Business Value Drives VoIP and IP-Telephony Layering

Enterprises must view IP telephony and voice over IP projects as functional layers composed of different vendors, stakeholders, technologies and evolution rates, which together deliver complete business value.

Enterprise architects and managers must explicitly define the end-to-end functional layers of their enterprise voice over IP (VoIP) infrastructure and IP-telephony application architecture; this will clarify the tasks of integration and cost justification (see Note 1). Figure 1 depicts the five major functional layers in an enterprise deployment. The lower layers provide the enabling network and VoIP infrastructure, while the upper layers show the IP-telephony applications and the enabled business processes. These layers clarify the technical aspects, because the products, vendors and replacement cycle for each layer differ. The project management tasks are also clarified, because the departments and stakeholders involved in implementing each layer are usually different. Functional layering also clarifies the business justification for the deployments; although each area is often budgeted from different departments and the costs of VoIP deployments frequently focus on specific components in the lower layers, the largest value of the technology is frequently found in higher-level IP-telephony and business applications. Defining all of the layers enables the cost of each layer to be justified within the broader context of overall business value. Defining these layers also enables more flexibility in how service providers and enterprise business solutions are related. Figure 1 indicates enterprise premise solutions on the left and service provider solutions on the right.

Core Topic
Network and Telecom Managers: Network Technologies, Procurement and Management

Key Issue
What network technologies, procurement and management practices will provide competitive advantage to enterprises?

Strategic Planning Assumption
By 2005, 80 percent of enterprise IP-telephony deployments will use functional layers as the basis for technical architecture and business case justification (0.8 probability).

Note 1
Definitions
Voice Over Internet Protocol (VoIP): The use of TCP/IP infrastructure and Internet-based standards to transport live voice and video traffic. VoIP is an infrastructure-focused term.
IP Telephony: Telephony platforms and applications, such as IP private branch exchanges (PBXs), that are designed to provide voice and video services over VoIP infrastructure. IP telephony is an application-focused term.
Here, we provide an overview of the five functional layers that comprise a complete VoIP implementation. Each layer provides a different type of required functionality. If these layers are viewed in isolation, the reliability and quality of the end result is at risk: The true value, costs and risks of the deployment are not accurately defined. For instance, defining VoIP-capable gateways and routers is required to ensure quality of service. Yet, it is difficult to justify these changes to the gateways and routers without referencing the applications that will use them. Similarly, enterprises seeking to deploy an IP private branch exchange (PBX) must consider all of the underlying requirements and costs. The costs of deploying an IP PBX far exceed the simple cost of replacing the PBX: The infrastructure and underlying TCP/IP network connectivity must also be considered. Additionally, once an IP PBX is in place, other changes to enterprises applications and workflows may be enabled. Again, these should be considered part of the long-term plan. Because of this, enterprise planners must understand the synergistic, dependent relationship between the lower and upper layers of the architecture. The lower layers are difficult to justify without referencing the upper-layer applications, but once in place, these lower VoIP infrastructure layers can be leveraged by multiple IP-telephony applications.
VoIP-Capable Networks: This layer of functionality enables wide-area network (WAN) connectivity between locations or enterprises, and is offered through asynchronous transfer mode, frame relay or, increasingly, through Multiprotocol Label Switching (MPLS) and virtual private networks. In larger enterprises, governments and public institutions, this layer of functionality is provided by internal services. In other types of enterprises, it is obtained from network operators. Most operators offer multiple classes and types of service, but only some of these offer the quality suitable for VoIP (see "MPLS Networks: Drivers Beat Inhibitors in 2003").

VoIP-Enabled Infrastructure: The components at this level of functionality provide enterprise-specific infrastructure to enable and secure voice traffic over enterprise local-area networks (LANs). This layer does not provide the telephony itself. Components include gateways, routers and firewalls. Data and voice functions usually share the same infrastructure. However, VoIP demands additional requirements in key areas such as quality of service, availability, reliability, performance and business continuity. Power may also be required at this layer for many VoIP devices (see "Preparing Your LAN for IP Telephony").

IP Telephony: This area provides basic telephony and voice-switching functionality, including traffic management, call setup and tear-down, call control and reporting. Currently, the focus in this area includes IP PBXs, hybrid IP/circuit-switched PBXs, SIP phones and softphones (see "IP Telephony for Enterprise Networks: Technology Overview").

Advanced IP-Telephony Applications: This level introduces the value-added telephony applications that build on base IP-telephony/IP-PBX capabilities. The most common IP-telephony applications are contact center functions, unified communications and conferencing. Most of these applications leverage two unique capabilities of TCP/IP. The first is the ability to operate in a distributed environment that allows physically distributed sites, devices and resources to be operated as a single integrated environment. For instance, applications may enable virtual contact centers or remote access to real-time and messaging information. A second critical capability is the use of common protocols across different channels and applications, because it enables greater integration between applications and greater access to multiple channels. For instance, SIP can be used to set up communication sessions for voice and instant messaging (IM); the same application can also access messages, directories and calendars.
IP-Telephony Integration With Business Processes and Workflows: Broader IP-telephony initiatives often involve changes to business processes that will enable this new technology to be properly leveraged. These changes can include rules, roles, procedures and structures that are related to the communication and exchange among people and between the environment and the people. The specific changes differ between enterprises and industries. For instance, in higher education, the IP-telephony initiative may involve modifying the phone services provided to students. The new approach might employ a softphone, which is integrated with IM, unified messaging, presence and “find me, follow me” services. Students and faculty then have a complete communication setup anywhere they can plug into the campus LAN. In the retail and healthcare segments, an IP-telephony initiative may involve regional offices receiving personalized local phone and self-service coverage, which is managed and operated at a central corporate location. In the financial services segment, IP-telephony initiatives may involve changes to the way that contact centers route phone and Web interactions to different locations for load balancing, and to better match client needs with agent skills. In all of these examples, VoIP and IP-telephony initiatives require changes at the business level to succeed, and the value of the underlying infrastructure changes are only fully realized if corresponding organizational changes are made.

Figure 1 depicts the differences between premise-based solutions (shown on the left) and those offered by service providers and network operators (shown on the right). At the lower layers, enterprises can develop their own VoIP-enabled infrastructure or they can purchase this as access services from their carriers. Similarly, at the IP-telephony layer, while an enterprise would consider deploying an IP-PBX on-site, the service provider could offer similar functionality via IP Centrex. At the advanced, IP-telephony application layer, service providers offer a range of hosted and managed solutions as alternatives to premise systems. The use of layers clarifies how and where these service provider functions can be used, as well as the responsibilities of the parties involved.

When grouped together, these layers provide the enterprise planner with a more-accurate understanding of costs and risks. For instance, a call center implementation will require high-throughput, high-bandwidth WANs between their sites. This initial investment may be leveraged for toll bypass immediately. However, the long-term value to the enterprise is the ability to have multiple physical call center sites transparently networked as a single logical center with application integration across the sites.
**Bottom Line:** Enterprise voice over IP infrastructure, such as routers and gateways, are often defined and justified independent of IP-telephony initiatives; for example, an IP-private branch exchange deployment. However, this kind of disconnected approach leads to inaccurate planning and significant risks. These initiatives should be considered together to better understand the total costs, actual risks and true value. VoIP initiatives frequently focus on modifying the lower layers, such as routers and gateways. This enables functionality such as toll bypass. Similarly, IP-telephony initiatives, such as IP-PBX deployments, are frequently considered without accounting for the costs of voice enabling the underlying TCP/IP networks. For many enterprises, the largest potential value is found in how VoIP and IP telephony together will enable different, more-productive business processes. Enterprises must view their VoIP and IP-telephony architectures in terms of functional layers, understanding that, although the layers have different sets of vendors, are based on different technologies, have different internal stakeholders and will evolve at different rates, all are required to deliver full business value.

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<tr>
<th>Acronym</th>
<th>Key</th>
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<tr>
<td>IM</td>
<td>instant messaging</td>
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<td>LAN</td>
<td>local-area network</td>
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<td>MPLS</td>
<td>Multiprotocol Label</td>
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<td>PBX</td>
<td>private branch exchange</td>
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<td>VoIP</td>
<td>voice over Internet Protocol</td>
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<td>WAN</td>
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