The TeleWare Application Architecture

White Paper

Abstract

Originally developed to support the complex multi vendor architectures found in the telephony world of the 90's, the TeleWare application suite has consistently demonstrated the unique flexibility of its architecture by enabling support for new network types and protocols. This has included accommodating the changing world of mobile networks, the demands of proprietary vendors' solutions in their traditional Time Division Multiplexing (TDM) architectures and support for the new open standards of converged Internet Protocol (IP). Support for the IP protocol start with H.323 and more proprietary early IP solutions and then developed to support the IP based open architecture of Session Initiation Protocol (SIP). This white paper gives an overview of the TeleWare architecture, explaining the unique approach that has enabled this flexibility which provides the ability to support mixed network solutions today, and has finally opened the way for separating telephony software from vendor specific hardware and removing the limitations and restrictions of proprietary telephony application solutions.

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Overview of the TeleWare Architecture

The TeleWare architecture has been implemented so as to ensure the decoupling of telephony applications from telephony hardware such as the switch, the telephony network infrastructure and end user devices. By separating each into functional areas, TeleWare can ensure the longevity of the applications in the changing world of hardware and infrastructure. This separation protects the customer's investment in people skills and in its communications strategy, whilst ensuring it has the flexibility to adopt new and high performance infrastructure and devices as they become available.

The aim of this architecture is to enable choice and flexibility in the network infrastructure, to support changing technologies within the operating system environment. This allows it to support new capabilities while ensuring that the telephony applications are not forced to change, but can migrate seamlessly and have new capabilities added as driven by the business needs, not by hardware changes.

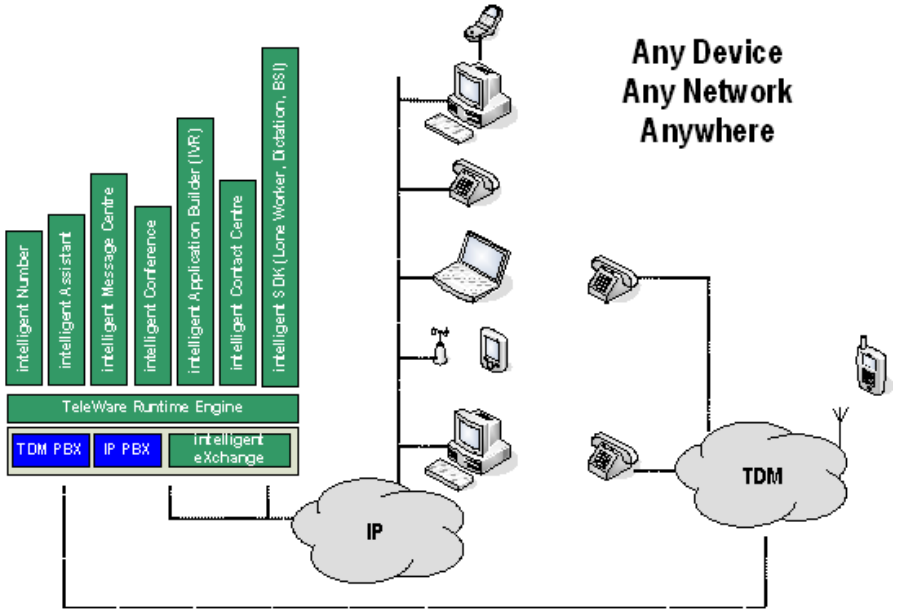
The TeleWare architecture can be split into three distinct areas: Application, Runtime and Resource layer.

The Application layer is a suite of telephony applications that use the functions of the Runtime to deliver a range of advanced telephony services such as Personal Numbering, Voice Mail, Unified Messaging, Interactive Voice response (IVR) and Call Centre functionality to mobile, fixed, circuit switched and Internet Protocol (IP) based devices.

The Runtime layer is a software integration capability that sits between the Application layer and the Resource layer to provide the applications with shared access to the resources and to provide low level management of the Resource layer providing easy access from the applications and so speeding up introduction of new applications to existing resources, and new resources to existing applications.

The Resource layer provides the 'plug in' capability for system hardware and resources such as external interfaces ensuring these resources are available to any application operating on the

Runtime. This includes capabilities such as Text to Speech, SMS support and support for signaling protocols, such as DNPSS and Q-Sig, to make a physical connection to PBXs and/or networks.



What is the Runtime?

The Runtime is multi-tasking software which runs on the Microsoft operating systems based on Intel compatible hardware. The first TeleWare Runtime was created as multi-tasking software for DOS, providing a multi-tasking capability on this single-tasking architecture. The Runtime has evolved in line with the Microsoft operating system, from Windows 3.1, through NT, Windows 2000 to the current Windows 2003 Server edition, adopting the capabilities of each of these operating systems as they were introduced and enhancing these with added value capabilities to reflect the demands of telephony applications. For example, the introduction of email support on mobile phones, using text-to-speech, took place in 1999, with first deployments in, 2000 and this capability is only today being introduced into the Microsoft portfolio via Live Communications Server. One of the functions of the Runtime is to provide a cross communication platform between common telephony standards, vendor only proprietary standards and IP standards, ensuring interoperability of all applications with a wide range of devices. The Runtime also provides a set of programming interfaces which can be used to enable applications to perform a range of telephony tasks without the application having to talk natively to the telephony hardware, port or corresponding protocol stacks. This means that the applications have simultaneous support of multiple protocols on multiple platforms, introducing interoperability between these platforms and saving in port costs on the platforms and licence costs on resources.

Why was it Written?

The TeleWare Runtime was created to enable the rapid development and continued support of software telephony applications. It is a 'Hardware Abstraction Layer' in a similar vain to the HAL

within Windows. Typically, when vendors produce a new application it is specifically designed to run on certain hardware under a defined operating environment with specific interfaces and replies on dedicated resources. Decoupling the Runtime removes all these constraints from the applications and changes to the environment or interfaces are accommodated by changes to the Runtime alone.

The Runtime ensures compatibility with the hardware and protocols and propagates new features or changes to any application that uses the Runtime. The Runtime has evolved to include support for both industry and vendor specific interfaces to provide a high level of integration and allow a wide spread of applications compatibility. Without the Runtime, each application would need to be written for every possible permutation of hardware and protocol used. This provides TeleWare with a unique ability to support an unusually wide range of PBXs and to support mixed vendor and mixed protocol networks.

Operating Environment and Deployment

The same Runtime is used for both customer on-premises equipment implementation and for hosted environments where telephony applications are delivered and billed on a per-month-per-user basis.

The Runtime can be used on single, dual, quad, X-tier processor servers to scale to the customer's requirement. This remarkable achievement in hardware independence is facilitated by the unique approach of storing the call information to disk once a call is connected, avoiding the need to hold active call information and so immediately freeing resources. This approach enables a collaborative hardware approach where the system can be expanded when demand for resources increases, with specific processors dedicated to a number of common processes.

Durability and reliability are dependent on a particular system configuration and the Runtime and telephony applications are, typically, deployed on high availability servers. The hardware architecture can range from a single processor, single server solution, to an architecture that is deployed across a large number of collaborating servers. This approach enables a collaborative hardware architecture with servers dedicated to a number of processes, such as: call server, file server, media server, utility server and gateways to other protocols. Each of these areas can be scaled independently and irrespective of the applications. This means that the solution can be scaled to very high levels of user population and can accommodate the varying division of labour needed in different business environments. Options exist for the duplication of servers and use of RAID technologies for file storage to ensure that there is no single point of failure in the hardware architecture.

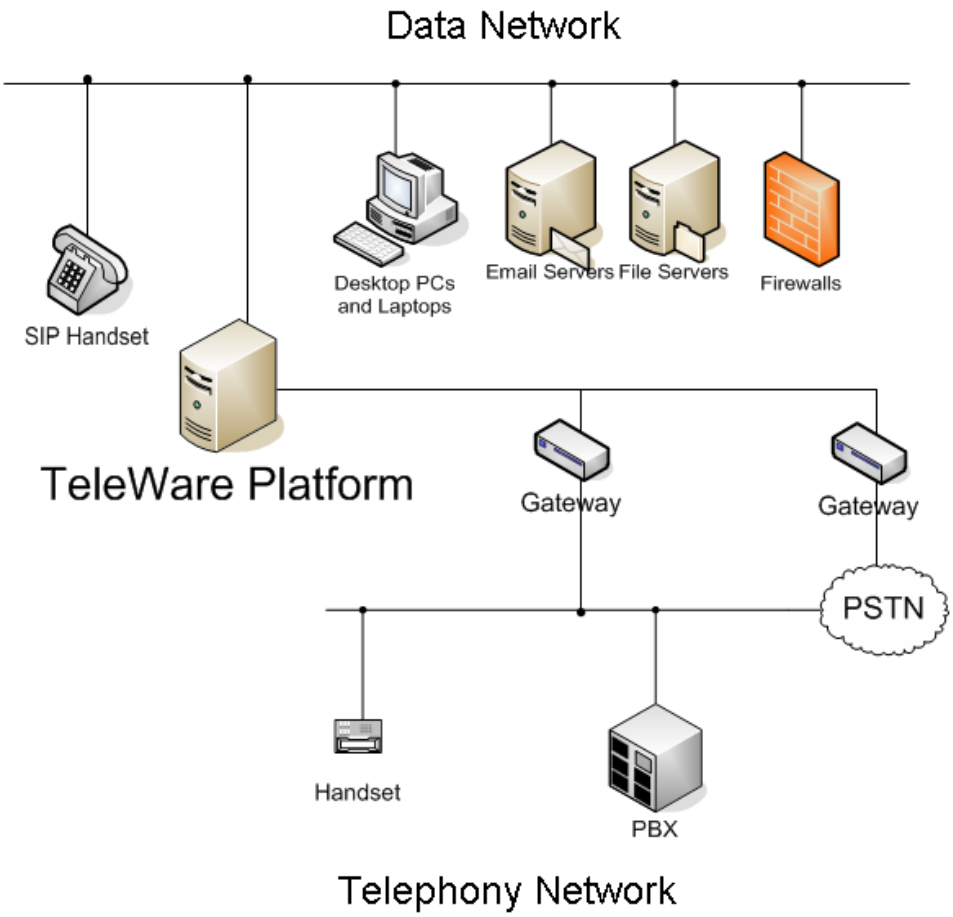
The Runtime has been designed to support the vital capabilities of telephony applications. These include support for multi-tenant environments by creating tenancies or partitions within the database. This delivers a substantial advantage in multi-user systems and in the hosted environment where creation and maintenance of secure tenancies is critical for protection and privacy of data.

TeleWare Interfaces to Telephony Hardware

The Runtime communicates with the applications in one direction and a PBX in the other. If the PBX is SIP of H.323 based, this connection is direct. If the PBX is TDM based, a gateway

interface is needed to convert the SIP protocol from the Runtime into a Digital Access Signalling System (DASS), Digital Private Network Signalling System (DPNSS) or the ISDN-based protocol Q-Sig for a connected PBX to execute. To accommodate the many vendor-specific idiosyncrasies, the gateway includes specific capabilities to convert telephony signals accommodating the idiosyncrasies of the particular vendor PBX. TeleWare has already developed interfaces for all common PBXs and IP PBXs found installed in the corporate space and has not, to date, found any specific vendor PBX to which we cannot interface. This translation process is transparent to both connected PBXs and applications and enables TeleWare to support mixed vendor PBX installations, avoiding the compatibility issues or less open solutions.

The TeleWare server appears to a PBX as the telephony network while, on the data network, the server appears as an application server with its own IP addresses and server operating system.



This ability to support multiple PBX and IP PBX infrastructures means that the TeleWare architecture can be configured for a variety of business requirements:

- Greenfield Site: for sites without a legacy PBX, a TeleWare server comprising of Runtime and call switching (Call Server) and applications (Media Server) elements can provide IP telephony over an IP data network.

- Mixed Networks: as a supplement to an existing PBX infrastructure, to either provide additional applications or to enable IP Telephony to local or remote users, using a File Server, Media Server and SIP to TDM gateway.

- Unification: TeleWare deployed, as a centralised hub between disparate PBXs to form a coherent single telephony solution, using a File Server, Media Server and, if the unification includes both SIP and TDM PBXs, a gateway.

- Full / Part Hosted: available to users as a hosted telephony service to replace an existing PBX or to provide additional functions - such as 'one numbering' as a service to existing TDM or IP Centrex services.

Interfaces to Third Party Software

The Runtime communicates using industry standard protocols, including Session Initiation Protocol (SIP), Internet Protocol (IP) and Extensible Markup Language (XML), enabling internal procedure calls and creation of message queues. Connection to backend databases is via Open Database Connectivity (ODBC), which is supported by the majority of current Database management systems, allowing the Runtime to connect to several different brands of database management systems (DBMS) using the same basic code. As new protocols emerge or existing protocols are revised, the Runtime is changed to meet new standards that, in turn, update support to dependent applications.

Application Development

The Runtime provides a set of Application Programming Interfaces (APIs) that are used by TeleWare and 3rd party software developers to perform telephony functions. This enables the Runtime to interface quickly with application functions developed by 3rd parties, such as voice recognition or text-to-speech, bringing these capabilities to the full range of TeleWare applications very quickly.

TeleWare have also developed an interface kit for the Runtime. The Software Development Kit (SDK) provides commands for use with any C Sharp programming structure. This allows for extensive customisation of both TeleWare and 3rd party application. This approach allows a developer familiar with Visual Basic or C Sharp to develop and implement close telephony integration with customer applications without the need for detailed telephony knowledge.

Write Once Use Many

Once a new feature has been created and integrated within the Runtime, it can be used by any application that has visibility of the Runtime. For example, the Runtime is integrated with the Scansoft Text-to-Speech engine; this development allows the Runtime to deliver a text-to-speech capability to all applications within the connected application layer, such as the applications for speech activated directory access and IVR building solutions. This delivers advantages in speed to market for new capabilities.

A unique advantage of this approach is that it delivers savings in third party licence costs. Since the Runtime assigns these services dynamically to multiple applications, licences are shared on demand rather than issued on a per application basis. This can result in considerable costs savings to the enterprise and enable the more pervasive use of these capabilities without consideration for increasing licence costs.

What are the Advantages to the Customer using the same Core Runtime for Multiple Applications?

The TeleWare application suite uses the same Runtime engine to provide core feature sets. Developers can use the tested features of the Runtime to build new telephony applications, based on tested and proven Runtime software, independent of hardware configuration. This reduces development timescales and ensures new products are well proven.

The common Runtime architecture approach provides economies of scale, enabling the business to upgrade performance or support a greater number of users without requiring software modification - what is needed in a scaling of hardware to handle the increased workload.

Another result of this approach is that, since the management of the physical telephony ports at a hardware level is controlled by the Runtime, the ports can be used for multiple applications. This means that, where software use is limited to a number of users or where an application is used infrequently, port sharing can come into effect and so the ports required are reduced and the business does not pay for over provisioning of licences or ports.

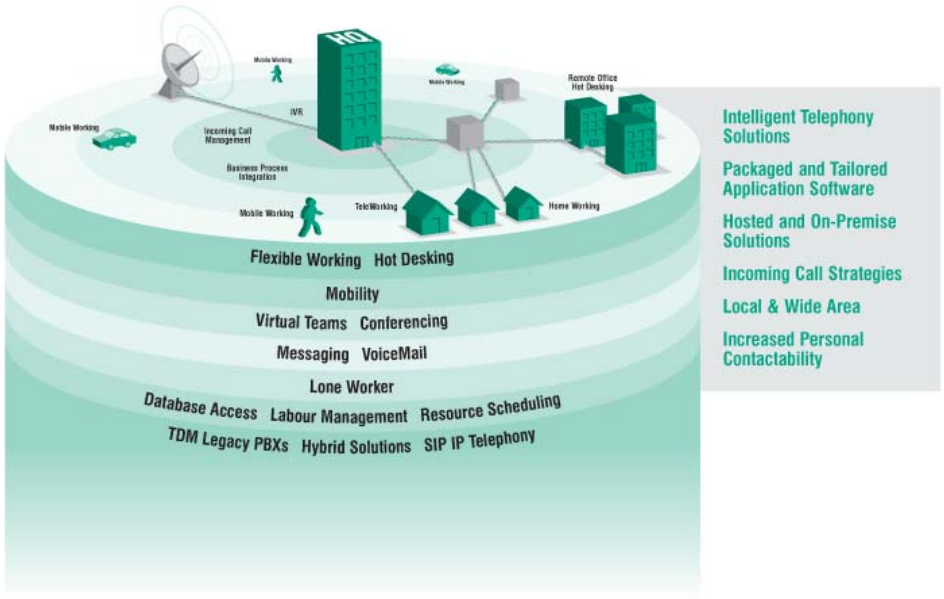
The Application solutions are purchased on an Annual Use License & Maintenance (AULM) model to ensure applications remain evergreen, with new features being introduced, ongoing, without additional licensing costs to the business. The application pricing model is dependent on the runtime ports needed to support the features each user requires. Features are delivered based on the class-of-service profile for each user, allowing licensing to be kept at a minimum, with additional users or features only activated when needed. Because the solution is software based, enabling features on demand becomes simple and the business pays for what they need. For example, a mobile sales force may need retrieval of email as voice messages using text-to-speech integration, while fixed call centre staff would not. The AULM agreements provide access to new application software versions and Runtime upgrades as they become available.

The Application Layer

TeleWare has developed a range of telephony software that interfaces to the Runtime architecture and delivers office applications such as personal numbering, unified mailbox, email integration, voicemail, IVR, audio conferencing, voice activated directories and a host of other solutions. All of these applications communicate directly with the Runtime so that compatibility is guaranteed across the entire product suite, providing a common set of user and management interfaces and so saving on training costs and making introduction of new applications into the business less demanding. Changes required for interaction with new technologies or standards need only be applied in the Runtime for them to be available to all the TeleWare applications.

Within the TeleWare suite are 6 key functionality areas:

- Personal Numbering
- Unified Communications
- Wide Area Contact Centre
- Interactive Voice Response
- IP Telephony
- Business Process Integration



More detailed information on the full TeleWare application set is available within a further white paper available on www.teleware.com.

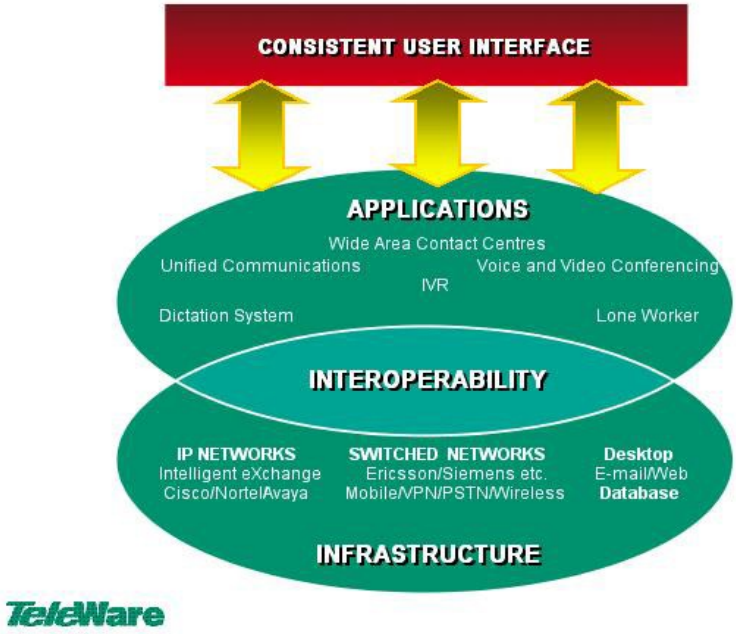
Why the TeleWare Approach?

The TeleWare approach is to separate Telephony software from Telephony hardware. This is unique in the telephony industry where box-based solutions are the usual approach.

The traditional and IP telephony deployment methodology for a telephone system involves lines connected to PBXs that switch calls to and from desktop handsets. A basic implementation provides a limited number of core features such as voicemail, local call forwarding and conference calling. To add more internal or external lines or increase the telephony features available will, typically, require further hardware such as an add-in card, possibly a new cabinet and more cabling to new locations. Even with the new emerging standards for IP telephony, most customers are forced to buy their PBX, handsets and telephony features from a single vendor to avoid compatibility and support problems. If the customer wants to deploy a new telephony feature that is not supported in hardware or via an upgrade card, it is notoriously difficult.

The TeleWare architecture separates the telephony applications from the base telephony hardware. This strategy mirrors the move from tabulation machines to spreadsheets that the advent of microprocessors and operating systems sparked in the 1970s. Although a mechanical adding machine may be reliable and functional, it is severely limited in flexibility and connectivity to other systems. With a hardware based PBX, making fundamental changes to its core routing,

signalling or configuration is only possible if the designers had foreseen the requirement and made provision. A PBX has its software hard-coded within its design and it is often only the original architects, who understand the core design and impact of changes, who can make these modifications. This policy does little to protect the customers' original investment as changes in technology occur and new applications are introduced by third party vendors. The nearest analogy within computing might be a customer forced to buy a new vendor specific server to run each new application. This situation is not natural - Telephony software shares the same inherent flexibility and upgradeability as other software packages. This means that there is no inherent reason that businesses should not change underlying telephony connectivity and extend capabilities without changing hardware and without depending on input from the original vendor. The limitations are imposed by the designers of the PBX hardware.



For example, a customer may want to send SMS messages to a group of consultants, but only if they are listed within their Microsoft Outlook or Lotus Notes based schedules as available. For a software system, this is feasible because Outlook and Notes and the parent mail servers have an API that can be integrated to pass this information to management applications that can then use a soft switch to create and deliver the relevant SMS messages.

This type of complex example is inherently difficult on a piece of hardware with a non-malleable firmware instruction set. Firmware is effectively hard-coded into the design of a device and new requirements, such as SMS, would have to be coded by the vendor and downloaded as new firmware; there is no flexibility for the customers. Although the biggest application for telephony has always been voice mail, new requirements such as video and interfaces into business processes have emerged that test the limits of the traditional PBX. The addition of new applications and interfaces into existing systems is simplified when using a software telephony architecture.

Business Requirements from Telephony

One of the major changes to the telephony industry in recent years is the move to running Voice over the IP (VoIP) protocol on data networks, with recent surveys suggesting 40% penetration within large enterprise and growing fast. The drivers for this move are both infrastructure and business related. The infrastructure cost saving is achieved from moving voice over to the data network. The business can then run a single network for call cost reduction and network management with a single support team and resulting costs savings.

The more powerful driver for IP Telephony is, typically, presented in the media as being the enabling of telephony applications – this is a complete misrepresentation. Telephony applications are software based and so can be provided over any hardware infrastructure, TDM or IP, proprietary or standard based – the limitation to running these new applications was not IP but the artificial linking, by vendors, of the applications to the hardware. The fork lift upgrades to IP being presented by hardware based PBX vendors today as the solution to enable telephony applications are entirely industry created and do not represent a technology limitation but a vendor design limitation. TeleWare has been delivering the business requirements from telephony over mixed vendor architectures for twelve years by maintaining the separation of the hardware from the software.

To give some real world examples; a large financial services organisation was involved in a major merger with a rival and then had the task of integrating its two existing telephony platforms with a third at its former rivals. All three systems were from different vendors and had different voice mail and even operating interfaces. The solution they choose was to deploy a TeleWare single number to each employee and a TeleWare server to unify the disparate systems into a common platform. Three infrastructures, but a single software architecture delivering the same solution over each PBX.

With staff moving to new jobs, desks and even offices – each member of staff simply registered themselves at a phone on any desk and calls would be automatically routed to them. If they changed location, the phone number was still the same. This allowed all the small things such as stationery, business cards and even internal email to be standardised as the single number was for a person and not a location.

The cost saving to the businesses involved was substantial and the original PBXs are still operational within the system – with just the addition of an extra pair of servers to run the TeleWare software suite. The above is an example of an organisation faced with an unforeseen telephony issue that can quickly and cost effectively be solved by the flexibility of software.

Another organisation that wanted to improve staff retention decided to introduce home and flexible working via a software telephony solution to allow the same level of telephony functionality for teleworkers, whether working over the PSTN, the GSM network or the Internet or IP broadband network. The TeleWare hardware and network independent solutions provided the same high level of telephony functionality over all network types and made these remote workers part of the office without increasing operational costs.

Vendor Independence and Standards Based Strategy

There was a time in the computing era when only the mainframe and server vendor provided software for its systems. The rise of independent data software companies broke this monopoly and created greater choice and substantially lowered application costs. The separation of telephony software from hardware is having the same result. TeleWare uses open standards to communicate between software and hardware that allow a customer to change the infrastructure without having to change the applications and to enhance the applications without having to change the infrastructure. The open nature of the solution also means that, if the business should wish to select a third party vendor's application for any part of the solution, this will not detract from the abilities of either system.

Conclusion

The competitive edge is a goal strived for by businesses of all sizes across every market. Telephony is often a major deciding factor and many organisations are investing in converged applications that will enable new business processes. The flexibility of telephony business applications plays a major part in providing this competitive edge.

The advantages of the TeleWare software based approach are clear: flexibility, future-proofing and the opportunity for long-term strategic planning. Like the move to industry standard server and operating systems, software based telephony will be driven by the need and stability of emerging standards. Also, like the world of computing, fantastic new applications and requirements will emerge that will require organisations to respond quickly.

By establishing a stable core technology platform, these challenges and opportunities can be met with the best possible readiness and without disrupting the balance of good business.

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