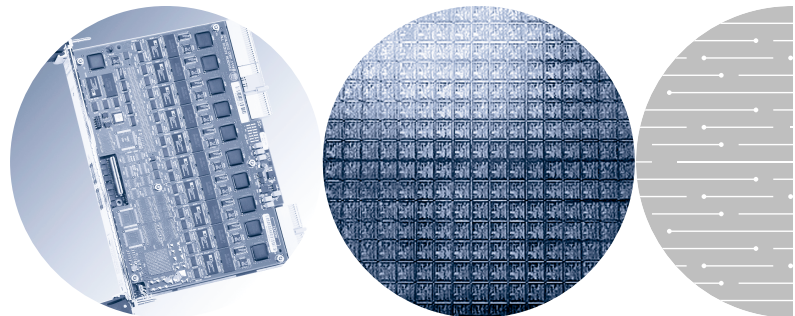**intel®**

Changing the Landscape for Enterprise Communications Solutions:

Business Communications Platforms

Intel in Communications

Contents

Executive Summary

Business communications platform technology from Intel is ready to transform the communications industry by providing an architecture that emulates the model that has driven the development of cost-efficient systems in the computer industry. With a standards-based server platform configured with telephony boards, developers can build both core switching and enhanced enterprise applications. Supporting circuit and packet networks, the platform provides a clear migration path to an IP environment. The business communications platform can free developers from the application limits and integration costs of proprietary systems, enabling innovative applications, and providing enterprises with advanced, flexible communications systems.

Enterprise Communications Today

The landscape for enterprise communications systems is being re-drawn as communications and data technologies converge, and Voice over Internet Protocol (VoIP) technologies are recognized as the voice transport and switching technology of the future. Emerging as a strong competitor in this new landscape are converged systems built on business communications platform technology from Intel. Drawing from a strong group of Intel® telephony boards, configured for trunks, stations, and a rich media processing mix, developers are building efficient new converged systems for enterprise customers. Applications developed on business communications platforms are delivering both the core switching functionality of a private branch exchange (PBX) or key telephone system (KTS) while also hosting a range of enhanced communications applications normally delivered on adjunct media servers.

The efficient delivery of core and enhanced communications applications on a standards-based computing platform is gathering momentum within large distributed enterprises and in vertical market segments as well. The value of a communications system, which is modeled on the competitive efficiencies of Information Technology (IT) systems and which

leverages infrastructure and management resources, truly resonates with customers. The open standards business communications platform approach from Intel can free developers from the application limits and integration costs of proprietary systems, enabling their solutions to compete effectively with any communications system on the market.

To meet the evolving application need for IP trunks and stations, both public switched telephone network (PSTN) and VoIP telephony building blocks can be seamlessly integrated into various business communications platform configurations today. This converged approach to traditional circuit-switched and emerging packet-switched voice allows enterprise customers to migrate and adopt IP voice technologies at their own pace. And innovations that shift IP and media resources to the host Intel processor will enable developers to deliver more cost-effective and efficient business communications platform solutions as VoIP accelerates.

For these reasons, systems deployed on business communications platform technology from Intel are bringing more efficient communications to the enterprise.

New Choices for Enterprise Communications

Because of advances in communications technology, enterprises that need to replace or invest in a new communications system have more options than ever before. They can choose to stay with the traditional architectural model, or invest in a new system that incorporates packet technology.

The traditional enterprise communications system is generally built around a PBX or KTS with adjunct media servers that enable applications, such as voice mail and interactive voice response (IVR). This model has several shortcomings — high cost, integration complexity, and reliance on a single vendor for the base PBX/KTS technology. IP PBXs and many IP-centric converged systems provide the advantages of packet-based communications, but can still lock enterprises into the disadvantages of owning a proprietary system.

One exception is a converged system built on a business communications platform—an industry-standard computing platform for next-generation voice communications in an enterprise. This platform is comprised of a server with standards-based computer-telephony building blocks, supporting both network and station interfaces, and designed with media resources on which a wide range of communications applications can be developed. Configured to support the unique requirements of individual enterprises, this platform enables developers to create open, standards-based converged communications systems for specific customer needs.

Systems built on a business communications platform are flexible and scalable and provide a way to move gradually to IP technology at a pace that meets the business needs of the end user organization. Basing a system on open standards can also bring the cost-effective pricing associated with enterprise information systems to enterprise communications systems.

Perhaps most important of all, the business communications platform is poised to benefit from the introduction of Intel® NetStructure™ Host Media Processing (HMP) software, which performs media processing on the host processor. This technology reduces the need for telephony hardware and specialized DSPs, and can dramatically reduce the total cost of ownership of communications systems for both developers and system owners. Because of this radical technology shift, proprietary systems are expected to become increasingly obsolete from both an application and cost perspective.

Traditional Communications Systems Are Monolithic

Although PBX and KTS technologies have faithfully delivered real-time communications services with high reliability for many years, they are aging rapidly in today's world of converging data and communications technologies, networks, and systems.

The PBX and KTS are typically provided as an end-to-end, top-to-bottom proprietary system from a single manufacturer. Generally this type of system is expensive to manage, usually requiring specialized training and maintenance. These systems can also be expensive to upgrade with additional applications from the manufacturer, and, since the system and software is proprietary, the application choice is often limited to those developed by the PBX manufacturer.

Adjunct Servers Add Flexibility

Becasue the base system is monolithic, the adjunct media server has become the dominant delivery mechanism for enhanced applications in the enterprise, capable of adding third-party applications such as voice mail, automated attendant, IVR, fax servers, and contact center to the core PBX/KTS switching functionality. It is common for an enterprise system to have multiple adjunct media servers as the enterprise adds new applications over the life of the PBX/KTS.

While this model has allowed the enterprise to expand proprietary communications systems with enhanced applications, the inefficiency of multiple hardware platforms, system integration challenges, and multiple management interfaces makes these system architectures complex, expensive, and challenging to maintain and manage.

A Traditional Configuration Is Complex

Figure 1 provides an illustration of how complex the configuration of a typical enterprise communications system often is today. The main PBX/KTS, which is connected to the PSTN, remains the core of the system, providing switching and automatic call distribution. A host of additional applications are connected to the PBX/KTS through adjunct servers, each dedicated to providing a different application. Many of these servers are also connected to the data center because they require access to enterprise data.

To make the current situation even more complex, the Internet has become a critical business tool, and companies are increasingly installing VoIP to reduce network expenses and support requirements for multimedia
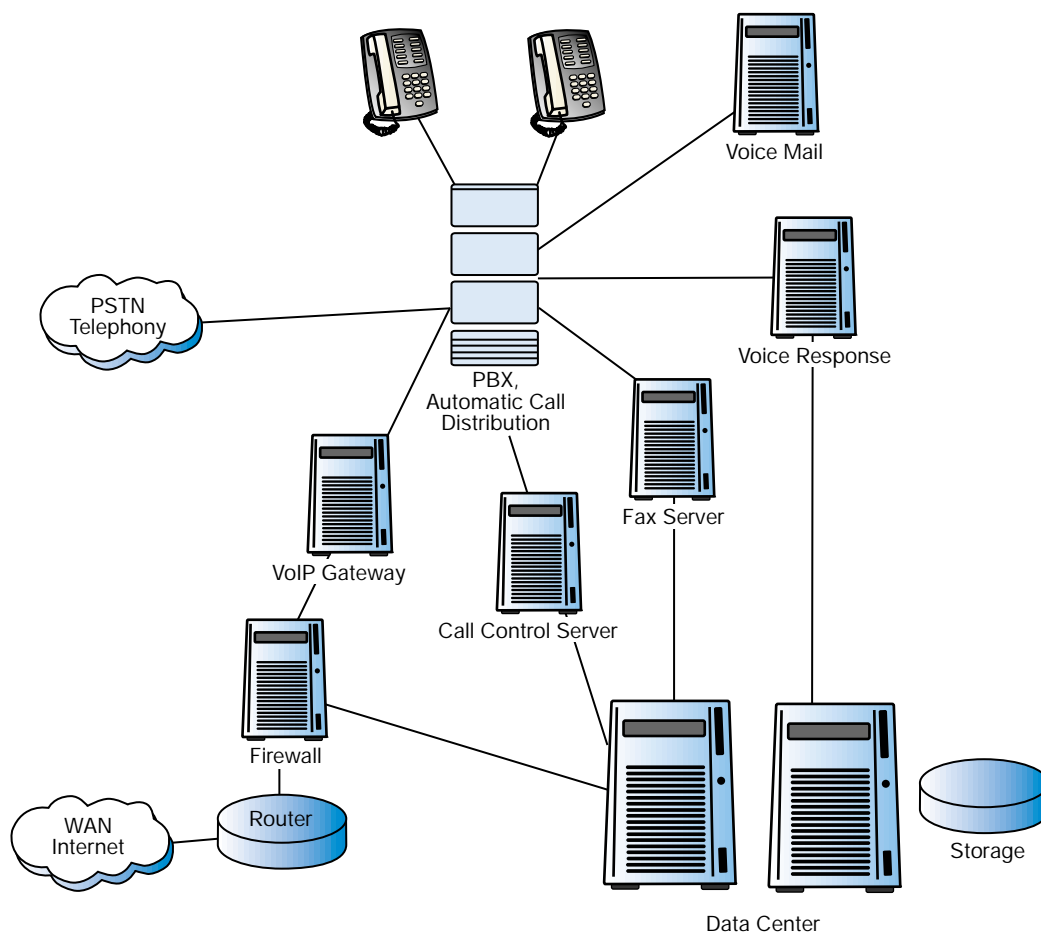
Figure 1. Typical Enterprise Communications System Today

communications. These services are provided through a gateway behind the enterprise firewall, and this gateway is also connected to the PBX/KTS.

A Standards-Based Configuration Is More Efficient

A simpler, more efficient way to configure and manage an enterprise communications system is to replace the aging PBX/KTS and its adjunct servers with a converged system based on the business communications platform concept. A basic configuration for such a system is shown in Figure 2.

The business communications platform sits at the heart of the enterprise communications system as an open, standards-based platform for traditional and next-generation voice appli-

cations and services. The system is built on standard computer and computer telephony building blocks, including both network and station interfaces and rich communications media resources. The applications, which ran on individual adjunct servers in a traditional configuration, now run in a single logical configuration on single or multiple physical servers connected to the enterprise network.

The business communications platform has the additional advantage of serving as a bridge between circuit-switched time division multiplex (TDM) and packet-switched IP technology, permitting the platform to act as a transition technology. It can allow enterprises to migrate at their own pace to IP station endpoints and next-generation networks where all communications are treated as packet-switched data,
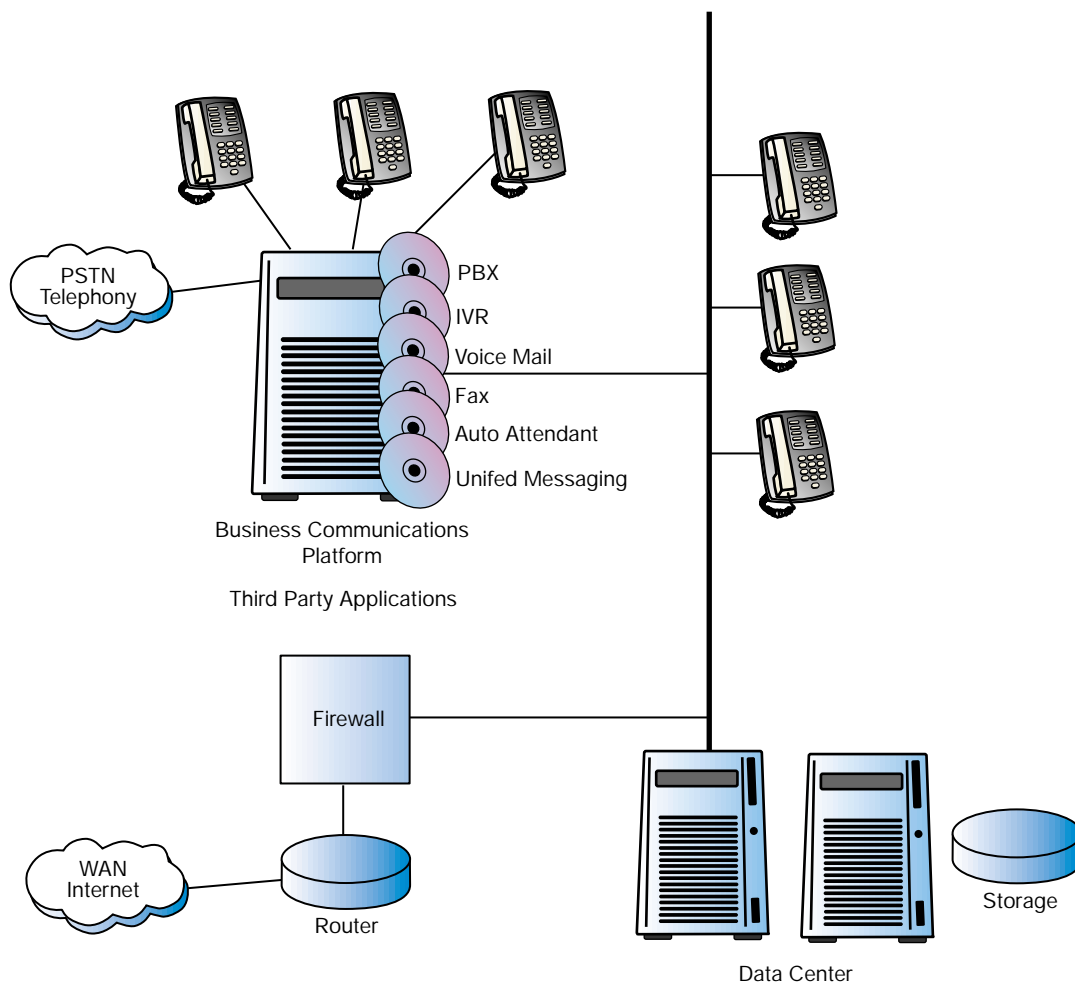
Figure 2. Business Communications Platform Configuration

and rich multimedia communications are available through enhanced applications.

Bringing a Computing Cost-Benefit Model to Communications

As a standards-based, application-ready communications server, the business communications platform aims to use the same cost-benefit model as the computing servers that provide today's database, email, and Internet services. In other words, developers use standard components manufactured at high volume (and thus generally at lower cost) to replicate the features and functionality of existing purpose-built equipment, supplemented by the flexibility to add functionality through open interfaces.

This model spawns competition at the application and user interface layer, which provides enterprises with productivity, systems management, and customer service

efficiencies. In addition, the underlying platform continually benefits from the exponential gains described in Moore's Law. By harnessing additional processor power to deliver more (and more advanced) functionality and support for a greater number of users, that increased computer and communications strength allows decreased cost per user.

Standards-Based Building Blocks Work Together Seamlessly

The architecture of a business communications platform has five layers of standards-based hardware and software building blocks that work together seamlessly. See Figure 3 for an illustration.

The first three integrated layers make up the business communications platform, which is
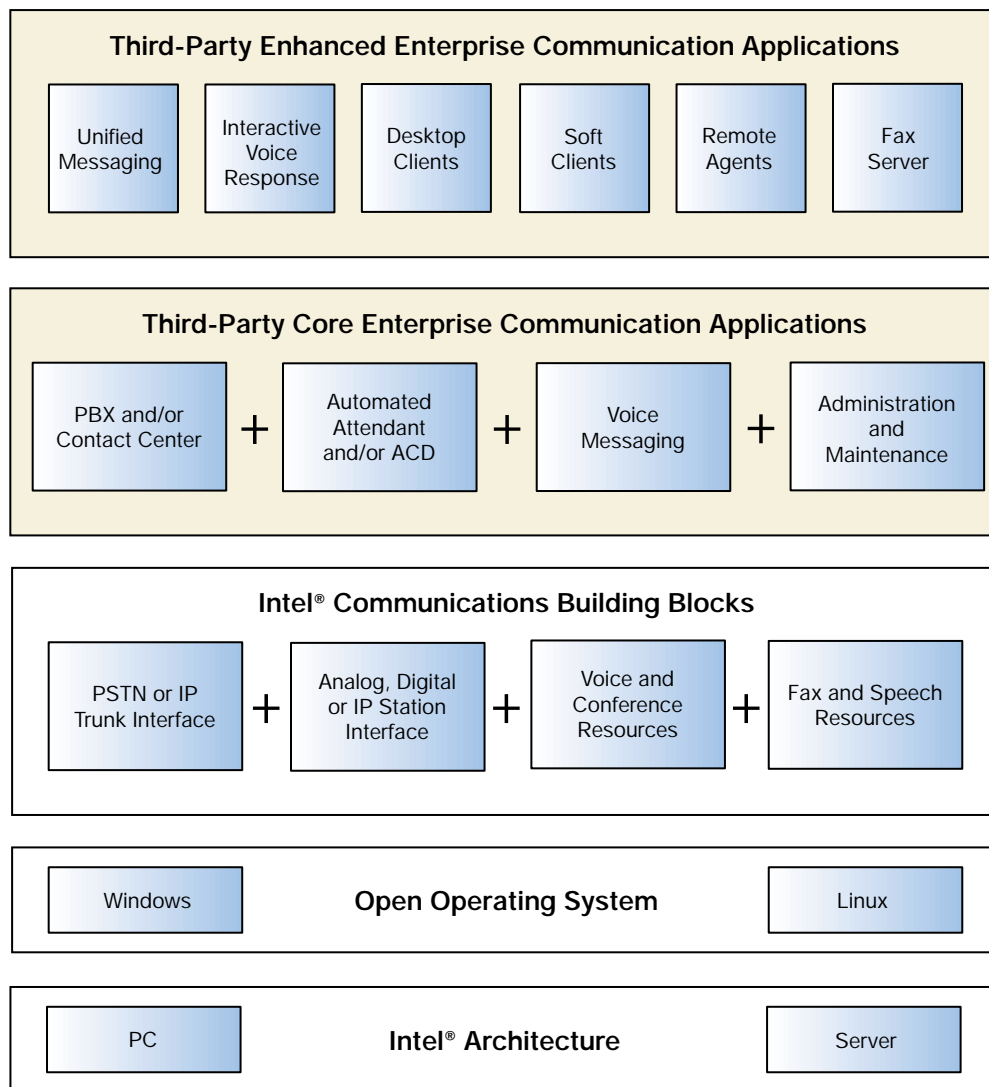
Third-Party Enhanced Enterprise Communication Applications

Unified Messaging	Interactive Voice Response	Desktop Clients	Soft Clients	Remote Agents	Fax Server

Third-Party Core Enterprise Communication Applications

PBX and/or Contact Center **+** Automated Attendant and/or ACD **+** Voice Messaging **+** Administration and Maintenance

Intel® Communications Building Blocks

PSTN or IP Trunk Interface **+** Analog, Digital or IP Station Interface **+** Voice and Conference Resources **+** Fax and Speech Resources

Windows	**Open Operating System**	Linux

PC	**Intel® Architecture**	Server

Figure 3. Business Communications Platform Architecture

ready to serve converged communications applications.

- Layer 1: Intel® Architecture PC or server technology

- Layer 2: Open operating system (Windows or Linux)

- Layer 3: Intel communications building blocks for a PSTN or IP trunk interface; an analog, digital, or IP station interface; and voice, conferencing, fax, and speech resources

The top two layers in Figure 3 represent the applications developed, integrated, and delivered by an ecosystem of independent software vendors, integrators, distributors, and value-added resellers.

- Layer 4: Core enterprise communications applications for PBX or contact center functions, automated attendant and automatic call distributor, and voice messaging. Typically Web-based administration tools manage the applications.

- Layer 5: Enhanced enterprise communications applications such as unified messaging, interactive voice response, desktop client, soft client, remote agent, and fax server.

Although the architecture presented here describes a complete converged

communications system built on a business communications platform, one of the advantages of the platform is that an enterprise can choose the applications it currently needs and add new applications in the future via software loads.

A single software vendor can develop communications applications suites in which enhanced applications are available as selectable modules. Another approach is to expose application program interfaces on a core switching application to encourage other software developers to create plug-in modules for enhanced applications.

For application developers, Intel's building block approach is ideally suited to the use of rapid application development (RAD) toolkits. RADs provide a collection of development utilities and runtime engines that help developers quickly create and deploy applications, saving both time and money. Typically RAD tools provide an abstraction layer, which hides or shields the developer from requiring an in-depth knowledge of specialized APIs, which greatly simplifies the development of communications applications, such as voice processing, speech recognition, computer-based fax, text-to-speech (TTS) synthesis, and others.

Easy Scalability and Dramatic Efficiencies

Business communications platform telephony building blocks can support system configurations from eight station ports to well over 500 ports in a standard computer server chassis. This scalability allows developers to address a broad enterprise market segment, as well as enabling a platform to grow as an enterprise grows. A complete range of trunk and station interface boards from Intel easily supports both contact center and less network-intensive PBX trunk configurations. IP resource boards allow the use of both IP trunks and stations.

As enterprises migrate to IP stations, the platform allows them to benefit from an overall reduction of physical station interfaces because of efficient hardware and software IP resources. Analog station ports have a fixed one-to-one hardwired relationship with station users while the IP resource to IP station user ratio is a flexible, shared resource.

For example, a 24-port analog station interface board is required to support 24 analog station users. However, a 24-port IP resource board can potentially support two to four times as many IP station users, delivering a dramatic rise in system efficiency. Such savings highlight both the efficiency of IP systems – and the important benefit that a business communications platform can provide by facilitating the migration to converged, IP-based communications.

Since business communications platforms are deployed using operating systems and computing hardware common in the enterprise IT environment, system managers can use their existing IT procedures and personnel to monitor and maintain their communications infrastructure. This is a distinct advantage over older proprietary solutions that required specialized skills and procedures. The monitoring of standard platforms can be done remotely or locally in the same way that existing email and database servers are monitored and managed, reducing costs and improving the efficiency of the IT organization.

Technology Trends Benefit Business Communications Platform

The business communications platform has benefited from several technology trends. Its roots are in the enhancements created for the contact center, and its future will be shaped by the exponential growth of processor performance observed in Moore's Law and the development of host media processing.

Contact Center Solutions Built on Standards-Based Hardware

Contact center application developers were early innovators in providing voice-switching solutions built on open, standards-based computer telephony hardware. These solutions developed because of the significant benefit received by integrating information from the contact database with the customer call automatically. Similar proprietary contact center solutions required a very high investment per agent, which made open-
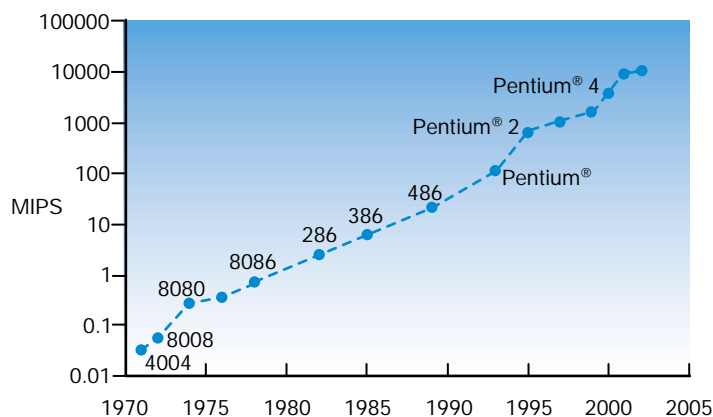
Figure 4. Processor Performance in MIPS

platform solutions more attractive from both a financial and functional standpoint. In addition, the typical workstation environment (telephony headset and data terminal) for contact center agents drove extensive development of standard analog station interface hardware.

Once switching functionality in a business communications platform was proven in the contact center, the development of standards-based full replacement solutions for the PBX/KTS could begin.

From an application standpoint, its contact center heritage is a major benefit for business communications platforms. Although contact centers were originally important only to large enterprises and telemarketing organizations, contact center functionality has rapidly become "must have" technology for business installations of all sizes because of the cost savings it can deliver. Driven by productivity and customer service initiatives, enterprise customers have become increasingly eager to benefit from the sophisticated routing, queuing, predictive dialing, IVR, and database integration technologies that have been developed and proven in the contact center using business communications platform architecture.

Adoption of business communications platforms in the contact center is a large and growing base for the general deployment of this technology. However, this base represents a fraction of the opportunity in the total enterprise communications system market segment, which encompasses next-generation PBX and KTS replacement products. Business communications platforms are poised to make significant inroads in this much larger area of opportunity.

Host Media Processing Can Displace DSPs

Because it is based on Intel® Architecture, the business communications platform will grow more powerful and cost-effective as microprocessor performance continues to accelerate according to Moore's Law. In 1965, Gordon Moore observed an exponential growth in the number of transistors per integrated circuit and predicted that this trend would continue. Because of Intel's history of technological advances, Moore's Law has been maintained and still holds true today, and Intel expects that it will continue at least through the end of this decade.[1] Figure 4 shows the rapid rise of processor performance over time as proof of Moore's Law.[2]

Continued gains in processor performance will directly impact the way in which business communications platforms develop in the future, making them increasingly more efficient and cost-effective.[3]

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[1] See http://www.intel.com/research/silicon/mooreslaw.htm.

[2] Taken from Gordon Moore's presentation "No Exponential is Forever … but We Can Delay 'Forever'" on February 10, 2003 at the International Solid State Circuits Conference (ISSCC).

[3] For more information on Moore's Law, see ftp://download.intel.com/labs/eml/download/EML_opportunity.pdf
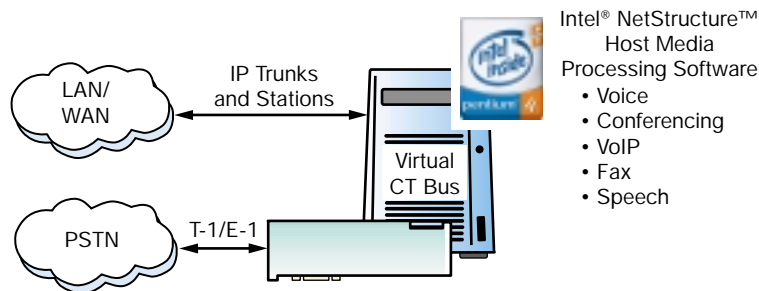
Figure 5. TDM-IP Solution Enabled with HMP Software

Today processor power allows telephony servers to provide advanced applications and multimedia technologies. With the introduction of Intel NetStructure Host Media Processing (HMP) software in September 2002, a new trend to migrate core communications processing functions from dedicated digital signal processors (DSPs) to the host microprocessor began.[4] The increasing power and cost-effectiveness of the Intel Pentium® processor now allows it to deliver specialized processing functionalities, such as digital signal processing, at reasonable cost and performance levels. By performing the functions of purpose-built DSPs on a central processor in a server, HMP software delivers telephony media processing in a new way.

DSPs deployed on computer telephony boards in today's business communications platforms run software modules that provide rich resources to telephony applications. Voice play and record, conferencing, fax, speech recognition, TTS, VoIP transcoding, and tone generation are all DSP-based operations today. However, HMP software promises to allow Intel processors in the business communications platform server to replace dedicated DSPs and reduce (and, in some cases, eliminate) the need for telephony boards in future business communications platforms. This further simplifies business processes for developers who are building business communications platforms by eliminating the need to manage, stock, install, and configure the hardware boards that use DSPs.

Combined with the move from the PSTN to a network based on IP voice service and station equipment, the shift to the host processor from DSPs has the ability to transform converged communications systems dramatically with the following benefits:

- Faster time-to-market for applications developed using software development and test processes
- Deployment that begins with a software download and not with hardware board installation
- Upgrades that are possible by simply reconfiguring software
- More users and features that can be added and supported using server-based (often GUI) management interfaces
- Maintenance costs that are lower because less physical hardware is required to support comparable system configurations
- Reduced working capital costs that may allow developers to price enterprise products more attractively

The sum of the benefits brought by the introduction of HMP software technology will likely translate to a reduction in the total cost of ownership for enterprise customers.

Figure 5 presents a future configuration of a business communications platform as a TDM-IP hybrid solution using HMP software. The HMP-enabled board provides an interface to the PSTN, but all the media resource and IP connectivity resides as HMP software modules on the Intel host processor.

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[4] For more information on HMP software, see http://www.intel.com/network/csp/resources/white_papers/7786web.htm

Most Enterprises Can Use Business Communications Platforms

Many industry analysts predict double-digit growth for next-generation IP-centric enterprise communications systems, which include business communications platforms. Although virtually every business and enterprise is a potential candidate for a business communications platform, two key types of enterprises are particularly important: the distributed enterprise and vertical marketplace.

The Distributed Enterprise

Nowhere do business communications platforms make more sense than in enterprises that have identical, distributed branches across a geographic region or worldwide. These businesses continually strive for economies of scale derived from replicating successful business processes across their locations.

Many enterprises are still tied to a rigid proprietary communications system designed decades ago. Businesses that have undertaken any consolidation, merger, or acquisition activity may even find themselves with multiple non-compatible communications systems. Dependencies and variations limit the type of applications they can deploy at each of their locations. Often the business is required to dispatch specially trained personnel to service their communications equipment and upgrade it at each location, often through expensive service agreements.

Even when open standards-based adjunct media servers are used to enhance communications applications, the proprietary interface between the legacy telephony hardware and the open platform presents roadblocks to true efficiency and cost reduction. Systems built on business communications platforms will allow distributed enterprises to benefit from the same open, standards-based model that has made their information systems so efficient and cost-effective.

Four powerful incentives will encourage these organizations to move to business communications platforms.

■ **Customize Once, Deploy Many** – Distributed enterprises can buy an open server-based communications system with an application customized to their needs, and deploy duplicate systems in all of their distributed locations, greatly simplifying communications system management.

■ **Off-the-Shelf Equipment Reduces Costs** – Because the business communications platform is built on a standard data server running switching and other communications applications with a standard operating system, no specialized telecom personnel are required. IT personnel can manage, maintain, and upgrade the communications system as easily as they do their organization's information system. And in a distributed environment, hardware and software can be managed remotely.

■ **Investment Is Protected** – With a business communications platform, applications can be upgraded or replaced without necessarily scrapping the underlying hardware platform. New standards-based hardware and software technologies can be implemented, and the platform expanded, without a wholesale forklift replacement. Since both the traditional PSTN and new IP networks and endpoints are supported, migration from one to the other is achievable at a pace that is right for the particular organization.

■ **IP Resources Enhance Applications** – Since the business communications platform can be equipped with IP resources, applications benefiting from the advantages of VoIP technology can be deployed. Distributed enterprises can route calls over the enterprise WAN and consolidate their communications infrastructure, often reducing overall costs. The platform can be managed over the WAN, and external calls can be transparently routed to alternative sites or channeled from a centralized 800 service to a local service center.

Vertical Market Segments

The business communications platform is also an attractive development platform for vertical

market segments, such as retail, finance, health care, travel, and more. Traditional PBX or KTS technology typically serves these vertical market segments with enhanced applications delivered via an adjunct media server. Since the business communications platform can support both switching and enhanced applications, it opens opportunities to serve vertical markets with innovative communications applications without the burden of integrating an adjunct server with a range of proprietary phone systems.

The single platform for both core switching and enhanced applications provides an efficient new delivery mechanism for vertical market segments. A server architecture makes it easier for developers to integrate with the most popular data applications in a particular vertical market segment. Such a strategy can open doors to new distribution channels for converged communications systems.

Standards Make Business Communications Platform Unique

Although this paper has focused on a comparison between traditional, proprietary PBX/KTS technology and a converged system using the business communications platform model, such a converged system can also be favorably compared to other next-generation communications systems in today's marketplace, such as proprietary converged systems and IP-PBX systems.

While some converged systems are built on standard data server platforms and operating systems, their telephony hardware and software remain proprietary and closed. Generally speaking, third-party developers are not free to innovate on these platforms.

IP-PBX systems have been introduced by both data switch and traditional PBX manufacturers, and are designed with IP technology at their core. Still, these systems are offered in the same way as traditional PBX and KTS products. A single manufacturer is the sole source for hardware, software, and station equipment, as well as the communications protocol that allows each of these components to communicate with each other and with a unique management and monitoring system.

The key differentiator for converged systems built with business communications platform architecture is the adoption of the open standards computing model in a communications system rather than the traditional proprietary communications model, which lacks a strong ecosystem of independent developers. Open standards in technology drive innovation and efficiency by reducing barriers to entry.

Just as the advent of open, standards-based computing allowed innovation and cost effectiveness to win out over proprietary data systems, Intel expects that systems built on open, standards-based business communications platforms will ultimately supplant proprietary communications systems in the enterprise.

Advantages of Business Communications Platform Technology

Developers searching for an opportunity to tap into the demand for next-generation converged communications systems in the enterprise should look closely at the advantages provided by business communications platform products from Intel. Enterprise customers considering a next generation, IP-enabled system to replace their legacy PBX or KTS systems should examine the benefits of a converged system built on Intel technology as compared to alternative systems.

The three powerful elements described below make business communications platform technology a uniquely strong competitor in the next-generation communications systems market segment.

1. A single hardware platform that will support core communications application needs (i.e., inbound and outbound calling and voice messaging), which is ready to support enhanced communications applications or modules as needed.

2. A platform that is truly converged, supporting both circuit-switched and packet-switched networks and endpoints, allowing migration between the two at a measured pace.

3. A platform based on open Intel architecture, enabling innovative software applications and providing a communications system with the type of flexibility, manageability, and application choice found in today's data technology.

The business communications platform is poised to dramatically transform the communications industry by providing an architecture that emulates the model that has driven the development of cost-efficient systems in the computer industry. This model will allow forward-looking companies to rapidly develop innovative solutions that work together because of open industry standards. With business communications platform technology, enterprises can lower the total cost of ownership for their communications systems while benefiting from the continual innovation fueled by standards-based application development. This will ultimately allow end users greater flexibility to meet their unique business needs.

To learn more, visit our site on the World Wide Web at **http://www.intel.com**.

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