of rail systems, migrating to VoIP was necessary in order to reorganize telecommunications support at its recently acquired site in Mannheim, Germany, where a workforce of approximately 2,000 is employed. Alstom opted for a hybrid solution, which combines the use of VoIP with analog extensions and system phones. This solution has several advantages for Alstom. The company is saving roughly € 150,000 each year, equal to one third of its previous costs, while the scope of services has remained the same. Invoicing has been simplified by concentrating on just one provider for voice and data services. Interface problems have disappeared.

An innovative solution was chosen for replacing 400 DECT cordless phones. Instead of replacing the DECT environment or constructing a wireless LAN infrastructure, the DECT terminals were replaced by GSM mobile telephony which was integrated into the VoIP infrastructure.

These terminals can be accessed everywhere via the four-digit extension numbers of the VoIP telecommunications system both within and outside the company campus.

Costs are kept down thanks to a new mobile telephony agreement, which guarantees cheap calls to all mobile telephony networks, while communication on the company's campus takes place solely in the local VPN.

It is not surprising therefore that Alstom sees the plant in Mannheim as a pioneer for the migration process and wishes to achieve further efficiency in other business units with the further deployment of VoIP.

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