



WHITE PAPER

IP Network Solutions

Interconnecting VoIP Networks and the PSTN
(for smaller service providers)



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VoIP service is growing, but the majority of calls still must connect to the PSTN.

Introduction

An increasing number of service providers are turning to IP technology for providing Voice over Internet Protocol (VoIP) service to their subscribers. While operating a packet-switched network offers many advantages such as integrated voice and data, new enhanced IP services, and greater operational flexibility, it also presents challenges. Today, most calls must connect to the Public Switch Telephone Network (PSTN) for completion, and for access to intelligent data and services requiring Signaling System 7 (SS7) signaling capabilities. SS7 signaling solutions can require significant capital expenditures and the need for experienced staff.

The purpose of this paper is to discuss and explore the issues, challenges, and solutions of interconnecting IP technology with SS7 technology to provide VoIP access to the PSTN. This paper will focus on a distributed ownership infrastructure model, designed for the smaller service provider, where the PSTN access is outsourced to a third party. This model is offered by VeriSign through its SIP-7 Service.

IP Infrastructure—Service Provider Issues

Managing operational efficiencies and costs is a top priority for telecommunications service providers. The introduction of IP technology provides an opportunity for carriers and service providers to implement more flexible networks for multimedia services and the integration of voice and data. However, there are still many challenges with the implementation of IP infrastructures, such as the ability to interoperate with the PSTN and to access the functions and features provided by SS7 protocol, and to allow access to non-VoIP networks. Even though the cost of next-generation devices, such as softswitches, may be less than that of circuit-based CLASS switches, many service providers are reluctant to expend the capital outlay required for various reasons, such as lacking experience to administer the equipment, questions as to stability of equipment vendor, or the changing environment surrounding IP.

+ Access to the PSTN and SS7 Networks

As service providers turn to next-generation/IP technology for providing services such as VoIP, they need interoperability between IP networks and the PSTN for call setup and call control of calls that must terminate to non-VoIP networks. This function is managed through SS7 signaling protocol used in traditional circuit-based switches or a packet-based switch with IP-SS7 conversion capabilities. Non-facilities-based service providers (those who do not own a switch), may access the PSTN, and hence the subscriber, via Primary Rate Interface (PRIs) or basic subscriber loops. A more cost-effective means of access to the PSTN and SS7 networks is via Intermachine Trunks (IMTs) however the service provider must be facilities-based, meaning they own and operate a switch. VoIP providers therefore may consider the purchase of a softswitch, allowing the use of IMTs to access PSTN network partners.

When evaluating options for PSTN interconnectivity, service providers must consider not only their growth objectives, but their experience in SS7 management.

+ Network Elements

Following is a review of the network elements for VoIP service and access to the PSTN:

- Media Gateway Controller (MGC) is the call control logic. It provides termination requests and performs call setup and call control (basically, ISDN User Part [ISUP] trunk signaling to the terminating network partner) on the Media Gateway. It is not uncommon for the Media Gateway Controller to be referenced as a softswitch. In a distributed model, this component is outsourced to a third-party provider.
- Signaling Gateway (SG) provides the SS7-to-IP-to-SS7 protocol conversion and is the interface between the MGC and the PSTN. The SG when combined with the MGC composes a softswitch. Throughout the remainder of this document, we will use the term “softswitch” to address the MGC and SG functionality. This device would also be outsourced to a third-party provider in the distributed model.
- Media Gateway (MG) is the transport plane of the IP network architecture. It is the network element inserted between the voice (PSTN) and IP networks to perform the voice processing functions for translations between the voice world and the IP world. In a distributed model, the service provider owns and operates this network element.
- Intermachine Trunks (IMTs) are switch to switch trunks for carrying calls (physical path for bearer traffic; not signaling) between carriers. The service provider is responsible for IMTs in the distributed model.
- SS7 is the set of packet network protocols, standardized for the PSTN and allows processing of calls via messages (i.e., signals) that direct destination, setup, and teardown of calls between switches. The SS7 network or network access is managed by the third party in the distributed model.
- Signaling Transfer Points are devices within the SS7 network that transmit messages between signaling links and other network components within the PSTN. This function is also owned/managed by the third-party provider in the distributed model.

Service Providers have options for network infrastructure—a fully insource model where all elements are purchased and managed by the service provider; a fully outsource model where a third party manages all elements of the network; or a distributed infrastructure where elements are managed by both the service provider and a third party. Determining the most appropriate model will depend upon a service provider’s level of experience with both IP and SS7 technologies, available capital outlay and operational resources, growth objectives, and target markets.

Fully Insource Model

In a “fully insource” model, the service provider will purchase, implement, and manage all elements required to access the PSTN. This includes the Softswitch, Media Gateways, and SS7 Signaling. Softswitches can range from \$200,000 to \$400,000 and Media Gateways are approximately \$40,000. SS7 Signaling requires access to Signaling Transfer Points (STPs) that provide network interconnectivity within the PSTN and is normally provided through

A distributed architecture for PSTN access allows the most complex and costly components to be outsourced to an experienced third party.

a SS7 Network Provider or an Incumbent Local Exchange Carrier (ILEC). This model may be more desirable for larger service providers that will start out with a high number of subscribers or are projecting quick growth and want total control of the network. Consideration must be given to the scalability of equipment, vendor stability, capital outlay, resources and the ongoing operational costs, and start-up time.

Fully Outsource Model

This is a solution where all elements are provided and managed by a third party. The benefit is a quick startup and significantly reduced need of in-house staff experienced in IP and SS7 technologies. While this model lowers or eliminates capital investment, it may be difficult to determine and control costs for changes in growth, as well as being locked in to a single-vendor solution that may limit introduction of new applications.

Distributed Infrastructure Model

In the distributed ownership infrastructure, the service provider takes responsibility for a portion of their network infrastructure, while outsourcing certain components that may be cost-prohibitive to own and maintain, or that require expertise not resident in-house. This model is ideal for the smaller service provider not positioned to own and administer the softswitch and SS7 functionalities. It allows for the use of IMTs and eliminates the need for a softswitch—often resulting in immediate savings. It helps minimize operational resources and capital outlay, and allows for quicker startup. In a distributed ownership model, the service provider purchases and maintains the Media Gateways, while the third party provides the expertise to administer, maintain, and support the more complex and costly elements—the softswitch and SS7 signaling. Additionally, it reduces the risks of stranded investments associated with ownership of equipment in an industry with rapidly changing technology.

VeriSign® SIP-7 Service—SIP to PSTN Interconnectivity

As discussed earlier, service providers are turning to IP infrastructures to provide VoIP and enhanced IP services to customers. These services can be provided efficiently and cost-effectively using a partially outsourced functionality. VeriSign is providing such a service today with the VeriSign® SIP-7 Service—a cost-effective method for providers of VoIP service to access the PSTN. SIP-7 Service integrates SIP-based VoIP platforms with the VeriSign SS7 network, allowing seamless interconnection between IP networks and the PSTN.

SIP-7 Service removes SS7 connectivity requirements from the VoIP provider, while reducing capital expenditure costs and the risk of investment in new and changing technologies.

SIP-7 Service helps reduce the cost and complexity of PSTN connectivity by combining SIP-based network elements with the efficiency and control of VeriSign's SS7 signaling technologies, providing SS7 connectivity throughout North America and access to intelligent services through a single SIP feed. This managed service model helps reduce capital expenditure costs and the risk of investment in new and changing technologies and vendors.

SIP-7 Service removes SS7 connectivity requirements from the VoIP provider while allowing control of routing in the network. One IP connection from the SIP-based equipment to the VeriSign network provides:

- SIP to SS7 conversion
- Connectivity to the PSTN—Every destination switch in the United States and Canada
- Signaling to VoIP networks
- Ability to access intelligent services such as calling name (CNAM), number portability, and toll-free
- Ability to access the VeriSign Public IP Directory (the VeriSign network routing directory service) that checks for an IP address to allow calls to connect directly IP

VeriSign SIP-7 Service provides the benefits of a managed service with experienced technical support including:

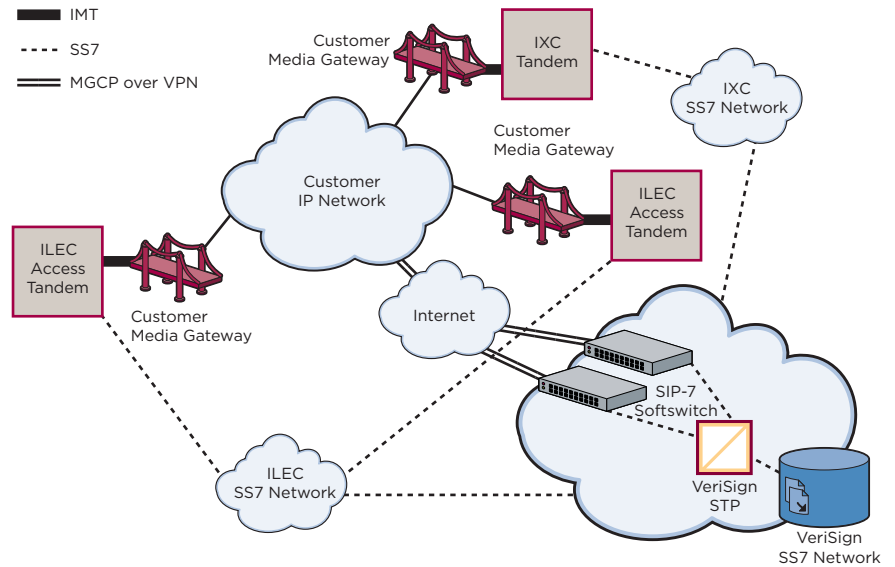
- SS7 call setup connectivity to all of your PSTN partners via ISUP signaling towards the PSTN
- SS7 link access
- SIP signaling to VoIP networks
- Flexible routing criteria
- Twenty-four-hour customer support
- Software updating and maintenance for the VeriSign softswitch (signaling gateway and the media gateway controller)
- Trouble resolution and support for the SS7 and the softswitch
- Provisioning of the SS7 network and the softswitch

+ SIP-7 in Action

- Service provider sends a SIP feed to VeriSign
- VeriSign converts the SIP feed to SS7 and connects to its North American SS7 network
- Service provider is connected to every destination switch in the United States and Canada
- VeriSign sends MGCP (Media Gateway Control Protocol) messages to the bearer gateways in the service provider's network

Today, and for some time into the future, IP telephony requires access to the PSTN to provide the full service that users expect.

Figure 1: SIP-7 Interconnect Model



With the VeriSign SIP-7 Service, VoIP providers can realize the benefits of an IP infrastructure and be confident that calls requiring access to the PSTN are connected in a reliable, cost-effective manner without having to manage the SS7 signaling. VeriSign operates the largest independent SS7 network in the world, assuring you of the efficiencies and reach of our established system. The VeriSign® Public IP Directory can also check for an IP endpoint to connect calls directly IP for even more efficient routing.

Summary

VoIP providers require access to the PSTN to provide full service to their customers. They must find the most efficient and cost-effective methods to provide voice services and manage their network infrastructures. Outsourcing control of signaling and network elements through a distributed architecture, as provided in the VeriSign SIP-7 Service, provides reliable access to the PSTN.



About VeriSign

VeriSign, Inc. (Nasdaq: VRSN), delivers critical infrastructure services that make the Internet and telecommunications networks more intelligent, reliable, and secure. Every day VeriSign helps thousands of businesses and millions of consumers connect, communicate, and transact with confidence.

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