Internet Protocol (IP)–Telephony Clearinghouses

Definition

Clearinghouses provide Internet service providers (ISPs), Internet telephony service providers (ITSPs), and telecommunications companies with a complete solution, enabling them to offer Internet telephony, fax, and a range of valueadded services. Clearinghouses act as intermediaries for the financial settlement of Internet telephony and fax traffic and guarantee payment to all members.

Overview

This tutorial describes how Internet protocol (IP) telephony clearinghouses operate, from a technical, operational, and business perspective.

Topics

1. Introduction

In the past, entering the telephony business consisted of only two options: reselling the facilities of another operator (switchless resale) or purchasing a circuit-switch infrastructure at a cost of upward of US$1 million. With the advent

of voice over IP (VoIP), any provider with a retail channel and a business infrastructure can enter the switched telephony business for an up-front investment of less than US$50,000.

These new VoIP service providers have the strength of retail channels and customer relationships, but they often lack the skills, contacts, and resources to provide one of the essential ingredients of any telephony service offering: global termination. While many have proven adept at originating minutes, they have struggled at finding, maintaining, and expanding relationships with other carriers worldwide to terminate their outgoing minutes.

The role of the VoIP clearinghouse is to bring together regional and local service providers for origination and termination of telephony minutes. Rather than pursuing traffic-sharing agreements with hundreds of service providers in different countries and cities around the world, local ITSPs turn to the clearinghouse operator to provide a single point of contact and interface for termination worldwide. In addition, regional clearinghouse services have also emerged, gathering traffic from dispersed local sites in specific areas of the world and pooling that traffic for low-cost termination to global clearinghouses or other regional operators.

2. Clearinghouses: More Than Termination Points

A VoIP clearinghouse, however, is more than just a termination point. It is a service provider for other service providers, offering a mixed portfolio of termination, financial services, and enhanced applications. Many clearinghouses perform the following functions:

- a single point of contact for termination of telephony minutes worldwide
- a source for termination rates to specific destinations
- financial accounts management
- settlement of accounts between carriers
- credit risk assessment between carriers
- receivable processing between carriers (financial settlements)
- quality of service (QoS) monitoring and provisioning
- bandwidth and IP access provisioning

- value-added service offerings, including global roaming, messaging, and other enhanced applications

In addition to these clearinghouse roles, today's VoIP clearinghouses also have the ability to exploit existing and future bilateral relationships with major carriers and wholesalers for large-scale exchange of telephony minutes over IP. These include wholesale minutes exchange of traffic taken directly from central-office (CO) switches using C7 integration and tandem switch hubbing over peered IP backbones or international private leased circuits (IPLCs). Taken together, bilateral minutes exchange and clearinghouse operations represent a major source of new revenue, cost savings, and infrastructure development for carriers worldwide.

3. Operations Models

The business operations covered under the clearinghouse umbrella actually consist of four separate (but closely related) concepts that come together to form a highly functional, diverse source of revenue for today's service provider. All four components of the clearinghouse business contribute to the migration of business, technical, and supporting processes to the unified network that will underlie all communications transport in the future. In this way, clearinghouse operations are more than a short-term revenue source; they contribute to the completion and advancement of additional value-added services. The four elements of the clearinghouse business can be deployed simultaneously and employ the same common technical and management components for a single point of management and configuration.

Wholesale Minutes Exchange

For years, tier-1 and wholesale carriers have entered into long-term, high-volume contracts with other carriers for the exchange of telephony minutes. These contracts are typically based on fixed volumes over dedicated circuits between the two carriers. To maximize efficiency along these international routes, carriers have employed various compression techniques, including digital multiplexing compression equipment (DCME). These peer-to-peer relationships have yielded mixed results in terms of quality, and the equipment to achieve even modest compression rates of 4 to 1 has typically been expensive when compared to the cost of the switched infrastructure itself.

VoIP is rapidly emerging as the transport of choice for large-scale minutes exchange. The advantages of replacing DCME–based leased circuits with VoIP are numerous:

- compression rates of up to 12:1 with voice quality far superior to that of DCME

- equipment costs of less than half of DCME plus circuit switch, as most gateways provide both switching and compression equipment in the same chassis

- migration of underlying infrastructure to IP

- development and enhancement of broadband (bandwidth) sales internationally

- single management interface for both IP and public switched telephone network (PSTN) services

Large volumes of multimillion-minutes-per-month contracts are already taking place between major carriers, and (given the huge economies of doubling the traffic down the same cables at half the cost of equipment) this trend toward IP–based bilateral minutes exchange will rapidly accelerate in 2000 and beyond.

Traditional and Switchless Refile

Telephony transit or refile businesses have exploded in recent years as a result of the onset of competition and the simple economics of volume purchase of telephony minutes. In the classic refile model, providers in one region of the world act as concentrators of telephony minutes to achieve bulk termination rates that are many times lower than those that can be achieved by individual carriers terminating directly into a country. For example, a carrier in the United States could have a rate to Country X of US$.05 per minute, while carriers in other countries must pay twice that amount. By bringing telephony traffic to the United States before terminating to Country X, carriers can take advantage of the lower rate. In addition, the larger the volumes the U.S. carrier can achieve by pooling traffic from multiple providers drives its rate down even further, providing additional cost savings to the participating carriers and increasing the revenue of the U.S. carrier.

The VoIP model for refile is similar to that of traditional circuit switch in that it is based on pooling large volumes of minutes for a particular destination from disparate sources around the world. However, VoIP adds several key advantages that will drive additional traffic to existing refile hubs and provide the capability of building new refile businesses for carriers operating outside of traditional hubs such as the United States and the United Kingdom:

- All minutes originate on IP, eliminating the need for transport fees along the route to the hub.

- Compression rates of 12 to 1 along the originating routes are possible, allowing large volumes of traffic to be directed to the hub along a single E1–T1 IP link.

- Use of PSTN refile hubs is permitted for traffic overflow that cannot be terminated through direct IP connections, as a result of circuit or network congestion.

Beyond traditional refile growth, however, the biggest benefit of the IP clearinghouse model lies in the switchless refile capabilities offered by VoIP. Switchless refile is achieved when a carrier obtains partners on both the originating and terminating ends of the transaction and can direct traffic from Country A to Country B entirely over the IP network. Much like traditional refile, the clearinghouse operator maintains the buying relationship with Country B and purchases bulk termination from that provider. Unlike traditional refile, however, the clearinghouse need not bring physical user traffic to its country. It receives its accounting information based on IP signaling traffic, while user traffic follows that shortest IP route between Country A and Country B. Thus, the clearinghouse need not occupy physical voice circuits or bandwidth to provide refile services—traffic never comes to the middle country. In this manner, the clearinghouse operator can provide refile services—and reap the revenue associated with these—without investing in circuit infrastructure. The model is pure revenue at very low investment.

Clearinghouse and Settlement

The third component of the clearinghouse business is the pure financial and route clearing function. With the growth of small regional operators, ISPs, and ITSPs, the clearinghouse can provide worldwide termination services to emerging IP–telephony operators worldwide. While it is difficult and time consuming for these emerging operators to maintain termination relationships in dozens of countries around the world, a clearinghouse can provide single-point termination worldwide at a very low cost, as a result of the economies of scale from representing many small operators. In addition, the clearinghouse can provide financial settlement and termination services to its members, providing an additional source of revenue on each transaction. With the number of operators in many countries exploding as a result of deregulation and the low cost of entry of VoIP technology, the potential revenues available to clearinghouse operators are enormous. For example, a clearinghouse operator that can sign up just one partner in 30 different countries can generate more than 15 million minutes of termination revenue a month, with further growth opportunities in the future.

In addition, local and regional ISPs and ITSPs need more than just termination. They also require bandwidth, provisioning, and management services. To assure high-quality voice and fax transmission, VoIP providers look to major carriers for backbone access and QoS management. By offering VoIP clearinghouse services, operators can provide a turnkey package that includes IP connectivity worldwide, QoS management, and other services such as data access, virtual private networking (VPN), and peering. Thus, the potential revenue from clearinghouse

services includes not only voice services, but connectivity and management ranging from small deployments of several E1s to large ISP contracts of multiple digital signal–3 (DS–3) connections and higher. Taken together, IP connectivity and clearinghouse services are very large revenue sources that generate healthy profits, help finance IP network buildout internationally, and drive toll revenue and expansion of IP capacity.

Enhanced Services Clearinghouses

Beyond the basic service offerings of large-scale movement of telephony minutes and global bandwidth provisioning, the long-term role of clearinghouse operators will be to go far beyond that of today's global carriers. IP transport networks open up the capability of offering centralized enhanced services and applications to members to increase revenues and profits in the face of falling margins for plain vanilla termination. Whereas in the past it was very difficult to provide enhanced services such as global 0800 number and messaging services from a single location, IP removes circuit backhaul charges and creates a powerful model for centralized service provisioning and management. In a single location, a clearinghouse operator can provide global feature and application provisioning for its members—driving utilization of the network and providing additional revenue on a per-use basis. Examples of centralized enhanced services are already appearing in the VoIP industry:

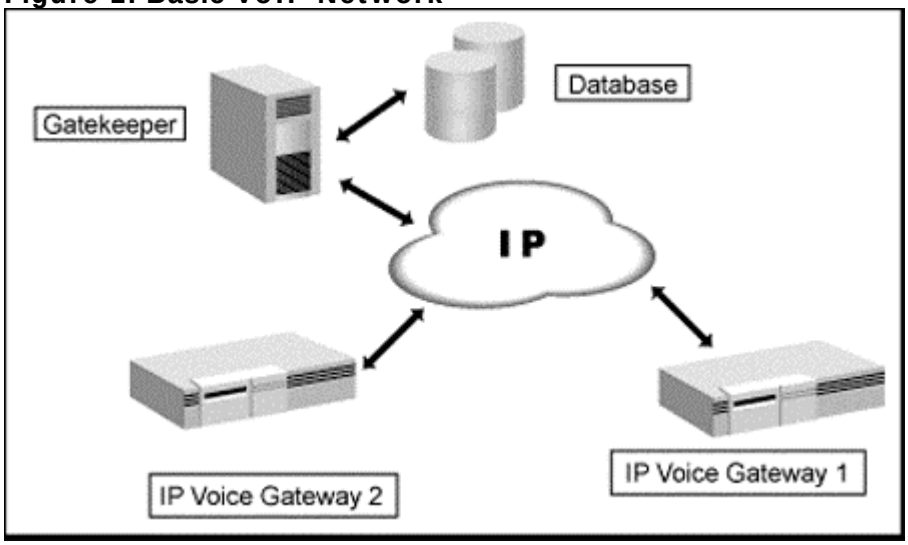
- global 0800 services that member enterprises can use in all participating countries for routing to a centralized or distributed call center
- centralized messaging and broadcast services without PSTN backhaul charges
- global roaming services
- VPN offerings for large enterprises that provide a single interface and service logic, regardless of where the offices are located
- new services, such as video and multimedia, as they emerge

By leveraging the centralized intelligence of VoIP, carriers are truly laying the foundation for the advanced service offerings of the future. These applications will form the core of revenue and traffic growth in the future and determine the providers that are central to the communications network as it migrates from several unconnected networks to a unified transport infrastructure.

4. Technical Requirements

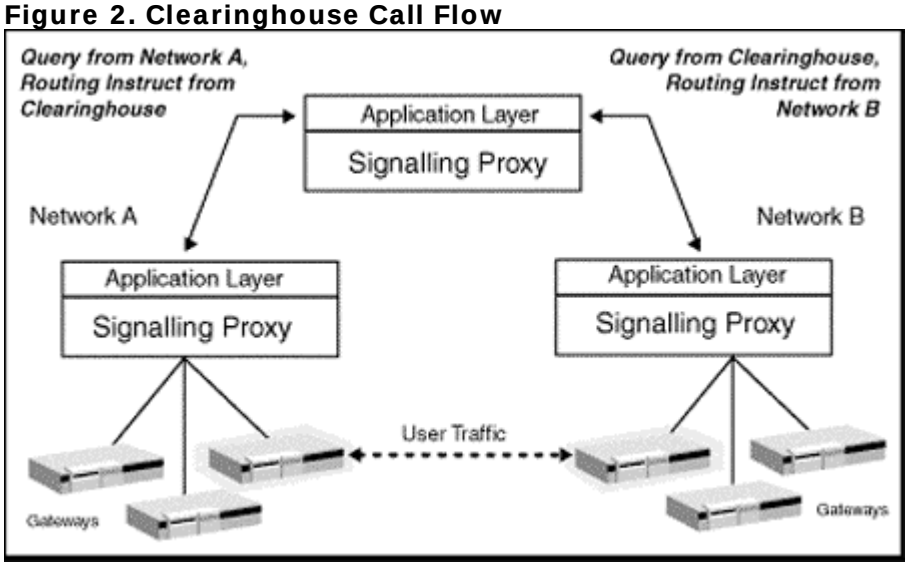
The key advantage of clearinghouse operations is that a single technical infrastructure can be used to provide all four operations services to members—from simple bilateral exchange to global enhanced services. To understand the simplicity of the clearinghouse architecture, first consider the basic components of VoIP services. As outlined in *Figure 1*, VoIP operations consists of a management layer (an application server or intelligent network [IN] layer), a signaling proxy to exchange call setup data between networks, and a transport layer (IP gateways and IP network). Using this simple model, carriers worldwide have offered calling-card, single-stage dialing, and wholesale services for more than two years.

Figure 1. Basic VoIP Network



A clearinghouse, in its basic technical configuration, is simply an application and a signaling protocol (such as H.323) without gateways. It provides routing instructions, service logic, and billing capabilities to other networks. As such, adding clearinghouse capabilities requires the provisioning of the IN layer and database to the network to provide the same routing and service management to other networks that the existing network control layer provides for its gateways. *Figure 2* is a diagram of basic clearinghouse operations.

Figure 2. Clearinghouse Call Flow



The technical and business requirements for becoming a VoIP clearinghouse are extremely simple. Service providers with existing international or regional business can leverage existing infrastructure to drive new revenues to their networks with minimal investment:

- clearinghouse applications
- bandwidth provisioning and IP access
- sales and marketing channel for recruiting partners and members
- financial and network management infrastructure

With these simple tools in place, an operator has everything it needs to enter the profitable market for IP clearinghouse services.

5. The Business Case

Beyond the theoretical and strategic incentives for establishing clearinghouse operations, the driving force behind the growth of VoIP clearinghouses is the simple fact that they generate revenue for service providers who have the bandwidth, sales channel, and minutes volume to enter the clearinghouse business. With the volume of IP–based telephony minutes expected to grow more than 300 percent in the next two years (according to analysts such as Frost & Sullivan), today's opportunity is sure to grow in the future. Service providers who enter the market now can achieve substantial first-to-market growth and establish the infrastructure to grow services in the future to remain a step ahead of the competition.

While the financial terms and volumes of traffic from clearinghouse operations will vary over time and by geography, simple guidelines of the potential sources of revenue generation and cost savings are provided by the examples in this section and described in detail below. The important ideas to keep in mind are the general categories of financial impact, while the more detailed factors such as number of partners and volumes can be determined by the operator. General guidelines on realistic numbers are provided to aid the evaluation of the business opportunities for clearinghouse operations.

Revenue Sources

Wholesale Minutes Exchange

The model for bilateral minutes exchange is already familiar to most operators, and the growth of high-volume IP minutes contracts advanced rapidly in 1999. Many large service providers have already determined that they will send a percentage of their traffic over IP during the next 12 months, with the volume set to expand steadily in the future. Exact volume will depend on the number of bilateral relationships that a service provider can negotiate, but typical contracts between large carriers consists of one to two million minutes per month to start, with growth to five million minutes per month or more in the second year. To calculate the expected revenue from wholesale minutes exchange, enter the number of partners and the expected minutes volume, along with the typical termination rates offered into the host country. As a general guideline, it is often realistic to expect three to four entry-level partnerships in the first year, with growth to seven to eight partnerships at a higher average in the second year. *Table 1* illustrates this calculation.

Table 1. Monthly Revenue Sources—Wholesale Minutes Exchange

Partners	Minutes Volume	Termination Rate	Total Volume	Total Revenue	Annual Revenue
4	2,000,000	0.04	8,000,000	$320,000.00	$3,840,000

Refile Growth

Beyond simple termination in one's home country, clearinghouse operators have a strong opportunity to drive growth of refile and transit businesses. Based on countries where one operates low-cost PSTN refile businesses, one can expand the entries in *Table 1* to include additional destinations covered by one's clearinghouse over PSTN refile hubs. For each destination covered through a refile hub, add the new fields in the same manner as for direct termination. Depending on one's geography, it is typical to forecast an additional four to five

destinations through PSTN refile, at traffic volumes of about 25 percent of direct termination per route. See *Table 2*.

Table 2. Refile Minutes Revenue

Route	Partners	Minutes Volume	Total Route Vol.	Termination Rate	Total Route Revenue
Route 1	4	500,000	2,000,000	0.05	$100,000.00
Route 2	4	500,000	2,000,000	0.05	$100,000.00
Route 3	4	500,000	2,000,000	0.05	$100,000.00
Route 4	4	500,000	2,000,000	0.05	$100,000.00
Total Refile Revenue:					$400,000.00

Clearinghouse Operations

The growth of ITSPs and ISPs continues to exceed forecasts and opens up a large universe of new customers for any clearinghouse operator. Already in 1999, more than 400 new operators have entered the VoIP business. Any ISP, ITSP, or retailer is a potential member of one's clearinghouse. While minutes volume varies dramatically depending on size, experience, and capitalization of the partner, even small clearinghouses have found it reasonable to expect 12 to 14 partners in the first year, with upward of 30 new members in subsequent years of operation. A small regional operator typically starts with low volumes, but powerful retail tools such as prepaid calling-card capabilities make traffic generation simple for new operators. In addition, termination rates are typically higher for small operators, as the clearinghouse is providing financial and routing services. This means higher margins and greater revenue from clearinghouse operations, as compared to the bilateral model. See *Table 3*.

Table 3. Clearinghouse Operations

Partners	Average Volume	Total Monthly Volume	CH Ave. Rate	Total Monthly Revenue
12	200,000	2,400,000	0.1	$240,000.00

Bandwidth and Enhanced Services Revenue

Finally, clearinghouse operators can supplement their minutes-based revenues by offering enhanced services and bundled bandwidth-termination options to their customers. In the short term, bandwidth-based services are a strong source of revenue. New and emerging operators demand worldwide connectivity and peering relationships to provide seamless voice quality and non–VoIP services. High-capacity IP access worldwide is a competitive market but, as it is the core of

any communications business, should be factored in as a key revenue source for any clearinghouse operator with an existing broadband business. See *Table 4*.

Table 4. Services

Service Type	Volume	Total Revenue
Roaming	200,000	$60,000.00

Value-added services revenue will be minimal for most operators in the first year of operations, but the availability of turnkey and third-party messaging platforms will allow for rapid growth in services revenues.

Cost Savings and Increased Efficiency

Beyond the significant sources of new revenue opened up by clearinghouse operations, carriers can also realize significant cost savings on existing operations by entering the VoIP marketplace. Cost savings—from decreased bandwidth costs to reduced termination rates—should also be factored into the overall business case for entering the clearinghouse business. A few of the most important sources of cost savings are outlined in additional examples.

Increased Traffic over Existing Infrastructure

VoIP products provide for greatly enhanced compression rates over existing transport infrastructure—at voice quality rates much higher than existing techniques such as DCME. Rather than altering voice composition, many IP–telephony gateways use standard industry codecs such as G.723.1 and achieve high-volume compression by eliminating IP overhead along the transport route. Using this advanced compression methodology, IP–telephony gateways can reduce IPLC and bandwidth costs by as much as half. Taking traditional DCME compression rates of 4 to 1, service providers can calculate bandwidth cost savings by adding the overall cost savings from better capacity utilization by entering the reduced bandwidth requirements over key routes, as outlined in *Table 5*.

Table 5. Bandwidth Utilization

Route	Bandwidth Cost	Compression Factor	Route Savings
Route 1	$25,000.00	0.5	$12,500.00
Route 2	$25,000.00	0.5	$12,500.00
Route 3	$25,000.00	0.5	$12,500.00
Route 4	$25,000.00	0.5	$12,500.00
Total Savings:			$50,000.00

Equipment Cost Savings

In addition to bandwidth cost savings, VoIP equipment is typically much less expensive than DCME and circuit-based compression equipment. Using this field, service providers can enter the reduced capital cost of compression based on figures typically encountered in each network. See *Table 6*.

Table 6. Equipment Savings

Expenditure	Savings Factor	Total Equipment Savings
$500,000.00	0.7	$350,000.00

Termination Cost Savings

Beyond basic compression and transport, the single biggest source of cost savings is the reduced cost of termination over IP compared to circuit-switched networks. While the arbitrage difference between IP and PSTN is falling in many markets, the opportunity for short- to medium-term cost savings based on cheaper termination rates is still substantial in many markets and is likely to remain so for several years to come. While the clearinghouse operator is generating revenue by providing termination services into key markets, it is also reducing costs by opening up the ability to terminate existing traffic along the same routes. See *Table 7*.

Table 7. Termination Rate

Route	Existing Rate	IP Rate	Volume	Route Savings
Route 1	$0.05	$0.03	1,000,000	$20,000
Route 2	$0.05	$0.03	1,000,000	$20,000
Route 3	$0.15	$0.07	1,000,000	$80,000
Route 4	$0.20	$0.10	1,000,000	$100,000

Although the overall cost savings will be based on minutes volume and varying termination rates, to get a basic estimate of termination cost savings, enter the six-to-eight key routes in your network in the termination section of *Table 7*. Enter the existing PSTN rates, benchmark IP rates, and volumes expected. A benchmark savings level along these key routes will be generated to approximate overall cost savings based on IP termination.

Management Cost Reduction and IP Buildout

Beyond the quantifiable cost savings of VoIP as a result of compression efficiency and reduced termination cost, the real cost-side benefits are more difficult to qualify with objective measurements. In particular, the reduced cost of managing

a single, unified network for all communications types—as opposed to the parallel management and provisioning of mobile, fixed-line, and IP services commonly used today—will represent a major cost savings source going forward. In fact, carriers that can rapidly migrate to a unified communications network will have a major competitive advantage in their ability to add services to all networks through a single interface and to manage the entire transport network through a single set of administrative logic. In addition, VoIP clearinghouse operations will provide the revenue and business drivers to allow rapid expansion of IP capacity and infrastructure, again laying the foundation for enhanced competitiveness in the future. While these intangible benefits are difficult to quantify, they should be carefully considered as core benefits to the deployment of VoIP clearinghouse services.

Cost of Entry: Notes on the Clearinghouse Model

While the benefits of VoIP clearinghouse operations are substantial in terms of revenue enhancement and cost savings, the cost to enter the market is quite low. The exact configuration and equipment requirement will vary based on the service offering and scale of operations, but the basic components of operations are very simple:

- **VoIP equipment—**Typically the smallest component in operations costs, the VoIP equipment needed to operate a clearinghouse is minimal. Basic clearinghouse operations require only a gatekeeper with a back-end database for data processing and financial settlement. To provide refile and in-country termination, third-party gateways are required, based on the traffic volumes projected from each route.

- **bandwidth and connectivity**—Clearinghouse operations do not require significant bandwidth. Because a clearinghouse operates only on the signaling level, high-capacity IPLCs or IP backbone connections are not required. Typical clearinghouses can be operated without any additional IP capacity investment. IP access is required only for bilateral engagements and for refile termination and can be calculated according to the traffic requirements and estimates provided earlier.

- **management and sales—**In most cases, clearinghouse operations can leverage existing network operations and sales channels. Many IP–telephony products are designed to integrate seamlessly with standards-based management systems such as signaling network management protocol (SNMP) managers for simple, low-cost provisioning of the entire VoIP network. And because clearinghouse operations are essentially a new twist on the old market for large-scale minutes exchange, sales and marketing channels for existing

businesses can be leveraged to drive partnerships and memberships to the new operations.

6. Summary: Clearinghouse Operations Create Value

The growth of IP–based traffic and services presents both challenges and opportunities to service providers. The challenges relate to the change associated with new business models and technological requirements. The opportunities, however, far outweigh the challenges, as VoIP and related services provide immediate markets for new service offerings. Clearinghouse services—from basic bilateral termination to high-value services such as financial settlements and enhanced applications—are immediate sources of revenue for operators interested in driving their networks toward the unified, high-capacity infrastructure of the future. Clearinghouse operators can leverage existing sales, marketing, and technical resources to provide immediate revenue opportunities with minimal investment. Revenue sources include wholesale minutes termination, refile minutes growth, and clearinghouse services. In addition, clearinghouse operators benefit from the cost savings of enhanced compression, reduced equipment costs, and lower termination rates offered by VoIP networks. With minimal investment, operators can enter the clearinghouse business in a matter of months and harness not only great revenue opportunities and cost savings, but also create the foundation of the best-in-class transport network essential to effective global competition in the communications market of the future.

Self-Test

1. A VoIP clearinghouse is a(n) _____ point.

    a. origination

    b. termination

2. VoIP clearinghouses provide multiple points of contact for termination of telephony minutes worldwide.

    a. true

    b. false

3. VoIP is emerging as the transport of choice for large-scale minutes exchange.

    a. true

b. false

4. Which of the following is not true of VoIP?

   a. Voice quality is superior to that of DCME.

   b. All minutes are originated on IP.

   c. Equipment costs are nearly double those of DCME plus circuit switch.

   d. A single management interface for both IP and PSTN services is provided.

5. A clearinghouse need not occupy physical voice circuits or bandwidth to provide refile services.

   a. true

   b. false

6. Clearinghouse operations require several technical infrastructures to provide all four operations services to members.

   a. true

   b. false

7. The volume of IP–based telephony minutes is expected to grow more than _____ percent by 2002.

   a. 50

   b. 100

   c. 200

   d. 300

8. Which of the following is not a factor when calculating the expected revenue from wholesale minutes exchange?

   a. the number of partners

   b. termination rates offered into the host country

   c. origination rates offered by the host country

   d. expected minutes volume

9. Termination rates are typically lower for small operators.

    a. true

    b. false

10. Bandwidth-based services are a strong source of revenue in the short term.

    a. true

    b. false

Correct Answers

1. A VoIP clearinghouse is a(n) _____ point.

    a. origination

    b. termination

    See Topic 2.

2. VoIP clearinghouses provide multiple points of contact for termination of telephony minutes worldwide.

    a. true

    b. false

    See Topic 3.

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7. The volume of IP–based telephony minutes is expected to grow more than _____ percent by 2002.

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See Topic 5.

8. Which of the following is not a factor when calculating the expected revenue from wholesale minutes exchange?

a. the number of partners

b. termination rates offered into the host country

c. origination rates offered by the host country

d. expected minutes volume

See Topic 5.

9. Termination rates are typically lower for small operators.

    a. true

    b. false

    See Topic 5.

10. Bandwidth-based services are a strong source of revenue in the short term.

    a. true

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    See Topic 5.

Glossary

CO
central office

DCME
digital multiplexing compression equipment

DS
digital signal

IN
intelligent network

IP
Internet protocol

IPLC
international private leased circuit

ISP
Internet service provider

ITSP
Internet telephony service provider

PSTN
public switched telephone network

QoS
quality of service

SNMP
signaling network management protocol

VoIP
voice over Internet protocol

VPN
virtual private network