Access Gateways

Definition

A gateway is a network element that acts as an entrance point to another network. An access gateway is a gateway between the telephony network and other networks, such as the Internet.

Overview

Access mediation supports the arbitration of call control and signaling between individual networks, resources, users, and services. Access mediation is the next evolutionary step for the advanced intelligent network (AIN). With the growing importance of the Internet, access gateways are a critical component of access mediation. This tutorial presents several application scenarios that utilize an access gateway point between the traditional telephone network and the Internet. First, the tutorial will review general background information on access mediation. As part of this overview, specific information on the important components of access gateways will be addressed. Access gateway-application scenarios will also be discussed. Finally, the tutorial will present several elements of network design that are crucial for a network to support an access gateway.

Topics

1. Overview of Access Mediation and Access Gateways
2. Access Mediation Example
3. Access Gateway Example
4. Application Scenarios I: User-Network Interface and Telephone Switch Trigger Control
5. Application Scenarios II: Call Waiting with Internet Enhancement
6. Application Scenarios III: Shared Subscriber Information and Call/Connection Control Across Networks
7. Access Mediation: Platform Functional Requirements
8. Summary

Self-Test

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Correct Answers

Glossary

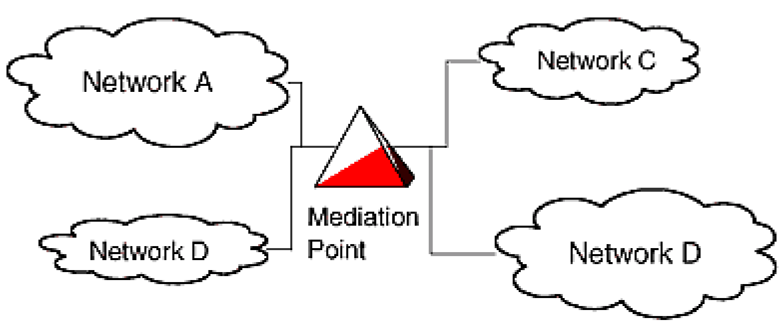
1. Overview of Access Mediation and Access Gateways

As stated in the tutorial overview, access mediation supports the arbitration of call control and signaling. The key mediation functions to be managed and controlled include privacy, security, message routing, message screening, message parameter screening, bridging and protocol conversion, performance monitoring and protection, error handling, and billing. The goal of access mediation is to enable the interconnection of individual networks.

As shown in *Figure 1*, access mediation can be created with a mediation point in the signaling network. The networks that are interconnected can be any service provider's wireline, wireless, long-distance, or Internet network. Signaling messages must be able to pass freely within and between these networks. The networks can vary by standards definition, protocol, and vendor or service provider implementation. Even where standards and protocol match, offered services may vary by availability and implementation. Advanced services may be obtained from a network different from the one providing basic service to subscribers. For each of these cases, several issues must be resolved in order to enable the interconnection of the networks. Questions that must be addressed include:

- What signaling messages should be allowed between the networks?
- What services should be made available?
- How is billing handled for each network involved?
- What type of protocol conversion is necessary for the networks to communicate?

Figure 1. Access Mediation in a Conceptual Network



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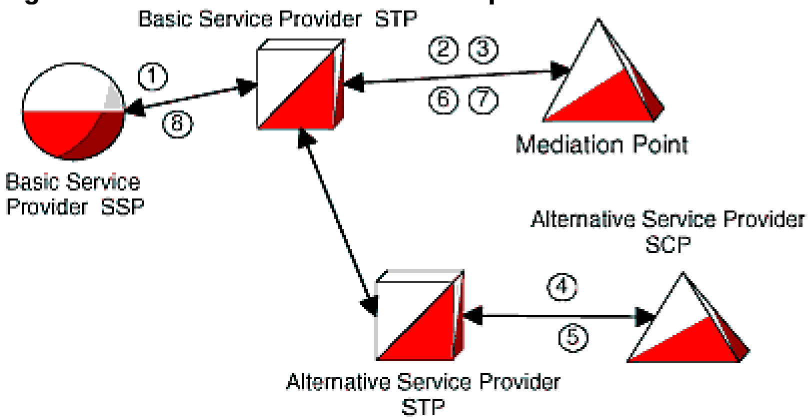
2. Access Mediation Example

Specific to telephony-based applications of access mediation is the need for a mediation point in the AIN SS7 signaling network. The mediation point allows the interconnection of SS7 networks owned and operated by different telephone service providers. By interconnecting the SS7 networks, AIN query messages that originate on one provider's network can pass to another provider's network. On the second network, the query messages can reach an AIN service control point (SCP) where they will be processed by AIN applications, and appropriate AIN response messages will be returned. As a result, a customer receiving basic telephone service from one provider's network can subscribe to and utilize AIN service offerings available on a second provider's network. *Figure 2* illustrates how a mediation point handles AIN signaling associated with this example.

Figure 2. Access Mediation Example



As shown in the figure, numbers indicate the chronologically ordered path of the IN message. IN message is indicated by numbers. The following text describes the message flow:

1. The AIN trigger is detected, and a query is launched to the basic service provider's service transfer point (STP).

2. Based on global title translation, the basic service provider's STP forwards the AIN query to the mediation point.

3. The mediation point receives the AIN message. Mediation is then performed. The mediation functionality can include network element screening, network message screening, parameter screening, overload controls, and destination selection. As an example, destination selection can be based on SCP data or on more sophisticated data such as TCAP parameters (e.g., ten-digit calling/called party number or trigger criteria type). Acting as a proxy, the mediation point forwards the AIN query to the alternate service provider's SCP destination point code via the basic service provider's STP.

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4. The basic service provider's STP receives the AIN query message and forwards it to the alternate service provider's SCP.

5. The alternate service provider's SCP receives the AIN message, performs the appropriate AIN functionality, and sends the response message back to the basic service provider's network.

6. The basic service provider's STP receives the AIN response message and sends the message back to the mediation point for additional mediation functionality, such as network element screening, message and parameter screening, and billing.

7. The mediation point forwards the response message back to the basic service provider's STP.

8. The basic service provider's STP in turn sends the message back to the basic service provider's service switching point (SSP) for final AIN treatment.

3. Access Gateway Example

As an important application area of access mediation, access gateways allow networks based on different signaling protocols to be interconnected. For example, telephone company mergers have created the need to interconnect networks based on different signaling standards. Wireless networks based on GSM must now interconnect with networks based on IS–41. The access gateway provides the protocol conversion needed to interconnect these networks. In addition, providers are using TCP/IP networks in place of SS7 for certain signaling (see *Figure 3*). In *Figure 3*, a TCP/IP–based network interconnects two distant IS–41–based wireless networks. The TCP/IP–based network is used to transport short messages between the two wireless networks. Since the short messages are not time-critical, the TCP/IP network is utilized to interconnect the distant networks which is a cost-efficient solution.

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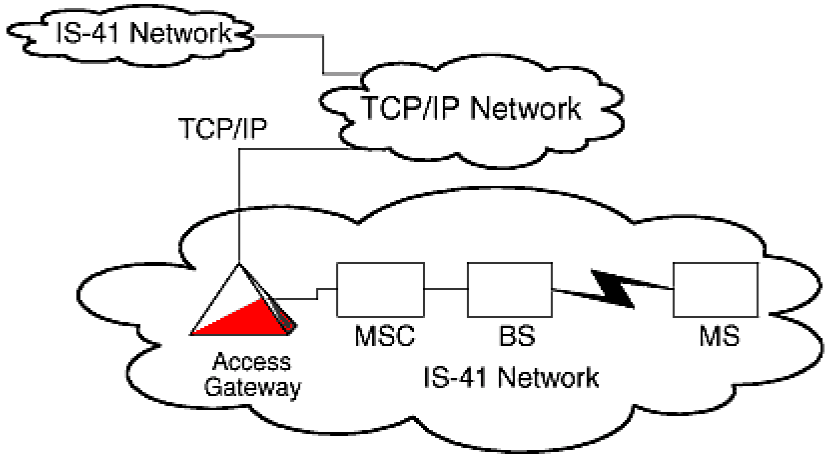
Figure 3. Access Gateway Example



In terms of message flow, a short message can originate in the distant IS–41–based network (shown in the upper left-hand corner of *Figure 3*). An access gateway in this distant network would protocol convert (i.e., encapsulate) this short message so it can flow over the TCP/IP network. Upon reaching the second IS–41 network, a corresponding access gateway converts the short message back to an IS–41 message. The short message then flows to the mobile switching center (MSC) where it is routed to the wireless base station (BS). At the BS, the short message is transmitted to the targeted subscriber's mobile station (MS), where the short message is displayed.

In addition to the fact that TCP/IP–based networks are less costly to implement and maintain than IS–41 networks, expanded capabilities also make the TCP/IP–based network desirable in this application scenario. For example, instead of requiring that the short message be inputted by a wireless subscriber based on an IS–41 network, the TCP/IP network can support Web site–based short message entry (see *Figure 4*). This not only makes the actual entry of the short message easier than entry on a mobile handset, but it also allows many more short-message senders. Anyone with Web access could enter the mobile subscriber's telephone number and a short text message at the short-message Web site. After the user enters the short message, it is sent over the TCP/IP network to the appropriate IS–41 network. The access gateway converts the short message into an IS–41 message and sends it to the mobile switching center, which routes the message to the base station. From there, the short message is transmitted to the mobile station where it is displayed.

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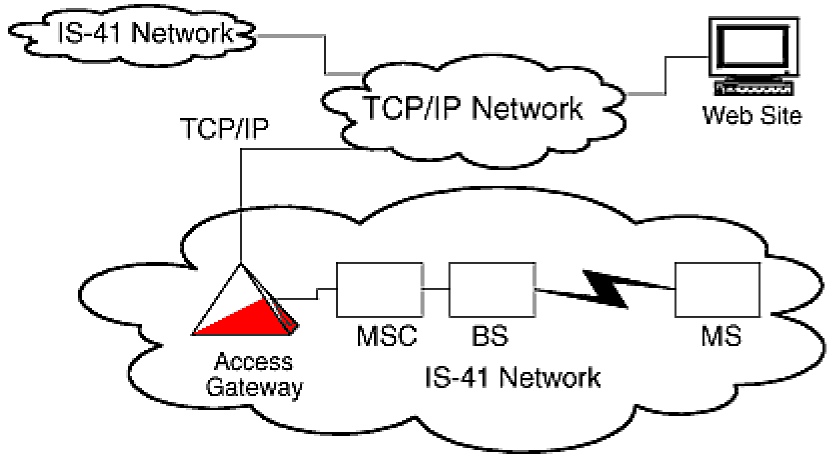
Figure 4. Enhanced Access Gateway Example



4. Application Scenarios I: User-Network Interface and Telephone Switch Trigger Control

This and the following two modules discuss application scenarios that utilize an access gateway point between the traditional telephone network and the Internet. These modules will show the importance of access gateways in a network service environment where the Internet is becoming as important as the telephony network. As a result, service providers need to partner or integrate the two networks into a single network.

User-Network Interface Scenarios

As discussed in *Topic 2*, Internet-based Web sites that are associated with telephony applications and services are a potential site for the use of access gateways. In the example in *Topic 2*, a Web site on the Internet was used as part of the wireless short-message service. This short-message Web site provided a better user interface to the service than that provided by a wireless keypad. In addition, entering text messages on a telephone keypad is more difficult than typing the text on an alphanumeric keyboard. The Web site could also provide access as a message entry point for more short-message senders. Anyone with Internet Web access could enter the mobile subscriber's telephone number and a message at the short-message Web site.

There are many more telephony-based applications and services that could benefit from similar Web sites. For example, the use of the telephone keypad as a user interface is notoriously difficult. As shown in *Figure 5*, Internet-based Web sites can be provided for services and applications that are located on telephone switches, intelligent network service nodes (IN SNs), IN SCPs, and IN service

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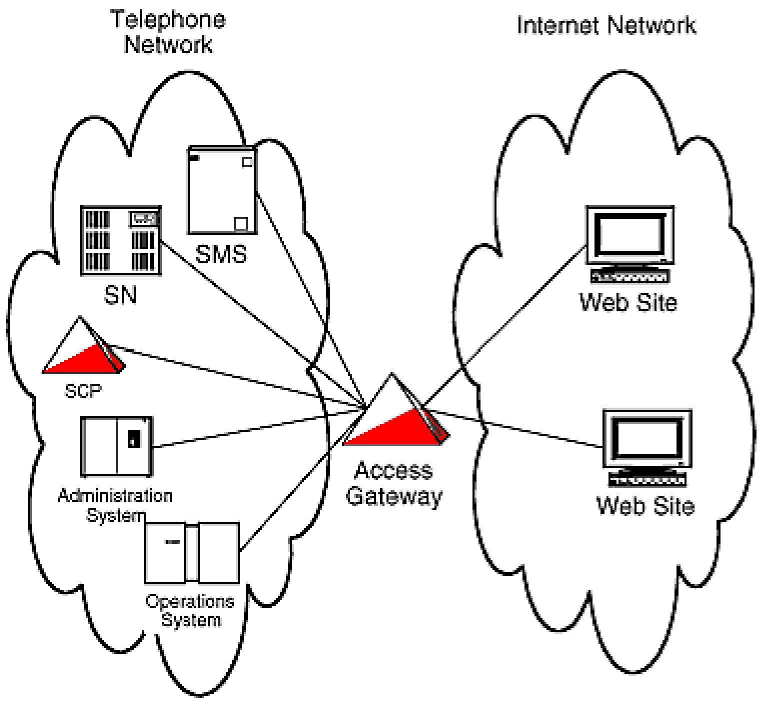
management systems (SMSs). For example, IN SN–based applications and services often have user-configurable parameters and lists that control the operation of the service based on the needs of the individual subscriber. Specifically, complex personal number or "follow me" services have been implemented on SNs. As part of these services, the subscriber can set up call forwarding control based on multiple telephone numbers and location lists based on time-of-day and day-of-week. These parameters are difficult to input and administer using only the subscriber's telephone keypad, and the addition of Web sites would greatly enhance the usability of the services. Potentially, this could result in more satisfied subscribers and increased subscription to the services. Similar services and applications are located on telephone switches and IN SCPs. In the same manner, these services and applications could benefit from Web-based user interfaces.

Figure 5. User-Network Interface Example



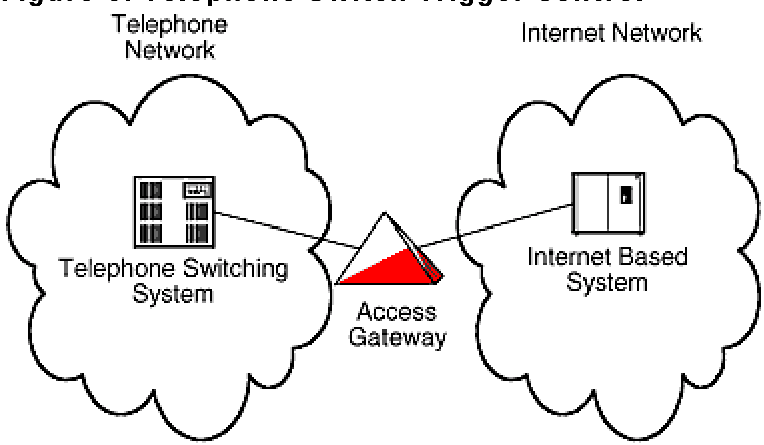
To expand services and applications, Web-based interfaces can be provided for telephony network administration and operations systems. For example, the FCC mandate to open the telephone network to competitive access provides the opportunity for Web sites to act as access points for administration and operations systems. A competitive service provider could gain controlled access to the incumbent provider's IN SMS through a Web interface. In a similar fashion, Web sites can provide controlled access to other administration and operations systems associated with the incumbent's network.

In these scenarios, the access gateway enables the negotiation of varied network protocols, which are needed to access and control telephone network systems. The systems have been acquired from different vendors and deployed over a wide time frame, resulting in a hodgepodge of protocols and control messages. In addition, most of these protocols and control messages are vendor-specific. The access gateway acts as a single point of translation between multiple Web sites and the varied systems of the telephone network.

Telephone Switch Trigger Control Scenario

The ability to control the status of a telephone switch trigger from the Internet will also become increasingly important to the integration of the telephone network and the Internet. In addition, the ability to turn the triggers associated with individual subscribers "on" or "off" will be crucial. This will become more important as customers demand services that require the use of both the telephone network and the Internet. *Topic 5* presents a specific example of such a service that uses both the telephone network and the Internet to expand traditional call waiting service. A network diagram of the basic trigger control scenario is shown in *Figure 6*. In this situation, an Internet-based application can communicate with the access gateway to request a change in the status of a telephone network trigger for a specific subscriber. The access gateway then communicates with the appropriate telephone switch via the SS7 network, altering the status of the trigger.

Figure 6. Telephone Switch Trigger Control



5. Application Scenarios II: Call Waiting with Internet Enhancement

This access gateway application scenario describes an Internet enhancement to call waiting service. The call waiting functionality is extended to calls to the

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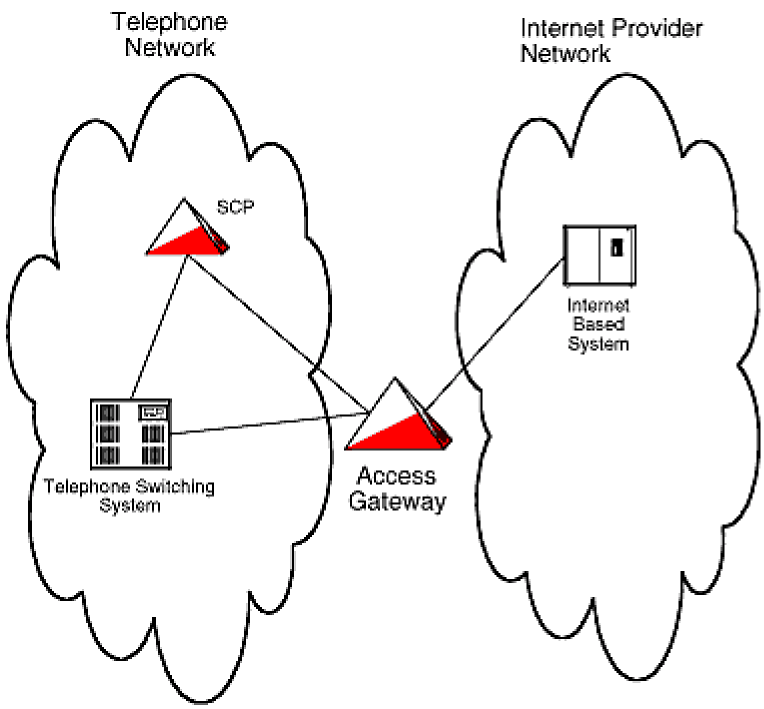
subscriber's number when the subscriber is connected to an Internet service provider. Currently, the telephone subscriber deactivates the call waiting service before calling the Internet service provider. As a result, while the subscriber is connected to the Internet provider, incoming calls do not activate the subscriber's call waiting service. In other words, for the typically long hold times associated with Internet calls, the subscriber is not aware of any subsequent calls. However, by integrating the capabilities of the telephone network and the Internet, the subscriber can be aware of incoming telephone calls while connected to the Internet. In addition, the information about the caller can be displayed on the subscriber's computer screen. *Figure 7* shows a network diagram of this access gateway application scenario. The access gateway is again used as the connection point between the telephone network and the Internet and is important because of its ability to translate between the Internet and the varied protocols used in the telephone network.

Figure 7. Call Waiting with Internet Enhancement



When the telephone subscriber calls the Internet service provider, the telephone services of the subscriber must be prepared for this application scenario. Specifically, when the subscriber successfully connects to the Internet provider, the provider sends a message to the access gateway informing it of the connection. The access gateway then uses the information in this message to activate the "call terminate—busy" trigger in the telephone switch serving the subscriber. As a result, any subsequent calls to the subscriber cause an AIN query message to be sent within the telephone network. In other words, when a call is made to the subscriber's telephone number, the "call terminate—busy" trigger

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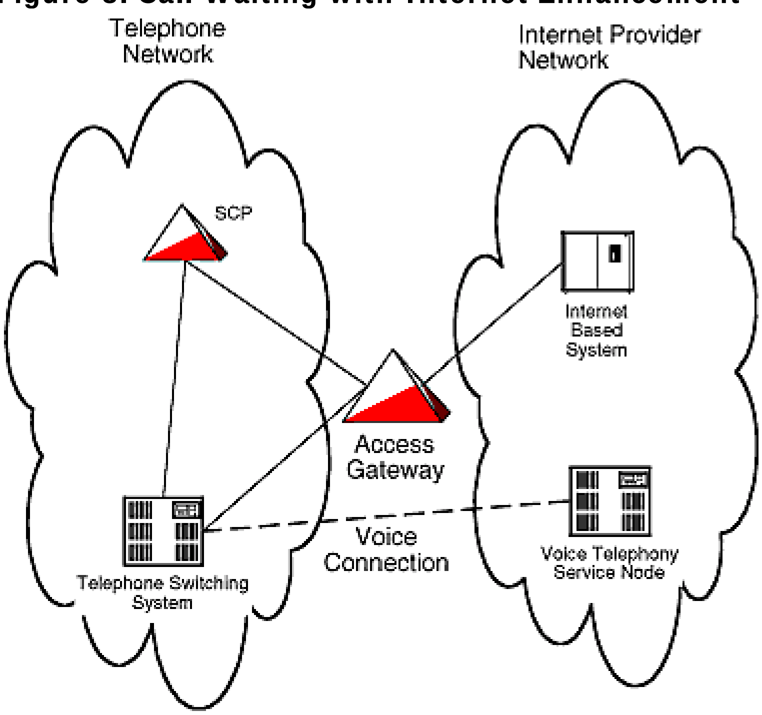
will fire because the subscriber is busy on the Internet call. The firing of this trigger causes the telephone switch serving the subscriber to send an IN query message to the SCP in the telephony network. Upon receiving this query, the SCP will perform a lookup in the "calling subscriber's name" database. The result of this lookup will be the name of the calling subscriber as text. The SCP then sends a message to the access gateway that contains the called subscriber's telephone number, the calling subscriber's telephone number, and the calling subscriber's name. The access gateway sends this information in a message to the Internet provider. Upon receipt of the information, the Internet provider informs the subscriber of the call by displaying the caller's name and telephone number on the subscriber's computer screen. When the subscriber disconnects from the Internet, the Internet provider will inform the access gateway. The access gateway uses this information to deactivate the "call terminate—busy" trigger in the telephone switch serving the subscriber.

As an extension of this application scenario, Internet telephony can also be used to deliver the telephone call to the subscriber. As in the previous example, the call to the subscriber's number is indicated by displaying the caller's telephone number and name on the subscriber's computer screen, but this application also provides options for handling the call. For example, the subscriber can accept the call, decline the call, or send the call to voice mail. If the subscriber accepts the call, Internet telephony functionality is used to deliver the call to the subscriber from the SN while the subscriber is still connected to the Internet provider (see *Figure 8*).

Figure 8. Call Waiting with Internet Enhancement



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6. Application Scenarios III: Shared Subscriber Information and Call/Connection Control Across Networks

Shared Subscriber Information

One thing that may be evident from the above text is that the subscriber information on the telephone network is spread over multiple locations and stored in different formats. As stated earlier about the hodgepodge of network protocols and control messages, this is the case since the systems have been acquired from different vendors and deployed over a wide time frame.

In this access gateway application scenario, the access gateway again is used to connect the telephone network to the Internet. However, in this scenario the access gateway will be used to enable the networks to share subscriber information. The ultimate goal of subscriber information access of this type is a common, centralized location for the information. For example, presently subscriber information is duplicated over both the telephone network and the Internet provider's network. A better configuration would be to locate the information in a common data store where it can be more easily accessed, updated, and administered. However, this ultimate configuration may not be possible. As a result, this scenario shows how an access gateway would most practically allow for subscriber information access and updating across the two networks.

As shown in *Figure 9*, the access gateway again acts as the connection point between the two networks. In this scenario, the access gateway is the translation point between the information access protocols used in the two networks. On the telephony network side, these protocols are often vendor- or application-specific. In addition, some utilize the SS7 signaling network. On the Internet provider side, many of the protocols can also be vendor- or application-specific. However, many Internet provider networks are fortunately moving toward the use of a common protocol, such as the lightweight directory access protocol (LDAP). In addition, in many networks a common information access point is deployed. As an example, the common access point might be the Active Directory capability from Microsoft. As shown in *Figure 9*, if a common access point such as Active Directory has been deployed in the Internet provider's network, the access gateway connects to it for information access from the Internet side. In a similar manner, the access gateway acts as a node on the Active Directory system, enabling access to the information maintained on the telephony network.

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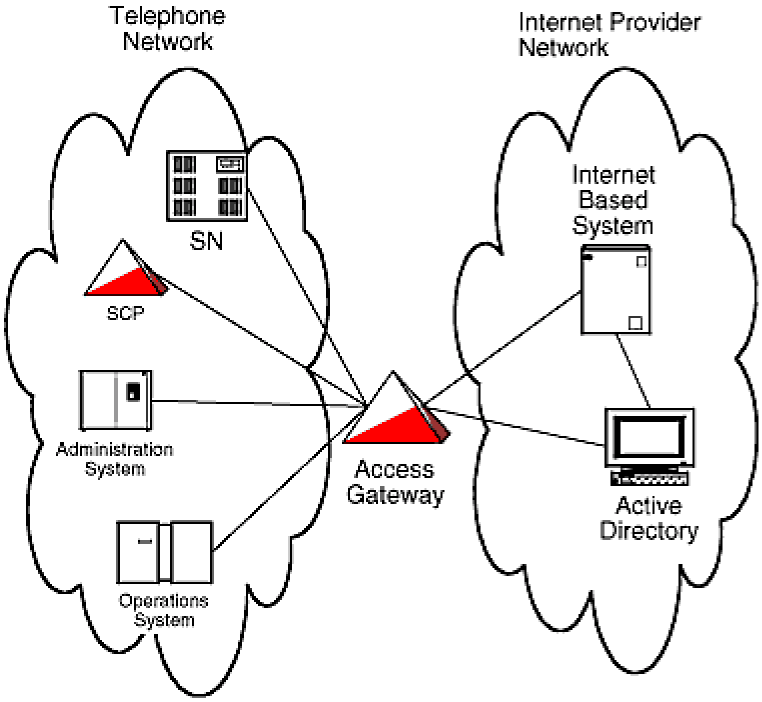
Figure 9. Shared Subscriber Information

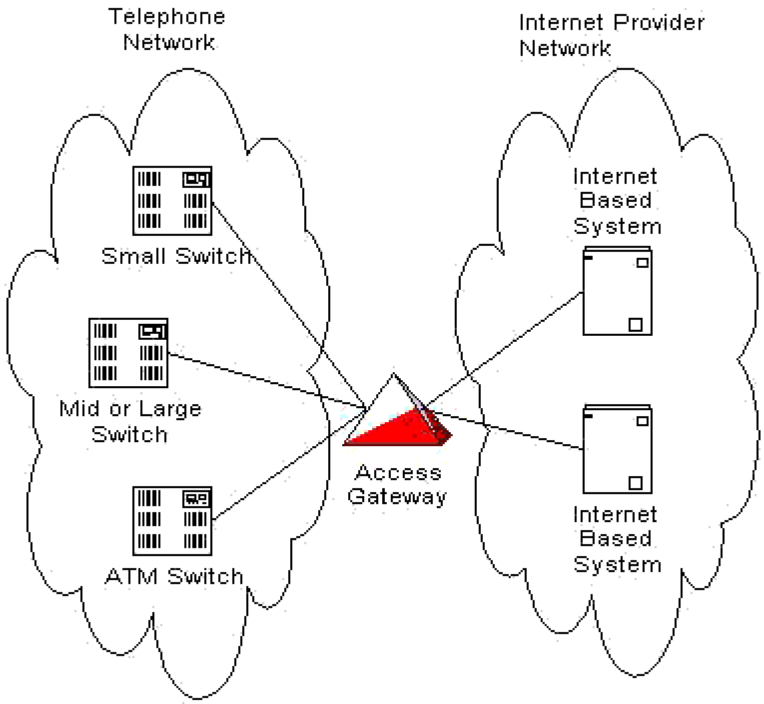


Call/Connection Control Across Networks

A final access gateway application scenario addresses the control of calls or connections across the two networks. On the telephony side, call control capabilities such as computer telephony integration (CTI) are available on smaller telephone switching systems. Integrated services digital network user part (ISUP) signaling for call setup is available on medium to large switches. On the highest end of switch bandwidth, standardized capabilities such as third-party call control (TPCC) are available to create switched virtual circuit connections on asynchronous transfer mode (ATM) switches. On the Internet side, the trend for similar connection control capabilities is growing. For example, Cisco is promoting its Internetwork Operating Systemä (IOS), which tells routers, hubs, and other network devices what to do.

The purpose of the access gateway in this scenario is to translate the signaling differences between the networks. An application on the Internet side could set up a voice call on the telephony network using CTI or possibly ISUP. A similar application could establish a high-bandwidth, multimedia connection on a series of ATM switches using TPCC. In either case, the access gateway provides the necessary protocol conversion. *Figure 10* shows a network diagram representing this application scenario.

Figure 10.



7. Access Mediation: Platform Functional Requirements

This section will highlight some of the functional characteristics necessary for the design of an access mediation or access gateway applications platform.

Highly Flexible Applications Development Environment

The candidate platform should be flexible enough to allow the application developer to utilize the functions necessary to implement access mediation/access gateway applications. For example, the developer must have access to almost every protocol and message set. In addition, the developer should not be restricted in the type of transactions that the application can handle. The platform requirement transcends merely accepting queries and sending responses. In access mediation/access gateway applications, queries must be forwarded from the mediation point, and the mediation point must initiate new transactions.

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Access to Multiple Protocol Sets in the Same Application

The platform should enable a single application to utilize multiple protocol sets. This allows for a protocol gateway to be created. As shown in *Figures 3* and *4*, this is the fundamental application of access gateways. In order for different networks to be interconnected, the ability to provide a gateway that converts the different protocols is essential.

Ability to Handle Complex Transactions

Most SCP platforms have been designed to handle basic transactions. In other words, they have been designed to accept a query and send a corresponding response. However, for access mediation/access gateway applications, the platform often handles complex transactions. For example, the platform must be able to forward or relay messages. The platform must also originate new query transactions and correlate the associated responses. Call or transaction state information may need to be maintained, and persistent storage mechanisms may need to be provided.

Overload and Performance Management

It is important that the platform be able to determine an overload condition on a per service basis. This is useful for transaction and quality of service monitoring. For example, if an overload condition is reached, the platform should be able to determine the offending service. As a result, the overloading service can be throttled independently, instead of throttling all services on the platform. This capability enables networks to handle overload and performance management separately.

Flexible Measurements

For access mediation/access gateway applications, measurements collection capabilities beyond those provided by basic peg counters are often needed. Usually, a more flexible collection and measurement system is required. For example, if a report is needed to determine the number of queries on an originating point code basis (where the point code will identify the system accessing the mediation point, possibly for billing purposes) this must be accomplished. One approach would be to collect information on individual transactions and later aggregate this information into custom reports.

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8. Summary

This tutorial has provided information on access mediation and access gateways. Access mediation is clearly the next evolutionary step for AIN. In addition, with the increasing importance of the Internet, access gateway applications are fast becoming necessary components of the access mediation applications catalog. To illustrate this, several access gateway application scenarios were presented throughout the tutorial. Finally, the specific functionality necessary to support access mediation/access gateway applications was identified. The result of this additional functionality is an ideal platform for access mediation/access gateway applications.

Self-Test

1. Access mediation supports the ___________.

    a. arbitration of call control

    b. arbitration of signaling

    c. access gateway

    d. both a and b

    e. none of the above

2. The goal of access mediation and access gateways is to _____________.

    a. regulate the flow of data between networks

    b. enable the interconnection of individual networks

    c. protect a network from viruses from other networks

    d. access data in other networks without being detected

    e. all of the above

3. A(n) ______-based network is less costly to implement and maintain than a(n) ____ network.

    a. TCP/IP; IS–41

    b. IS–41; TCP/IP

    c. copper; fiber

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d. externally; internal

4. Internet-based Web sites can be provided for services and applications that are located on:

    a. telephone switches

    b. IN service nodes

    c. IN service control points

    d. IN service management systems

    e. all of the above

    f. none of the above

5. In a call waiting with Internet enhancement scenario, when a subscriber is using the Internet and receives a call ___________.

    a. the caller is transferred into a voice mailbox

    b. there is a recorded message that informs the caller that the subscriber is using the Internet

    c. the subscriber can accept or decline to answer the call and send the caller to voice mail

    d. the caller hears a busy signal but the subscriber's Internet program delivers a message to the subscriber that a call has been received

6. Access gateways can be used to connect the telephone network to the Internet.

    a. true

    b. false

7. Access gateways cannot translate signaling differences between networks.

    a. true

    b. false

8. The creation of a "protocol gateway" is the fundamental application of an access gateway.

    a. true

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b. false

9. Through the use of access gateways, overloads can be managed by throttling only the overloading service.

   a. true

   b. false

10 Despite their many benefits, it is not likely that access gateways will be the next evolutionary step for AIN.

   a. true

   b. false

Correct Answers

1. Access mediation supports the _______________

   a. arbitration of call control

   b. arbitration of signaling

   c. access gateway

   d. both a and b

   e. none of the above

   See Tutorial Overview.

2. The goal of access mediation and access gateways is to ____________.

   a. regulate the flow of data between networks

   b. enable the interconnection of individual networks

   c. protect a network from viruses from other networks

   d. access data in other networks without being detected

   e. all of the above

   See Topic 1.

3. A(n) ______-based network is less costly to implement and maintain than a(n) ____ network.

    a. TCP/IP; IS–41

    b. IS–41; TCP/IP

    c. copper; fiber

    d. externally; internal

    See Topic 2.

4. Internet-based Web sites can be provided for services and applications that are located on ________.

    a. telephone switches

    b. IN service nodes

    c. IN service control points

    d. IN service management systems

    e. all of the above

    f. none of the above

    See Topic 3.

5. In a call waiting with Internet enhancement scenario, when a subscriber is using the Internet and receives a call ____________.

    a. the caller is transferred into a voice mailbox

    b. there is a recorded message that informs the caller that the subscriber is using the Internet

    c. the subscriber can accept or decline to answer the call and send the caller to voice mail

    d. the caller hears a busy signal but the subscriber's Internet program delivers a message to the subscriber that a call has been received

    See Topic 4.

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6. Access gateways can be used to connect the telephone network to the Internet.

    a. true

    b. false

    See Topic 5.

7. Access gateways cannot translate signaling differences between networks.

    a. true

    b. false

    See Topic 5.

8. The creation of a "protocol gateway" is the fundamental application of an access gateway.

    a. true

    b. false

    See Topic 6.

9. Through the use of access gateways, overloads can be managed by throttling only the overloading service.

    a. true

    b. false

    See Topic 6.

10. Despite their many benefits, it is not likely that access gateways will be the next evolutionary step for AIN.

    a. True

    b. False

    See Topic 8.

Glossary

AIN
advanced intelligent network

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ATM
asynchronous transfer mode

BS
base station

CTI
computer telephony integration

GSM
global system for mobile communications

IS–41
interim standard 41

ISUP
integrated services digital network user part

LDAP
lightweight directory access protocol

MS
mobile station

MSC
mobile switching center

SCCP
signaling connection control part

SCP
service control point

SMS
service management systems SN service node

SS7
signaling system 7

STP
shielded twisted pair

TCP/IP
transmission control protocol/Internet protocol

TPCC
third-party call control

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