Pre-installation Planning Guide for Cisco ICM Enterprise and Hosted Editions

Cisco ICM/IPCC Enterprise & Hosted Editions Release 7.0(0)

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About This Guide

Objective

This guide describes pre-installation requirements and issues to address in preparing for a Cisco Intelligent Contact Management (ICM) Enterprise Edition installation. It does not discuss, for example, pre-installation planning for ICM multichannel software or for IP Contact Center and its components (such as Cisco CallManager or Cisco IP IVR).

For ICM multichannel software, see the *Multichannel Software Overview for Cisco ICM/IPCC Enterprise & Hosted Editions* and Multichannel *Software Implementation Map for Cisco ICM/IPCC Enterprise & Hosted Editions,* as well as the documentation for Cisco E-Mail Manager Option and Cisco Web Collaboration Option (Cisco Collaboration Server, Cisco Dynamic Content Adapter, Cisco Media Blender).

For IP Contact Center Enterprise Edition, see the relevant documentation.

Audience

This guide is intended for contact center managers, system support personnel, and plant engineers who are planning and preparing contact center sites for an ICM system installation. Readers should be familiar with contact center site planning and preparation issues. They should also have a basic understanding of the ICM system and the components that are installed as part of the system.

Organization

This document is organized as follows:

Chapter	Description
Chapter 1, "Pre-installation Planning Overview"	Provides an overview of the ICM pre-installation planning process. This chapter includes a pre-installation document roadmap, which suggests an order to follow in using the ICM pre-installation planning guides.
Chapter 2, "ICM Enterprise Edition Overview"	Describes the role of the ICM software within the contact center enterprise. This chapter also reviews the main ICM software features.
Chapter 3, "IXC Overview"	Describes how to plan for access to the carrier's intelligent network service. This chapter includes an overview of ICM/IXC interaction and a discussion of ICM-Network Interface Controller (NIC) fault tolerance.
Chapter 4, "Switch Overview"	Provides an overview of ICM PG-to-peripheral interaction.
Chapter 5, "Peripheral Gateway Configurations"	Describes the options for configuring Peripheral Gateways in the ICM enterprise.
Chapter 6, "CTI Planning"	Describes the pre-installation planning for CTI, including reviewing CTI Server communications and platform options; becoming familiar with the desktop options; estimating CTI message traffic; planning fault tolerance for the CTI Server; and reviewing ACD support for client control and third-party call control.
Chapter 7, "IVR Planning"	Describes the pre-installation planning tasks for the IVR option, including reviewing the options for integrating IVRs into the ICM system, determining if any IVR programming or application development is necessary, and reviewing the PG platform requirements for IVR.

Chapter	Description
Chapter 8, "ICM Application Gateway and ICM Gateway SQL Planning"	Describes the pre-installation planning tasks for the ICM Application Gateway and ICM Gateway SQL options, including preparing host systems and databases; reviewing fault tolerance issues; and planning for data transfer (in the case of Gateway SQL).
Chapter 9, "ICM Product Options"	Provides a brief mention of various ICM product options.
Chapter 10, "Planning for ICM Platforms"	Describes how to determine the numbers and types of ICM nodes you will need.
Chapter 11, "Determining the Datacom Requirements"	Describes how to prepare network facilities for an ICM system installation, such as determining the requirements for visible and private networking, allocating IP addresses, and ordering any required network hardware.
Chapter 12, "Site Preparation"	Presents a brief list of basic considerations for site preparation.
Chapter 13, "IP Address Worksheets"	Provides worksheets you can use to record IP addresses for the visible and private networks.

Conventions

This manual uses the following conventions:

Format	Examples
Boldface type is used for user entries, keys, buttons, and folder and submenu names.	Choose **Design—>Retrieval Arguments** from the InfoMaker menu bar.—
Italic type indicates one of the following: • A newly introduced term • For emphasis • A generic syntax item that you must replace with a specific value • A title of a publication	• A *skill group* is a collection of agents who share similar skills. • *Do not* use the numerical naming convention that is used in the predefined templates (for example, persvc01). • IF (*condition*, *true-value*, *false-value*) • For more information, see the *Cisco ICM Software Database Schema Handbook*.
An arrow (—>) indicates an item from a pull-down menu.	The Save command from the File menu is referenced as **File—>Save**.

Other Publications

For more information about Cisco Intelligent Contact Management (ICM) software, see the Cisco ICM documentation web page.

Obtaining Documentation

Cisco documentation and additional literature are available on Cisco.com. This section explains the product documentation resources that Cisco offers.

Cisco.com

You can access the most current Cisco documentation at this URL:

http://www.cisco.com/techsupport

You can access the Cisco website at this URL:

http://www.cisco.com

You can access international Cisco websites at this URL:

http://www.cisco.com/public/countries_languages.shtml

Product Documentation DVD

The Product Documentation DVD is a library of technical product documentation on a portable medium. The DVD enables you to access installation, configuration, and command guides for Cisco hardware and software products. With the DVD, you have access to the HTML documentation and some of the PDF files found on the Cisco website at this URL:

http://www.cisco.com/univercd/home/home.htm

The Product Documentation DVD is created and released regularly. DVDs are available singly or by subscription. Registered Cisco.com users can order a Product Documentation DVD (product number DOC-DOCDVD= or DOC-DOCDVD=SUB) from Cisco Marketplace at the Product Documentation Store at this URL:

http://www.cisco.com/go/marketplace/docstore

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You must be a registered Cisco.com user to access Cisco Marketplace. Registered users may order Cisco documentation at the Product Documentation Store at this URL:

http://www.cisco.com/go/marketplace/docstore

If you do not have a user ID or password, you can register at this URL:

http://tools.cisco.com/RPF/register/register.do

Documentation Feedback

You can provide feedback about Cisco technical documentation on the Cisco Support site area by entering your comments in the feedback form available in every online document.

Cisco Product Security Overview

Cisco provides a free online Security Vulnerability Policy portal at this URL:

http://www.cisco.com/en/US/products/products_security_vulnerability_policy.html

From this site, you will find information about how to do the following:

- Report security vulnerabilities in Cisco products
- Obtain assistance with security incidents that involve Cisco products
- Register to receive security information from Cisco

A current list of security advisories, security notices, and security responses for Cisco products is available at this URL:

http://www.cisco.com/go/psirt

To see security advisories, security notices, and security responses as they are updated in real time, you can subscribe to the Product Security Incident Response Team Really Simple Syndication (PSIRT RSS) feed. Information about how to subscribe to the PSIRT RSS feed is found at this URL:

http://www.cisco.com/en/US/products/products_psirt_rss_feed.html

Reporting Security Problems in Cisco Products

Cisco is committed to delivering secure products. We test our products internally before we release them, and we strive to correct all vulnerabilities quickly. If you think that you have identified a vulnerability in a Cisco product, contact PSIRT:

- For emergencies only—security-alert@cisco.com

  An emergency is either a condition in which a system is under active attack or a condition for which a severe and urgent security vulnerability should be reported. All other conditions are considered nonemergencies.

- For nonemergencies—psirt@cisco.com

In an emergency, you can also reach PSIRT by telephone:

- 1 877 228-7302
- 1 408 525-6532

Tip We encourage you to use Pretty Good Privacy (PGP) or a compatible product (for example, GnuPG) to encrypt any sensitive information that you send to Cisco. PSIRT can work with information that has been encrypted with PGP versions 2.*x* through 9.*x*.

Never use a revoked encryption key or an expired encryption key. The correct public key to use in your correspondence with PSIRT is the one linked in the Contact Summary section of the Security Vulnerability Policy page at this URL:

http://www.cisco.com/en/US/products/products_security_vulnerability_policy.html

The link on this page has the current PGP key ID in use.

If you do not have or use PGP, contact PSIRT to find other means of encrypting the data before sending any sensitive material.

Product Alerts and Field Notices

Modifications to or updates about Cisco products are announced in Cisco Product Alerts and Cisco Field Notices. You can receive these announcements by using the Product Alert Tool on Cisco.com. This tool enables you to create a profile and choose those products for which you want to receive information.

To access the Product Alert Tool, you must be a registered Cisco.com user. Registered users can access the tool at this URL:

http://tools.cisco.com/Support/PAT/do/ViewMyProfiles.do?local=en

To register as a Cisco.com user, go to this URL:

http://tools.cisco.com/RPF/register/register.do

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The Cisco Support website provides online documents and tools for troubleshooting and resolving technical issues with Cisco products and technologies. The website is available 24 hours a day at this URL:

http://www.cisco.com/en/US/support/index.html

Access to all tools on the Cisco Support website requires a Cisco.com user ID and password. If you have a valid service contract but do not have a user ID or password, you can register at this URL:

http://tools.cisco.com/RPF/register/register.do

Note Before you submit a request for service online or by phone, use the **Cisco Product Identification Tool** to locate your product serial number. You can access this tool from the Cisco Support website by clicking the **Get Tools & Resources** link, clicking the **All Tools (A-Z)** tab, and then choosing **Cisco Product Identification Tool** from the alphabetical list. This tool offers three search options: by product ID or model name; by tree view; or, for certain products, by copying and pasting **show** command output. Search results show an illustration of your product with the serial number label location highlighted. Locate the serial number label on your product and record the information before placing a service call.

Tip **Displaying and Searching on Cisco.com**

If you suspect that the browser is not refreshing a web page, force the browser to update the web page by holding down the Ctrl key while pressing **F5**.

To find technical information, narrow your search to look in technical documentation, not the entire Cisco.com website. After using the Search box on the Cisco.com home page, click the **Advanced Search** link next to the Search box on the resulting page and then click the **Technical Support & Documentation** radio button.

To provide feedback about the Cisco.com website or a particular technical document, click **Contacts & Feedback** at the top of any Cisco.com web page.

Submitting a Service Request

Using the online TAC Service Request Tool is the fastest way to open S3 and S4 service requests. (S3 and S4 service requests are those in which your network is minimally impaired or for which you require product information.) After you describe your situation, the TAC Service Request Tool provides recommended solutions. If your issue is not resolved using the recommended resources, your service request is assigned to a Cisco engineer. The TAC Service Request Tool is located at this URL:

http://www.cisco.com/techsupport/servicerequest

For S1 or S2 service requests, or if you do not have Internet access, contact the Cisco TAC by telephone. (S1 or S2 service requests are those in which your production network is down or severely degraded.) Cisco engineers are assigned immediately to S1 and S2 service requests to help keep your business operations running smoothly.

To open a service request by telephone, use one of the following numbers:

Asia-Pacific: +61 2 8446 7411
Australia: 1 800 805 227
EMEA: +32 2 704 55 55
USA: 1 800 553 2447

For a complete list of Cisco TAC contacts, go to this URL:

http://www.cisco.com/techsupport/contacts

Definitions of Service Request Severity

To ensure that all service requests are reported in a standard format, Cisco has established severity definitions.

Severity 1 (S1)—An existing network is “down” or there is a critical impact to your business operations. You and Cisco will commit all necessary resources around the clock to resolve the situation.

Severity 2 (S2)—Operation of an existing network is severely degraded, or significant aspects of your business operations are negatively affected by inadequate performance of Cisco products. You and Cisco will commit full-time resources during normal business hours to resolve the situation.

Severity 3 (S3)—Operational performance of the network is impaired while most business operations remain functional. You and Cisco will commit resources during normal business hours to restore service to satisfactory levels.

Severity 4 (S4)—You require information or assistance with Cisco product capabilities, installation, or configuration. There is little or no effect on your business operations.

Obtaining Additional Publications and Information

Information about Cisco products, technologies, and network solutions is available from various online and printed sources.

- The Cisco Online Subscription Center is the website where you can sign up for a variety of Cisco e-mail newsletters and other communications. Create a profile and then select the subscriptions that you would like to receive. To visit the Cisco Online Subscription Center, go to this URL:

  http://www.cisco.com/offer/subscribe

- The *Cisco Product Quick Reference Guide* is a handy, compact reference tool that includes brief product overviews, key features, sample part numbers, and abbreviated technical specifications for many Cisco products that are sold through channel partners. It is updated twice a year and includes the latest Cisco channel product offerings. To order and find out more about the *Cisco Product Quick Reference Guide*, go to this URL:

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- Cisco Press publishes a wide range of general networking, training, and certification titles. Both new and experienced users will benefit from these publications. For current Cisco Press titles and other information, go to Cisco Press at this URL:

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- *Internet Protocol Journal* is a quarterly journal published by Cisco for engineering professionals involved in designing, developing, and operating public and private internets and intranets. You can access the *Internet Protocol Journal* at this URL:

  http://www.cisco.com/ipj

- Networking products offered by Cisco, as well as customer support services, can be obtained at this URL:

  http://www.cisco.com/en/US/products/index.html

- Networking Professionals Connection is an interactive website where networking professionals share questions, suggestions, and information about networking products and technologies with Cisco experts and other networking professionals. Join a discussion at this URL:

  http://www.cisco.com/discuss/networking

- "What's New in Cisco Documentation" is an online publication that provides information about the latest documentation releases for Cisco products. Updated monthly, this online publication is organized by product category to direct you quickly to the documentation for your products. You can view the latest release of "What's New in Cisco Documentation" at this URL:

  http://www.cisco.com/univercd/cc/td/doc/abtunicd/136957.htm

- World-class networking training is available from Cisco. You can view current offerings at this URL:

  http://www.cisco.com/en/US/learning/index.html

CHAPTER 1

Pre-installation Planning Overview

Note This manual deals with Cisco ICM Enterprise Edition. For information on IP Contact Center Enterprise Edition, see the *IPCC Installation and Configuration Guide for Cisco IPCC Enterprise Edition* and the I*PCC Administration Guide for Cisco IPCC Enterprise Edition*.

The Cisco Intelligent Contact Management (ICM) software is a distributed application that routes telephone calls, web inquiries, and e-mail across geographically distributed contact centers. A typical ICM system includes a number of computers located at different sites. A small ICM system might have computers at two or three sites. A larger system might have computers at 20 sites or more.

Because the ICM software works with different types of contact center equipment and sometimes one or more carrier networks, some pre-installation planning is necessary to ensure that the ICM installation process proceeds smoothly and on schedule.

This chapter provides an overview of the ICM pre-installation planning process. It also contains a pre-installation planning document roadmap, which suggests an order in which tasks might be started.

The Planning Process

The ICM pre-installation planning process involves coordinating and scheduling several tasks so they are completed in time for the arrival of the ICM server platforms. You typically need to make preparations at each site that is to contain ICM components.

Some pre-installation tasks may take longer than others. Therefore, try to start the time-consuming tasks early and continue working in parallel on the other pre-installation tasks.

Coordinating and Scheduling Tasks

Cisco suggests that one person in your organization have overall responsibility for coordinating and scheduling the pre-installation planning tasks. This person can also delegate responsibility to ensure that tasks are assigned to people with the appropriate expertise.

For example, you might have your MIS expert begin working with Cisco to order the server platforms. At the same time, your data communications expert can start the process of provisioning network facilities at each contact center site.

Pre-installation Document Road Map

The current document provides guidance on topics such as provisioning IXC access, preparing ACDs, and determining the ICM datacom requirements. In each case, one or more pre-installation tasks are covered.

You typically start the pre-installation planning tasks in the following order:

1. **Getting Started**: Document current contact handling procedures. Provide configuration data for contact center sites. Understand the ICM software. Review ICM product options. Determine ICM Configuration.

   See Chapter 2, "ICM Enterprise Edition Overview"; Chapter 9, "ICM Product Options"; *ICM Configuration Guide for Cisco ICM Enterprise Edition*.

2. **IXC Access**: Review ICM/IXC interaction. Choose network link fault tolerances strategy. Review IXC access specifics.

See Chapter 3, "IXC Overview"; the relevant Cisco NIC Supplement document.

3. **Switch Preparation**: Determine ACD requirements. Determine CTI and MIS link requirements. Order required upgrades and enhancements.

   See Chapter 4, "Switch Overview"; Chapter 5, "Peripheral Gateway Configurations"; the relevant Cisco ACD Supplement document(s).

4. **Product Options and System Integration**: Determine product option requirements. Order any required upgrades or enhancements.

   See Chapter 6, "CTI Planning"; Chapter 7, "IVR Planning"; Chapter 8, "ICM Application Gateway and ICM Gateway SQL Planning"; Chapter 9, "ICM Product Options".

5. **Estimating System Size**: Enter data using the ICM database sizing tool. Note the specifications provided by the tool. Determine the number of PCs required.

See the discussion of the ICM Database Administration tool (ICMDBA) in the *ICM Administration Guide for Cisco ICM Enterprise Edition*; Chapter 10, "Planning for ICM Platforms".

6. **Network and Site Requirements**: Determine requirements for ICM networking. Allocate IP addresses. Order any additional network hardware. Meet basic site requirements. Order addition cabling or other equipment required.

   See Chapter 11, "Determining the Datacom Requirements"; Chapter 12, "Site Preparation"; Chapter 13, "IP Address Worksheets".

For example, since the lead-time for provisioning IXC access is several weeks, this task is started early in the process. You can then proceed with tasks such as making sure your contact center equipment (ACDs, PBXs, IVRs) have the necessary software releases and options. While that task is in progress, you can select ICM product options and component platforms and begin preparing the installation sites.

NIC and ACD Supplements

The *NIC Supplements* are reference documents that contain specific information on how the ICM Network Interface Controller (NIC) interfaces to the supported IXC carrier networks. The NIC is the software process that allows the ICM system

to communicate with the carrier's intelligent switching network. You may want to refer to the NIC supplements for detailed technical information when you are planning for IXC access.

There are NICs, and NIC Supplements, for each carrier supported by the ICM software (AT&T, MCI, Sprint, etc.). The NIC Supplements are intended to be used as technical reference companions to the Cisco ICM software documentation set.

The *ACD Supplements* are reference documents that contain the specific information you need to maintain ICM Peripheral Gateways (PGs) in an ICM environment. The PG is the ICM component that provides an interface to proprietary ACD systems. There are ACD supplements for each ACD supported by the ICM software (Aspect CallCenter, Avaya DEFINITY, Nortel Symposium, etc.).

The ACD Supplements are intended to be used as the ACD-specific companions to the Cisco ICM software documentation set. For example, while other ICM documents such as the *Cisco ICM Enterprise Edition Configuration Guide*, and the *Cisco ICM Enterprise Scripting and Media Routing Guide* cover general topics such as configuring an overall ICM system and writing scripts to route contact center requests, the ACD Supplements provide specific information on configuring certain types of PGs and making any necessary adjustments to the ACD configuration. Refer to the ACD Supplements for detailed technical information when you are determining the requirements for your ACDs.

CHAPTER 2

ICM Enterprise Edition Overview

In the initial phase of pre-installation planning, you need to become familiar with the ICM system and understand how it fits into your contact center enterprise. You can then determine which products and components you want to deploy in an ICM virtual contact center.

In this chapter, complete the following pre-installation tasks:

- **Determine the role of the ICM software in your enterprise**. Understand how the ICM software fits into the contact center enterprise and carrier networks.
- **Choose ICM products**. Will your system be a complete Pre-Routing and Post-Routing system? Will you have other options such as ICM Gateway SQL, Cisco CTI, or IVR?

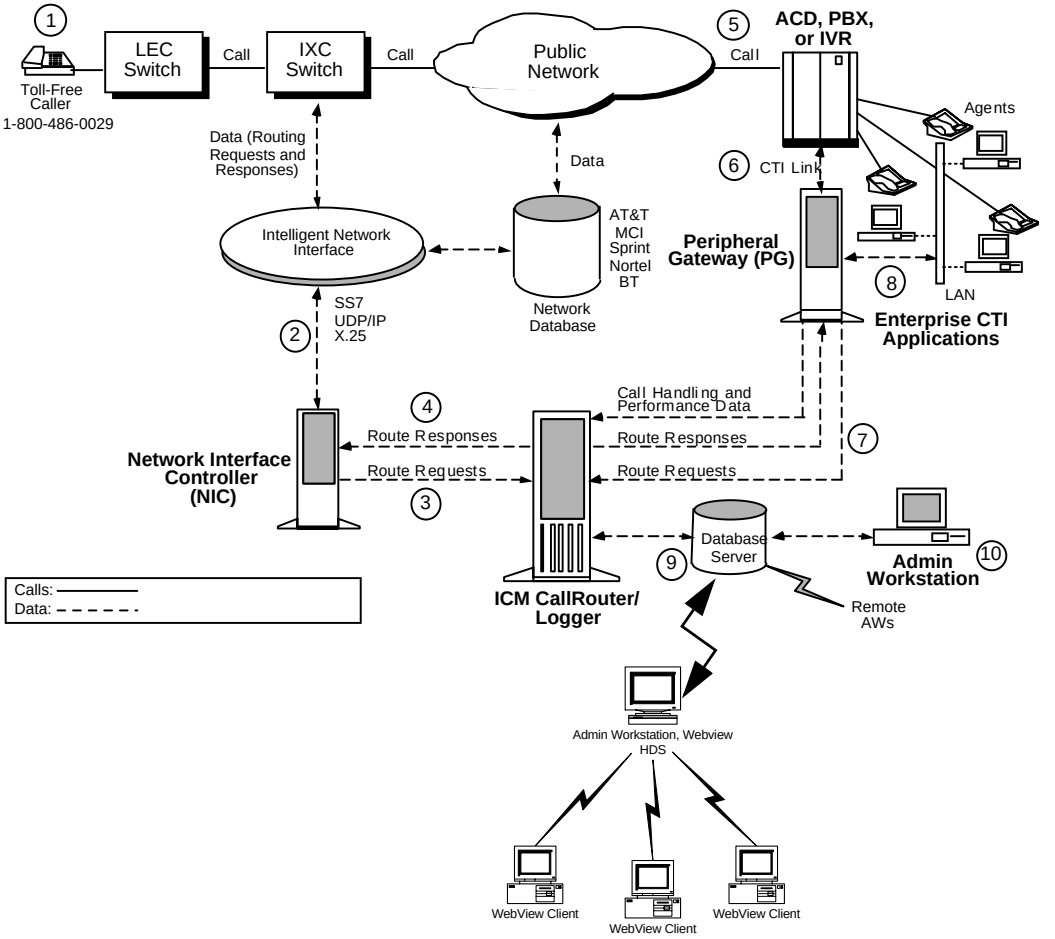
How the ICM Software Works

The ICM Enterprise Edition works with your contact center equipment and the IXC carrier network to create a *virtual contact center*. In the virtual contact center model, multiple distributed contact centers are linked to form one contact center enterprise. The agents within the contact center enterprise become members of a single team that is capable of servicing customer contacts throughout the enterprise.

ICM Call Routing

The ICM software makes the best use of your contact handling resources while ensuring that each customer is directed to the most appropriate resource available. To get a better idea of how the ICM software fits into the contact center and carrier environments, it might help to examine how the ICM software routes telephone calls (see Figure 2-1).

Figure 2-1 Intelligent Contact Routing (Telephone Calls)



Pre-Routing

The ICM software executes call routing decisions before a call terminates at a contact center. This concept is called *Pre-Routing*. As shown in Figure 2-1, calls to be routed usually originate in the public telephone network as calls to a toll-free number **(1)**.

The IXC Network

The ICM software is configured in the intelligent network of the IntereXchange Carrier (IXC) to receive a route request for each designated incoming call **(2)**. A subsystem of the ICM software, called the *Network Interface Controller (NIC)*, communicates with the carrier's network through an intelligent network interface.

Route Requests

The NIC translates the network's description of the call, including point of origin, number dialed, and any customer entered digits, into the language of the ICM software. The NIC passes this call information to the CallRouter in the form of a *route request* **(3)**.

Note For clarity, the NIC is usually shown in figures as a separate computer. Actually, NICs are implemented as software on the ICM software platform (usually on the CallRouter or CallRouter/Logger [Rogger] machines).

Route Responses

At this point, the ICM software may query an ANI or customer profile database before returning a *route response* to the NIC **(4)**. The NIC passes a destination for the call back to the IXC network. The IXC is responsible for connecting the call and maintaining the voice path.

ACDs

Each contact center has one or more Automatic Call Distributor (ACD) systems that direct incoming calls to the telephone sets of individual agents **(5)**. The ICM software maintains real-time communications with the ACDs in each contact center by using a *Peripheral Gateway (PG).*

Peripheral Gateway

The PG communicates with the ACD over the switch vendor's Computer Telephony Integration (CTI) link **(6)**. To make optimal decisions, the ICM software must know the latest status for every call, agent, and agent group in its network. One purpose of the PG is to extract this status information from the ACD and forward it to the CallRouter's in-memory database. (The PG can also be used as a *CTI Server* and as a communications interface between the ICM and Interactive Voice Response (IVR) systems located at contact center sites or in the network.)

Post-Routing

In private network configurations, ACDs can also originate call routing requests. This is called *Post-Routing*. Post-Routing provides the same intelligence used in Pre-Routing, but applies it to calls originating from a private network of ACD, PBX, and IVR systems. The PG assists in Post-Routing by forwarding routing requests to the ICM software and returning the target destinations to the ACD **(7)**.

CTI Server

External server or workstation applications can subscribe with a PG that acts as a CTI Server **(8)**. The CTI Server provides call and agent event data that can be used in screen-pops and other CTI applications. At the desktop level, the ICM CTI desktop provides an environment for integrating soft-phone, screen-pop, and data entry at the agent's workstation.

Monitoring and Reporting

All event data that are gathered by the PG and router are forwarded to the ICM software and stored in an industry-standard relational database **(9)**. These data are used in real-time monitoring and historical reporting. The standard ICM monitoring screens and reports can be easily modified with ICM-provided database access tools. Optionally, the data can be accessed directly with SQL or Open Database Connectivity (ODBC) tools.

Admin Workstation

The overall operation of the ICM software is monitored and controlled from an *Admin Workstation* **(10)**. The ICM software can support multiple Admin Workstations (AWs) located throughout the contact center network.

ICM System Components and Processes

Many different ICM system software components are involved in pre-installation planning. You may want to become familiar with the role of the components in the ICM system. (Note that not every component is used in every ICM system.)

CallRouter

This is the part of the ICM system that contains the call routing logic. The ICM software receives call routing requests and determines the best destination for each call. It also collects information about the entire system. The ICM software serves as a *real-time server* by forwarding performance and monitoring information to Distributor Admin Workstations.

Logger

The Logger is the interface between the ICM software and the database manager (SQL Server). As the ICM software collects performance and monitoring information about the system, it passes the information to the Logger for

short-term storage in a central relational database. The Logger forwards historical information to the Historical Data Server (HDS). The HDS on the Logger maintains statistics and data for use in monitoring and reporting.

Network Interface Controller (NIC)

The NIC connects the ICM software to the IXC signaling network. The NIC receives a route request from the signaling network for each incoming call and passes the request to the ICM software. The ICM software responds with routing information (a routing label), which the NIC passes back to the IXC signaling network.

Note For clarity, the NIC is usually shown in figures as a separate computer. Actually, NICs are implemented as software on the ICM software platform (usually on the CallRouter or CallRouter/Logger [Rogger] machines).

Peripheral Gateways

Each contact center device (ACD, PBX, or IVR) communicates with a Peripheral Gateway (PG). The PG reads status information from the device and passes it back to the ICM software. The PG runs one or more Peripheral Interface Manager (PIM) processes, which are the software components that communicate with proprietary ACD systems. A single PIM is required for each peripheral to which the PG will interface. Therefore, a single PG (and its associated PIMs) can serve multiple peripherals of the same kind. For example, one PG with four Aspect ACD PIMs can serve four Aspect ACDs in the contact center.

Note Beginning with ICM 5.0(0), a single PG can support both ACD PIMs and IVR PIMs, though the ACD PIMs must all be of the same kind and the IVR PIMs must all be of the same kind.

A single server can support up to two PGs.

For details, refer to the *ICM Configuration Guide for Cisco ICM Enterprise Edition*.

Admin Workstations

The Admin Workstation (AW) is the human interface to the ICM software. It serves as a control console from which you can monitor agent and contact center activity and change how the ICM software routes calls. For example, you can use the Admin Workstation to configure the ICM contact center data, create call routing scripts, and monitor and report on the ICM system or some part of the system. Admin Workstations can be located anywhere, as long as they have LAN or WAN connections to the ICM software.

One AW at each site maintains a connection directly with the ICM Central Controller (the Central Controller consists of the CallRouter and the Logger). This connection is referred to as the *real-time feed*. The real-time feed is used to send real-time monitoring data to a Distributor AW. The *Distributor Admin Workstation* receives the real-time data and acts as a real-time data distributor to all other AWs at the site. Admin Workstations that do not serve as real-time distributors are called *Client Admin Workstations*. (There must be at least one Distributor Admin Workstation at a site before a Client Admin Workstation can be installed.)

Historical Data Server

Admin Workstations need to access historical data (half hour data, call detail, etc.) for historical reporting in the Script Editor or in third-party tools. At least one real-time distributor Admin Workstation, in a system, must be installed with a Historical Data Server (HDS) to support reporting and longer term historical data storage.

The HDS IP address requirements are identical to those of a standard Admin Workstation.

WebView

WebView is an application for contact center reporting. The WebView application is installed on a machine acting as a web server, and can be accessed and used through client browsers. WebView provides templates that meet standard reporting needs. WebView queries relational databases, formats report results, and contains tools that you can use to modify, save, and export reports.

Cisco ICM WebView reports on ICM system data. For this type of WebView, the WebView server is usually installed on the ICM Admin Workstation or on a server with an ODBC connection to the databases on the ICM Admin Workstation. Reports can be used to monitor the ACD or IPCC system, including task treatment, agent skill group performance, and individual agents. ICM WebView requires an HDS to reduce the historical load on the Logger. The WebView server can be installed on an HDS or on a separate server with connections to the HDS.

If multi-media options, including Collaboration Server and E-Mail Manager, are integrated with the ICM software, reports also include data on the activity of those applications and the agents and skill groups handling tasks from those applications. However, ICM WebView reports do not contain detailed session information for the multi-media options. Instead, the Collaboration Server's reporting feature provides detailed information about agent and caller interaction, and WebView for E-Mail Manager provides detailed information about e-mail activity.

Note Unless otherwise specified, in this document "WebView" refers to "ICM Webview".)

ICM Options and Related Products

The ICM software can be set up with a variety of options, such as adding software to perform database lookups or performing secondary call routing once a call has terminated at an ACD. In some cases, the ICM software is an integral part of other Cisco contact center products, such as the IP Contact Center (IPCC).

You may want to review the ICM software options and related products to learn about the different ways the ICM software can be deployed in a contact center enterprise.

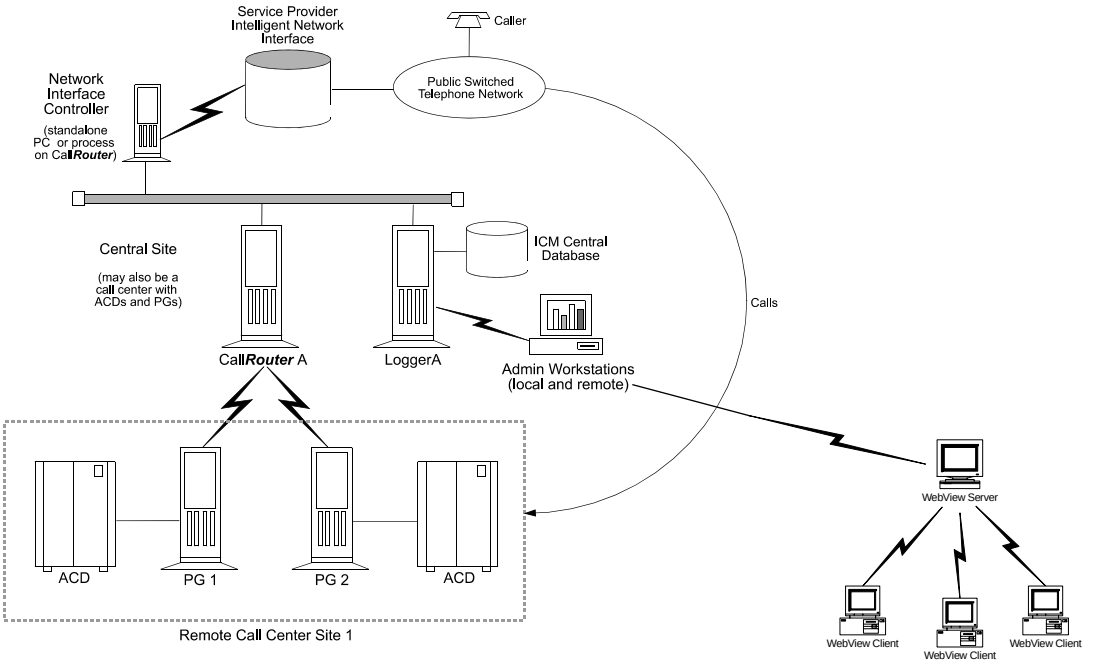
Pre-Routing

Pre-Routing allows the ICM software to execute routing decisions before a call terminates at a contact center. With Pre-Routing, the Network Interface Controller (NIC) receives the route request from the IXC and passes the call information to the ICM software. The ICM software processes the route request through a call

routing script, which defines how the call should be routed. The ICM software returns a route response to the NIC, which in turn forwards it to the IXC. The route response contains the call's final destination.

In Pre-Routing, the Peripheral Gateway's role is to keep the ICM software informed of the real-time status of switches, calls, and agents in the contact center enterprise. The ICM software uses this real-time data to make an informed call routing decision. Figure 2-2 shows an example of a Pre-Routing system in which the PGs are located at remote contact center sites with the ACDs. In this case, the PGs communicate over a WAN to the ICM software.

Figure 2-2 Pre-Routing System



Pre-Routing systems require the following components:

- Network Interface Controller (NIC)
- CallRouter
- Logger

- Admin Workstation
- WebView Server
- Peripheral Gateway (PG)

The Pre-Routing capabilities are enabled through the Network Interface Controller (NIC) and the CallRouter processes. For clarity, in the figure the NIC is shown as a separate computer. Actually, NICs are implemented as software on the ICM software platform (for example, on the CallRouter or Logger machines).

The ICM routes calls within the public network based on several dynamic variables. You can use any combination of the following variables to route calls:

Table 2-1 Pre-Routing Variables

Agent availability	Day of week
Agent skills	Number dialed
Caller-entered digits	Origin of call
Cost of the call	Preferences
Cost of the transaction	Quotas
Customer database lookup	Scheduled agents
Customer-defined business rules	Time of day

Calls are routed in the most efficient manner possible given the current contact center load conditions.

Post-Routing

In a traditional time-division multiplexing (TDM) environment, Post-Routing systems have software that allows the CallRouter to make secondary routing decisions after a call has been received at a contact center. In Post-Routing, the ACD or IVR submits a route request to the ICM software. The ICM software executes scripts to process the routing request and return a destination address to the ACD. The ICM software then directs the ACD to send the call to an agent, skill group, or service, either in the same contact center or at a different contact center.

In making a Post-Routing decision, the ICM software can use the same information and script it uses in Pre-Routing. In other words, the same call routing intelligence that is used in the Pre-Routing of calls is applied to calls that are interflowed between contact center sites, transferred between agents, or transferred into or out of IVRs.

Pre- and Post-Routing Systems

A Pre- and Post-Routing ICM system is a complete intelligent call routing, monitoring, and reporting system. The ICM software can execute routing decisions before a call terminates at a contact center. It can also make secondary routing decisions after a call has been received at a contact center. A Pre- and Post-Routing system can be expanded with optional features such as ICM Application Gateway, ICM Gateway SQL, ICM IVR interface, and CTI Server to create an intelligent call routing and management solution in which all the elements of the contact center enterprise play a role in intelligent routing.

Computer Telephony Integration (CTI)

Cisco CTI software provides an interface between the ICM software and agent desktop and server applications. The CTI software works with a PG's ACD and IVR interface software and all associated ACDs to track events and transactions and forward call- and transaction-related data to an agent's desktop computer.

The CTI software has full third-party call control features that allow agents and integrated desktop applications to perform tasks such as transferring calls, conferencing calls, and setting call data all within an enterprise framework. Voice and data collected by an agent at the desktop can be transferred in the form of a screen-pop among agents and across different ACD platforms. This allows customer and transaction data to accompany a call from an IVR or web server to the agent and from site-to-site as required. The ICM system can also use CTI data to determine call destinations based on factors such as customer value, business objectives, market penetration, and personalized service.

CTI Server

CTI Server, the basic server component of Cisco CTI, enables the ICM software to deliver agent, call, and customer data in real-time to a server and/or workstation application as events occur throughout the life of a call. The CTI Server is a software process that runs on a Peripheral Gateway (PG). It is the CTI gateway into the ICM software's data and services.

- Pre-route indications identify a caller and provide associated attributes to applications while the call is still in the public or private network and before the caller is connected to an agent, web server or IVR.
- Call events are provided throughout all stages of the call flow, from the moment a call arrives at an answering location (ACD, PBX, IVR, web server) until the caller hangs up.
- Agent work state changes are reported as they occur.

Cisco CTI Object Server (CTI OS)

CTI Object Server (CTI OS) is a high-performance, scalable, fault-tolerant server-based solution for deploying CTI applications. CTI OS serves as a single point of integration for third-party applications, including Customer Relationship Management (CRM) systems, data mining, and workflow solutions. Configuration and behavior information is managed at the server, simplifying customization, updates, and maintenance. Servers can be accessed and managed remotely. Thin-client and browser-based applications that do not require Cisco software on the desktop can be developed and deployed with CTI OS.

CTI OS incorporates the following major components:

- CTI OS Toolkit
- Client Interface Library
- CTI OS Combo Desktop for Agents and Supervisors

CTI OS, a client of CTI Server, has a single all-events connection to Cisco CTI Server. In turn, CTI OS accepts client connections using session, agent, and call interfaces. These interfaces are implemented in .NET, COM, Java, and C++, allowing for a wide range of application development uses. The interfaces are used for call control, to access data values, and to receive event notifications.

Note Refer to the Cisco CTO OS Software documentation for more information.

IVR Interface

This option allows for running a Cisco interface to Interactive Voice Response (IVR) systems. The IVR interface software runs on a PG platform. It allows the ICM software to route calls to targets on IVRs and collect data from IVRs for use in call routing, real-time monitoring, and historical reporting.

The IVR interface can also provide queuing at a network-based or premises-based IVR. With this feature, calls can be directed to an IVR queue when no other appropriate answering resource is available.

The IVR interface is not specific to a particular IVR system or manufacturer. It is based on an open IVR model. Many IVR systems support Cisco's Open IVR Interface Specification, including Cisco Customer Voice Portal (CVP).

The Cisco Customer Voice Portal integrates with both traditional time-division multiplexing (TDM) and IP-based contact centers to provide an call-management and call-treatment solution with a self-service IVR option that can use information available to customers on the corporate Web server. With support for automated speech recognition (ASR) and text-to-speech (TTS) capabilities, callers can obtain personalized information and can conduct business without interacting with a live agent.

Note CVP was previously called Internet Service Node (ISN)

For a list of IVRs that support this interface, contact your Cisco representative.

Note You can integrate IVR systems into the ICM software in several different ways. Chapter 7, "IVR Planning" provides more information on IVR integration along with examples of how you might integrate IVRs with the ICM system.

ICM Application Gateway

The ICM Application Gateway option allows the ICM software to interact with a host system that is running another contact center application. Within the ICM software, the Gateway feature is implemented as an *Application Gateway node* in a call routing script. You add an Application Gateway node to a script to instruct the system to execute an external application. This allows the script to evaluate responses from the external application and base subsequent routing decisions on the results produced by the application.

The Gateway option allows the ICM system to interface with any external application, not just database applications. You can use the Gateway option within the ICM system to:

- Allow other applications to select a call's destination.
- Control or trigger external applications through ICM call routing scripts.
- Pass data to and collect data from other contact center applications.

For example, a simple Gateway application might return a variable to the CallRouter that identifies the caller as having a premium account. The routing script can use this information to control where and how the call is routed. Optionally, the ICM can pass the retrieved information to the site that is receiving the call. Data such as account numbers, dates, billing phone numbers, and addresses can be passed along with the call to an answering resource.

Note Chapter 8, "ICM Application Gateway and ICM Gateway SQL Planning" provides more information on planning for the Gateway feature.

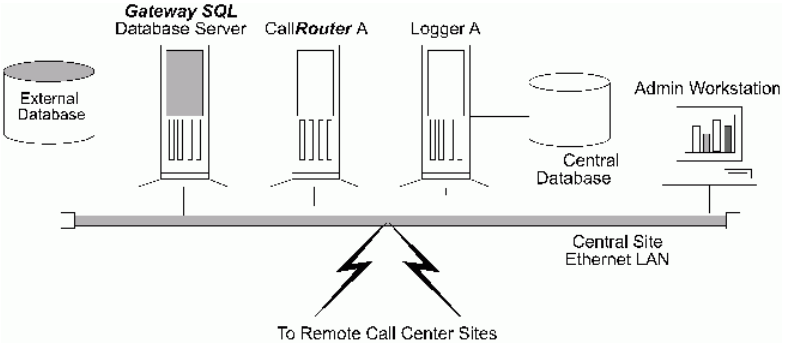
ICM Gateway SQL

ICM Gateway SQL allows the ICM software to query an external SQL Server database and use the data in call routing. If you have databases that contain customer account or profile information, you might want to perform database lookups to assist in call routing. The database lookups can be based on Calling Line ID (CLID), Dialed Number (DN), or Caller Entered Digits (CED) such as account or social security numbers.

A typical Gateway SQL application might prioritize callers. For example, a call routing script might use the caller's CLID to access a database and retrieve data about the caller such as the caller's average monthly bill. Based on this information, the routing script would route the caller to the most appropriate answering resource.

Figure 2-3 shows a basic Gateway SQL configuration. Note that this configuration requires an additional database server on which to load the external SQL Server database and data.

Figure 2-3 Gateway SQL Configuration



Note You need to perform some pre-installation planning if you are going to use the ICM Gateway SQL option. Chapter 8, "ICM Application Gateway and ICM Gateway SQL Planning" provides more information on planning for the ICM Gateway SQL feature.

Internet Script Editor

Internet Script Editor is an application you can use to work with routing and administration scripts. It provides the same functionality as the ICM Script Editor software, without the need for a full Admin Workstation (AW).

Internet Script Editor works through the IIS Web server on ICM software, using HTTP to communicate with the ICM software.

The Internet Script Editor and the ICM Script Editor GUIs are essentially the same. The menus, toolbars, palette, and work space are utilized in the same manner in both applications. The differences between the two occur primarily in the method by which each application communicates with the ICM software.

WebView

WebView is the web-based reporting and event monitoring tool of the ICM software. The WebView Server attaches to the HDS on an Admin Workstation and is a web server in your corporate intranet. Other computers with access to the web can use the WebView server to generate ICM reports and monitor call routing scripts in real-time.

WebView can now be installed either on an ICM Admin Workstation or on a separate server that has network connections to the ICM Admin Workstation where the real-time AW and the HDS databases reside.

ICM Multichannel Software

The Cisco multichannel software provides a flexible, integrated architecture to support a variety of agent and customer interactions for a contact center. The contact center manager can configure agents to handle voice, Web collaboration, text chat, and e-mail requests and have the agents switch between these media types on a task-by-task basis. The manager can also configure agents to support only one media type. Customers can choose the medium that is most comfortable and convenient for them.

Requests are routed by the ICM system using the same kind of business rules applied to contacts arriving from a carrier network. Every request is delivered to the most appropriate agent anywhere in the enterprise.

Note For more information about ICM multichannel software, see the *Cisco ICM Multichannel Software Implementation Map* and *Cisco Multichannel Software Overview*, as well as the documentation for Cisco E-Mail Manager Option and Cisco Web Collaboration Option (Cisco Collaboration Server, Cisco Dynamic Content Adapter, Cisco Media Blender).

IP Contact Center (IPCC)

IPCC combines Cisco's IP telephony products and Intelligent Contact Management (ICM) software to create an IP-based contact management solution. IPCC provides a migration path to an IP-based contact center by supporting integration with legacy call center platforms and networks. With IPCC, agents can use Cisco IP phones to receive both time-division multiplexing (TDM) and voice-over-IP (VOIP) phone calls. Capabilities of IPCC include intelligent call routing, automatic call distribution (ACD) functionality, network-to-desktop computer telephony integration (CTI), interactive voice response (IVR) integration, call queuing, and consolidated reporting.

IPCC is based mainly on two Cisco products: Cisco CallManager and Cisco Intelligent Contact Management (ICM) software. *CallManager* provides traditional PBX telephony features in an IP telephony environment. *ICM software* provides enterprise-wide management and distribution of voice and data from ACDs, IVR systems, small office/home office (SOHO) agents, and desktop applications. Cisco IP phones and Cisco IP IVRs (as well as traditional TDM IVRs) are also part of the IPCC product.

Note For information on IP Contact Center Enterprise Edition, see the *IPCC Installation and Configuration Guide for Cisco IPCC Enterprise Edition* and the I*PCC Administration Guide for Cisco IPCC Enterprise Edition*.

CHAPTER 3

IXC Overview

If pre-routing is to be performed, the ICM Enterprise Edition software requires access to the IntereXchange Carrier intelligent call routing network. Each interexchange carrier offers intelligent network services that allow customer-premises equipment to participate in network-level call routing. The ICM software connects to one or more networks by using a Cisco Network Interface Controller (NIC).

Specifically, this chapter helps you to complete the following tasks:

- **Choose your carrier(s)**. Cisco supports network interfaces to several carriers. You can use one or more carriers with the ICM software.
- **Choose the types of network link fault tolerance to apply**. It is important to apply fault tolerance in the network interface and the links to the carrier's intelligent network.
- **Order intelligent network service**. Once you review the requirements for your specific Cisco NIC, order intelligent network service and work with the carrier and Cisco to bring the service on line.

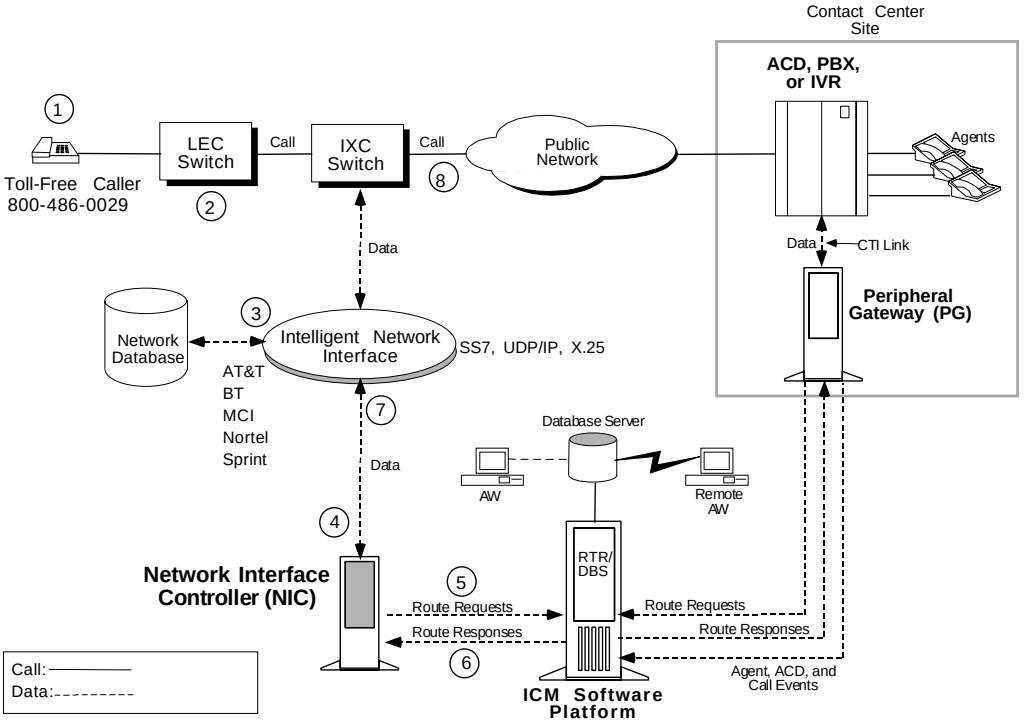
ICM Software and IXC Interaction

The Network Interface Controller (NIC) is the interface between the ICM software and the IXC intelligent network. The NIC communicates with the IXC network by using *network control links*. These links are typically offered as part of the carrier's intelligent network service.

Cisco provides a NIC to interface to the specific carrier network. For example, if you have Sprint toll-free service, your ICM system is equipped with a Cisco-supplied Sprint NIC. The Sprint NIC allows the ICM to interface with the Sprint intelligent network service. If you use both AT&T and Sprint as carriers, your ICM system is equipped with AT&T and Sprint NICs.

Figure 3-1 shows the interaction between the IXC network and the ICM NIC.

Figure 3-1 Network Interface Controller



For clarity, the NIC in Figure 3-1 is shown as a separate computer. Actually, NICs are implemented as software on the ICM software platform (for example, on the CallRouter or Logger machines). For ICM software Releases 4.1 and later, an ICM Network Gateway can be implemented for SS7 networks. The ICM Network Gateway is implemented as a separate node on the ICM signaling access network. When this node is implemented, the NIC software can be installed on the CallRouter machine.

Toll-Free Caller

As shown in Figure 3-1, the flow of messages between the network and the ICM begins when a caller dials a toll-free number **(1)**.

LEC-to-IXC

The Local Exchange Carrier (LEC) determines which interexchange carrier (IXC) is providing transport for that particular number and forwards the call to the IXC switch **(2)**.

Network Query

The IXC switch holds the call momentarily while it queries a network database to determine where to route the call **(3)**.

ICM NIC

The network database forwards the query to the NIC and requests an intelligent routing decision **(4)**.

NIC-to-CallRouter

The NIC software process receives the request, translates it into a standard format, and forwards it to the ICM CallRouter process **(5)**.

Best Destination Returned

The ICM software selects the appropriate call routing script, assesses the skills and current real-time status of agents throughout the contact center network, and returns the best destination address back to the NIC **(6)**.

IXC Network

The NIC sends the destination address to the IXC network **(7)**.

Connecting the Call

The network instructs the originating IXC switch to connect the call to the destination specified by the ICM software **(8)**. The total time taken by the carrier to connect the call varies. However, the additional time added by the ICM software to process the route request is typically less than half a second.

Carrier Connections

Table 3-1 summarizes the basic supported carrier connections and their corresponding ICM software routing client (NIC) and network transport protocol. Note that the SS7IN NIC is used for a number of carrier SS7 INAP interfaces..

Table 3-1 Interexchange Carrier Connections

Routing Client	Connection to ICM
AT&T	AT&T Network (SS7 INAP Gateway)
AUCS	Infonet/Unisource (SS7 INAP Gateway)
CAIN	Carrier AIN (SS7 AIN Gateway)
CRSP	Call Routing Service Protocol (UDP)
CWC	Cable & Wireless Gateway (SS7 Gateway)
GKTMP	Gatekeeper GKTMP interface (TCP/IP)
INAP	Intelligent Network Application Protocol (SS7 INAP Gateway)
INCRP	NAM/ICM Gateway Call Routing Protocol interface (UDP)
MCI	MCI Network (TCP/IP)
Nortel	Nortel Network (SS7 INAP Gateway)
NTL	NTL Network (TCP/IP)

Table 3-1 Interexchange Carrier Connections

Sprint	Sprint Network (X.25)
SS7IN	Generic / Extensible SS7 INAP (SS7 INAP Gateway)
Stentor	Stentor Adv Toll-free Gateway (HyperStream, TCP/IP)
TIM	Telecom Italia Mobile (SS7 INAP Gateway)

Applying Fault Tolerance in NICs

You may already have a strategy for fault tolerance for some parts of the ICM system. For example, you might have decided to use a duplexed, distributed ICM Central Controller and duplexed PGs at each call center. It is just as important to apply fault tolerance to the NICs and intelligent network access links. Without a connection to the carrier's intelligent network, the ICM system cannot perform Pre-Routing. If these links are lost, calls are typically routed according to the default routing plans set up in the carrier network.

Note For more information on ICM system fault tolerance, see the *Cisco ICM Enterprise Edition Administration Guide*.

Goals for NIC Fault Tolerance

The goal in applying NIC fault tolerance is to add levels of protection that successively eliminate single points of failure. Cisco requires an order of importance to follow when choosing the types of fault tolerance to apply in the carrier network-to-ICM system connection:

- First, use **redundant links** from the Cisco NIC to the carrier's intelligent network.
- Next, if you have redundant links, provision those links on **diverse facilities**. This adds another level of fault tolerance to your network connection.
- For NICs that run on the ICM CallRouter platform, the NIC processes are duplexed when the CallRouter is duplexed.

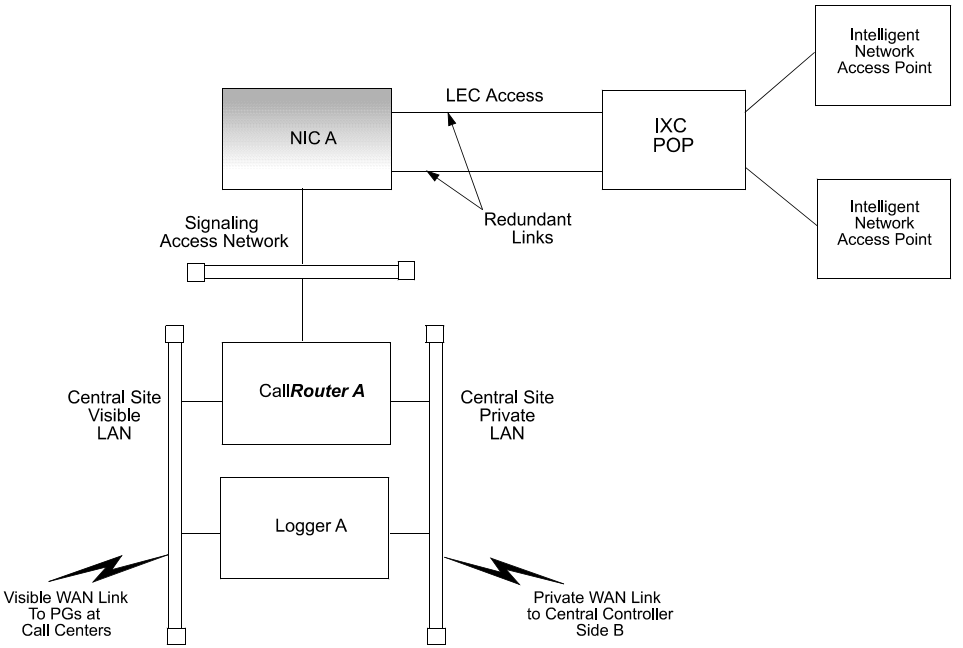
The types of NIC fault tolerance you apply have a bearing on the number of links you need to provision for IXC intelligent network access.

Link Redundancy

Cisco requires that you configure redundant links to the IXC network. In other words, rather than having a single link from the NIC to the IXC intelligent network, provision two links. Having just one link to the IXC network represents a single point of failure (that is, an area or node in the system that, should it fail, could cause the system to stop routing calls).

By using redundant links, you increase the reliability of the IXC network connection and add an important level of fault tolerance to the system. Figure 3-2 shows a simplexed ICM Central Controller and NIC with redundant links to the IXC network.

Figure 3-2 Redundant Links



In Figure 3-2, single points of failure still exist because the NIC, CallRouter, and Logger are simplexed. The simplexed Central Controller and NIC configuration is shown here only as an example. This type of simplexed configuration is used only for non-critical systems that can tolerate potentially long interruptions in service (for example, in lab or demo systems).

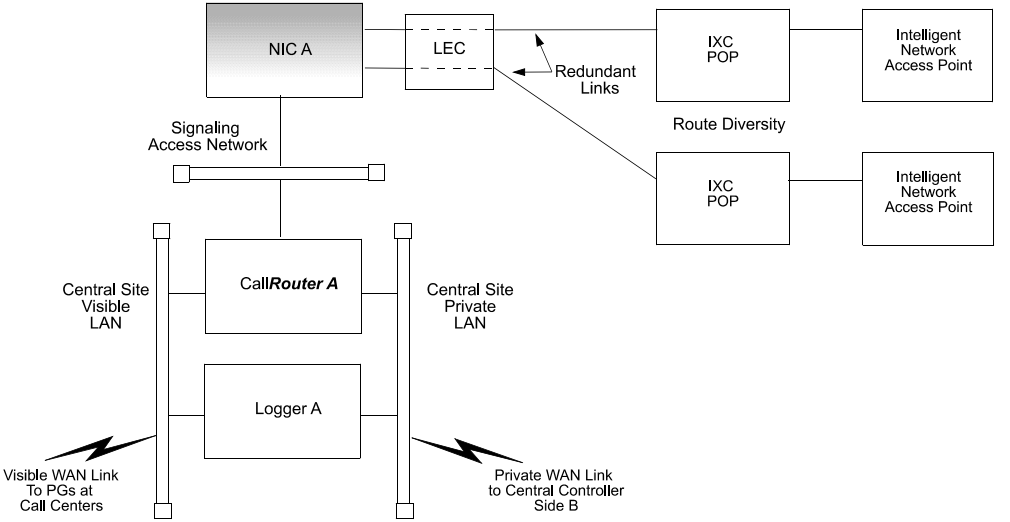
The major IXCs support redundant links to their intelligent networks. Contact your carrier for more information on access link options.

Route Diversity

For even more protection against network outages, Cisco requires that the network links be provisioned on diverse network facilities. By having diverse links, you further reduce the risk that another single point of failure (in this case, the failure of a circuit) might cause you to lose the connection to the IXC network. For example, you might provision one access link on one T1 circuit and provision the other access link on a different T1 circuit. By having diverse links, you protect against network failures in which an entire circuit is lost.

Figure 3-3 shows a simplexed ICM system with redundant links and route diversity:

Figure 3-3 Redundant Links and Route Diversity



This example provides more fault tolerance by protecting against circuit failure or the loss of an IXC *Point Of Presence (POP)*. Although the NIC is at one location, the redundant links connect to two different POPs. If one IXC POP is taken out of service (for example, in the event of a natural disaster), one link can still access the IXC network through the other POP.

The major carriers provide options for route diversity. Check with your carrier to discuss having the links handled by different POPs. You need to make sure that both the IXC and the Local Exchange Carrier (LEC) are using diverse circuits. Your LEC may impose some limitations on link diversity from the NIC to the IXC POP (that is, over the "last mile"). These limitations often depend on whether the call center is located in a metropolitan or rural area.

CHAPTER 4

Switch Overview

Each contact center device (ACD, PBX, or IVR) communicates with an ICM Peripheral Gateway (PG). The PG reads status information from the device and passes it back to the ICM software. The PG runs one or more *Peripheral Interface Manager (PIM)* processes, which are the software components that communicate with proprietary ACD systems. One PIM is required for each peripheral to which the PG will interface. So if you have two identical ACDs, your PG will require two PIMs.

A single PG can serve multiple peripherals of the same kind. For example, one computer with an Aspect PG and several Aspect PIMs can serve several Aspect ACDs in the contact center. Another PG and PIM on the same computer might serve an IVR.

Note A single PG can support both ACD PIMs and IVR PIMs, though the ACD PIMs must all be of the same kind.

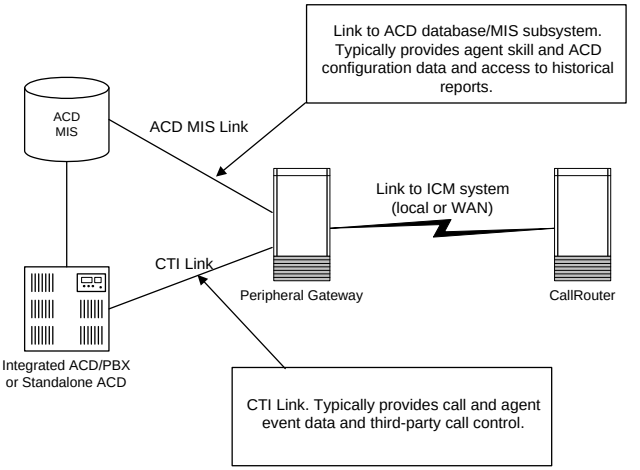
This chapter provides an overview of how the PG interfaces with ACDs in a contact center environment.

PG-to-Peripheral Connections

Each contact center peripheral (ACD, PBX, or IVR) requires a connection to a Cisco Peripheral Gateway (PG). The Peripheral Gateway provides a software interface between ACD, PBX, and IVR systems and the ICM routing software.

The PG connects to a peripheral via the peripheral's computer telephony integration (CTI) link. In some cases, the PG also connects to the peripheral's MIS subsystem. The MIS subsystem may be on a separate hardware platform or it may be integrated with the ACD, PBX, or IVR. The relationship of the Peripheral Gateway to an ACD system is shown in Figure 4-1.

Figure 4-1 Peripheral Gateway ACD/PBX Interface



Through the CTI link, the PG monitors changes in agent status, calculates call handling performance statistics, and forwards events to the CallRouter. The MIS connection provides additional information such as the mapping of individual agents to skill types and the current status of agents (either by themselves or relative to a given agent group or skill group). Typical agent states include Logged In, Ready, Talking In, Talking Out, Work Not Ready, etc. The MIS link may also provide the ICM system with ACD configuration data and historical reports.

Each PG has one or more connections to the peripheral. The type of connection used depends on the type of peripheral. For example, some ACDs use a TCP/IP Ethernet connection, while others require X.25 links. Refer to the *Cisco ICM Software Supported Switches (ACDs)* documentation for more information.

Supported ACD Switches

To ensure that your ACD software version is compatible with ICM software, refer to the Cisco ICM ACD PG Supportability Matrices document http://www.cisco.com/univercd/cc/td/doc/product/icm/icmentpr/acddoc/icmacdmx.pdf. This document contains the latest information on ICM switch support.

Note For more details on how ACDs interface to the ICM software, see the appropriate Cisco ICM software ACD Supplement. The ACD Supplements provide more technical details on the ICM-to-ACD interface than is provided in this document.

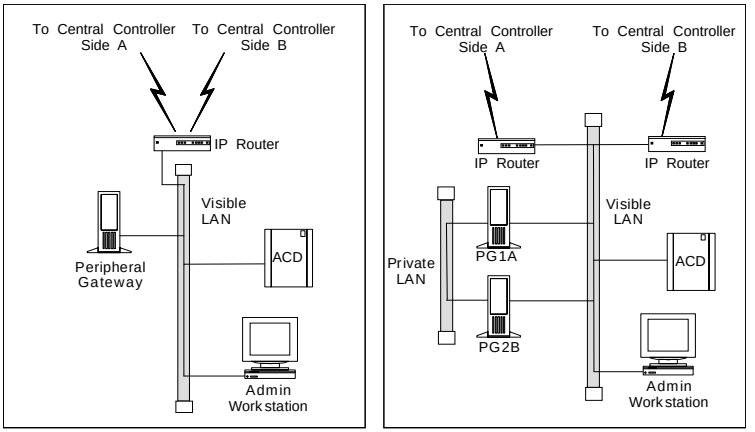
CHAPTER 5

Peripheral Gateway Configurations

As part of planning for ACDs and PGs, you need to decide whether your Peripheral Gateways will be simplexed or duplexed. *Simplexed* means that one PG is used. *Duplexed* means that two essentially identical PGs are used, one as a backup system. (Both PGs run simultaneously, with some processes active on both PGs. See the discussion in Peripheral Gateway Fault Tolerance, page 5-2.)

Figure 5-1 shows examples of simplexed and duplexed contact center configurations. Typically, duplexed PGs are installed for fault tolerance.

Figure 5-1 PG Contact Center Configurations



Simplexed PG **Duplexed PG**

Note Some ACDs can connect directly to the ICM visible LAN. Others connect to the PG via serial or other types of communication links.

The Peripheral Gateway reads information from one or more peripherals at a contact center and sends status information back to the ICM CallRouter. A peripheral might be an ACD, IVR, PBX, or another device that distributes calls within the contact center. If the ICM system is performing Post-Routing, the PG also sends route requests to the CallRouter and receives routing instructions in response.

Peripheral Gateway Fault Tolerance

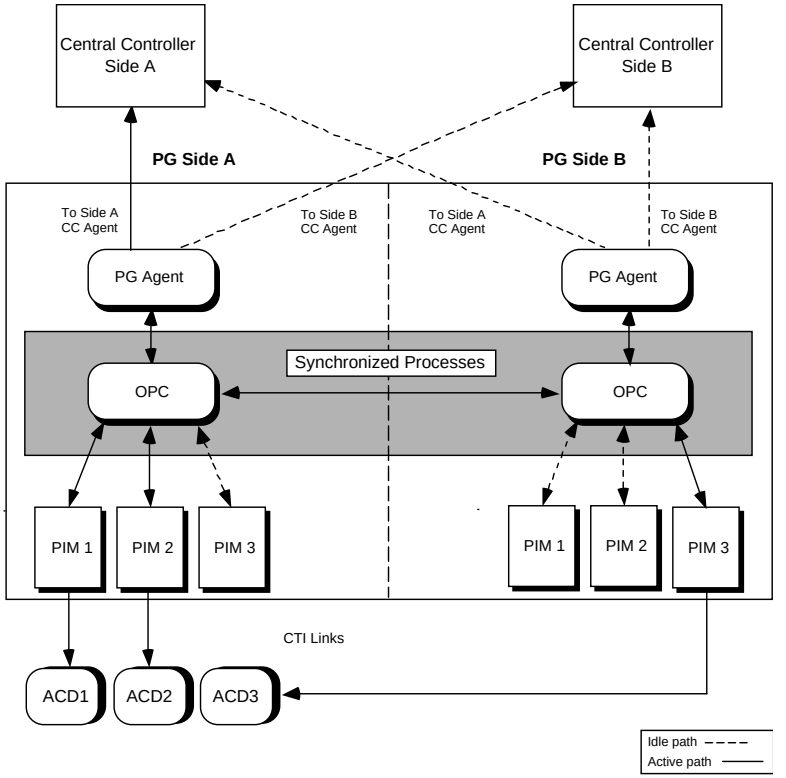
Duplexed PGs are usually implemented to provide fault tolerance in the ICM software's communication with peripherals. The duplexed PGs use a private network. The *PG private network* is used to synchronize certain processes within a duplexed PG pair. It is also used in "heartbeat detection," which is a process by which each PG sends a heartbeat packet every 100ms to keep track of the "health" of the other PG.

PGs use a combination of the hot standby and synchronization approaches to fault tolerance. In the *hot standby* approach, one set of processes is called the primary, and the other is called the backup. In this model, the primary process performs the work at hand while the backup process is idle. In the event of a primary process failure, the backup process is activated and takes over. In a duplexed PG system, the Peripheral Interface Manager (PIM) processes use the hot standby approach to fault tolerance.

In the *synchronization approach*, the critical process is duplicated on separate computers. There is no concept of primary and backup. Both process sets run in a synchronized fashion, processing duplicate input and producing duplicate output. Each synchronized process is an equal peer. Cisco refers to these equal peers as a *synchronized process pair*. In a duplexed PG system, the Open Peripheral Controller (OPC) process operates as a synchronized process pair.

Figure 5-2 shows how hot standby and synchronization are employed in a duplexed Peripheral Gateway.

Figure 5-2 PG Fault Tolerance



The OPC processes communicate with each other via a private network connection and the Cisco Message Delivery Service (MDS). The MDS provides a synchronizer service which combines the input streams from the PIMs and PG Agents on both sides of the PG to ensure that both OPC processes see exactly the same input.

The OPC process is responsible for activating PIMs and PG Agents on each side of the duplexed PG. The OPC process also supplies uniform message sets from various PG types to the ICM Central Controller.

The PIMs manage the interface between different types of ACDs and the OPC. PIMs are duplicated on each side of the system and operate in hot standby mode. A PIM can be active on either side of the duplexed PG, but not on both sides at

the same time. For example, in Figure 5-2 PIMs 1 and 2 are active on Side A; PIM 3 is active on Side B. The duplexed OPCs communicate with each other through the MDS to ensure that a PIM is active only on one side at a time.

The duplexed PG architecture protects against a failure on one side of the PG. For example, if an adapter card controlling access to an ACD fails, a hot standby PIM can use the alternate PIM activation path. As shown in Figure 5-2, PIM3 has been activated from Side B of the PG. This might be in response to an adapter failure between the Side A PIM3 and ACD3.

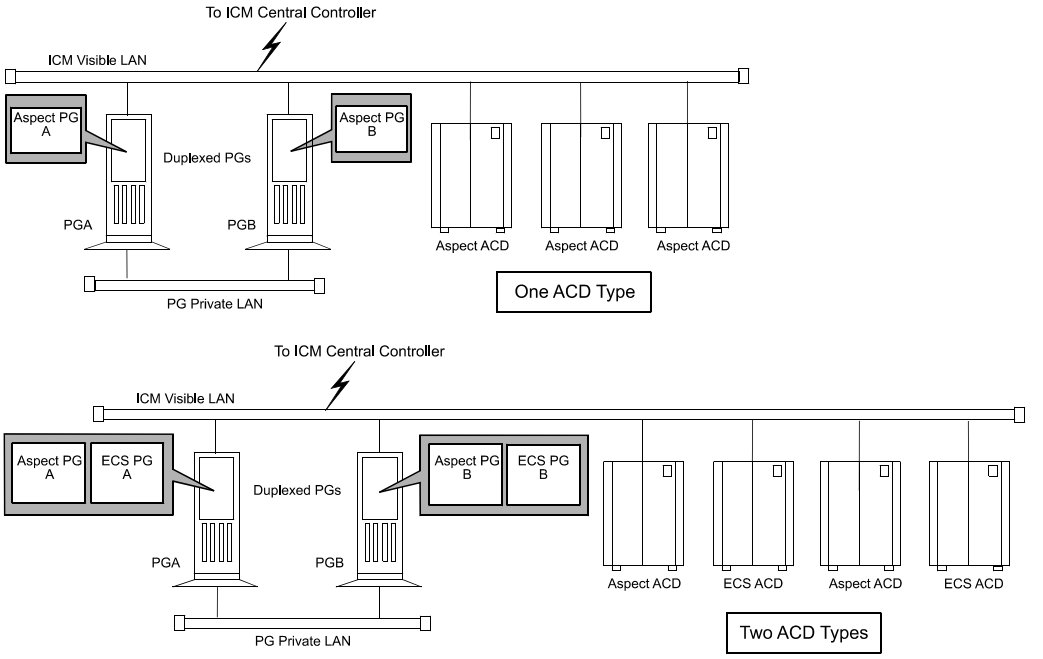
In this type of failure scenario, the PG is able to maintain communication with the attached ACD.

Only one PG Agent actively communicates with a side of the Central Controller. When messages arrive at the Central Controller, they are delivered to both sides by the Central Controller Synchronizer process. The PG maintains idle communication paths to both sides of the Central Controller in case a switch-over to the other side of the Central Controller or PG is necessary.

PG Platform Options

A maximum of two PGs can run on a single hardware platform. A single PG can serve only **one type** of ACD, but can also (as of ICM 5.0) contain one or more VRU PIMs and/or Media Routing PIMs provided that the server hardware has the capacity to support the aggregate processing load. For a single hardware platform to serve two different types of ACDs, you need two PGs—one for each peripheral type. Figure 5-3 shows some possible PG options.

Figure 5-3 PG Platform Examples



As shown in Figure 5-3, you might have an Aspect PG on PGA and an Aspect PG on PGB. This duplexed PG pair could serve multiple Aspect ACDs. One Aspect Peripheral Interface Manager (PIM) would be added through ICM Setup for each Aspect ACD to be connected to this PG. In this example, three Aspect PIMs would be installed on each PG. The PIM is the ICM software interface between the PG and different types of contact center peripherals. One PIM is required for each peripheral connected to a PG.

In a mixed contact center environment, you might want to run two different types of PGs on a single hardware platform. For example, you might want to put an Aspect PG and a DEFINITY ECS PG on the same computer. In this way, one hardware platform could serve two types of ACDs provided that the hardware platform has the necessary memory and CPU capacity to support the aggregate processing load.

Considerations for PGs and PIMs

Here are some points to remember when planning for PGs and PIMs:

- **Maximum PGs on a platform**. A maximum of two PGs can run on a single hardware platform. These may be of the same or different types. For example, on a single machine you could have an Aspect PG and an Avaya PG, or you could have two Avaya PGs.
- **PIMs and peripherals**. You need one PIM for each peripheral that will be connected to the PG. The PIMs are installed along with the PG software by using the ICM Setup tool.
- **A single PG serves peripherals of the same type**. A single PG (and its associated PIMs) can serve only ACDs of the same type. For example, an Aspect PG with four PIMs can serve only four Aspect ACDs. It cannot serve three Aspect ACDs and an Avaya DEFINITY ACD. You can put VRU and Media Routing PIMs on the same PG as an ACD, but all VRU PIMs must service VRUs of the same type.
- **Using two PGs on a platform**. Before you commit to installing two PGs on a single computer, consider the expected call load for the ACDs that will be connected to the PGs.

Note Along with call load, you should also consider the number of CTI OS agents, number of VRU ports, as factors in determining server capacity.

  You need to be sure that the computer has enough memory and processing power to handle the expected call load. In addition, you should ensure that the bandwidth in the network between the PG and the ICM Central Controller is enough to handle the route request and event traffic that will be generated by the PGs. (These same considerations apply to using multiple PIMs on a PG, but to a lesser extent.)

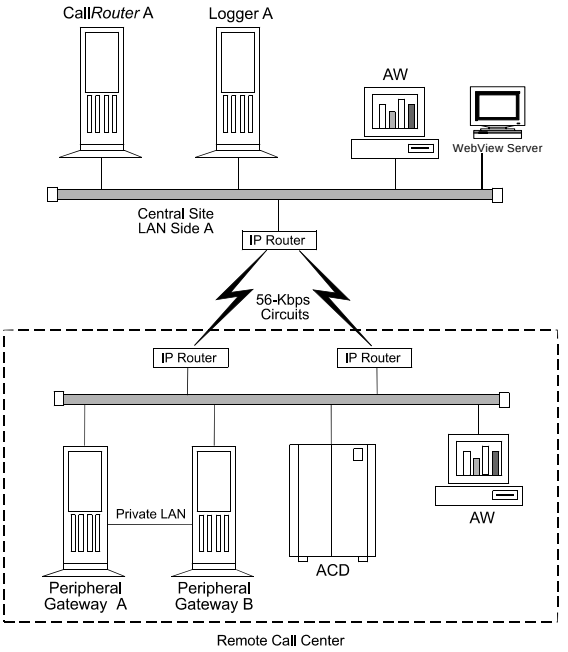
- **Properly sizing the PG hardware platform**. To properly size the PG hardware platform(s) and to determine which PG configuration is appropriate for your application see the *Cisco Intelligent Contact Management Software Release 7.0(0) Bill of Materials (BOM)*. The ICM BOM is available at: http://www.cisco.com/univercd/cc/td/doc/product/icm/index.htm. Cisco offers standard and high-end PG hardware platforms to suit more demanding contact center applications.

- **CTI Server and an ACD PG on the same platform**. You must install CTI Server and an IVR or ACD PG on the same hardware platform. The PG may run multiple PIMs. (The same considerations described earlier in "Using two PGs on a platform," also apply to the CTI Server-PG configuration.)
- **IPCC Gateway**. In ICM Enterprise for release 7.0.(0) the IPCC Gateway PG allows the ICM to pre-route calls to IPCC call centers and can also post-route IPCC calls. The IPCC Gateway feature allows IPCC Enterprise or IPCC Express to act as enhanced ACDs connected to the ICM. Refer to the I*PCC Gateway Deployment Guide for Cisco IPCC Enterprise Edition Release 7.0(0)* for more information.

Standard PG Configuration

In most PG configurations, the PG is located with the ACD at a contact center site. The PG communicates with the Central Controller via the ICM visible network WAN links. These WAN links can be a dedicated circuit, or—if QoS is implemented—the corporate WAN can be used. When Admin Workstations are located with PGs and ACDs at the contact center site, the WAN links to the Central Controller can be shared by both PGs and AWs. If the PG is collocated with the ICM Central Controller, the PGs connect directly to the ICM visible LAN. Figure 5-4 shows an example of a standard PG configuration.

Figure 5-4 Standard PG Configuration (Duplexed PGs)



Remote ACD and IVR Connection to PGs

Some ACDs allow a remote connection to the ICM Peripheral Gateway. In a remote ACD configuration, the PGs are located at the central site along with the CallRouter, Logger, and NIC. The ACD is located at a remote contact center site.

For information on remote PG support, see the ACD Supplement for the particular ACD. Generally speaking, Alcatel, Aspect, Avaya, NEC, Siemens, Symposium ACDs are supported over the WAN. However, in all cases, you must check with the ACD manufacturer for any WAN limitations.

The IVR PG can communicate remotely with IVRs via a TCP/IP network. However, you must ensure that the network link between the PG and IVR system provides enough bandwidth to support the call load for the VRU.

Multiple PGs Connecting to a Single ACD

It may be necessary to connect multiple PGs to the same ACD. This type of configuration is required when multiple ICM customers need to share the same service bureau ACD. In order for this configuration to be possible, the ACD must allow multiple CTI applications to share its CTI link(s). Support for multiple PG connections varies depending on the ACD platform. Please see the appropriate Cisco ICM software ACD Supplement and contact your ACD vendor to determine the availability of this functionality.

CHAPTER 6

CTI Planning

Cisco CTI software provides an interface between the ICM software and agent desktop and server applications. The CTI software works with a Peripheral Gateway's ACD and IVR interface software and associated ACDs to track call events and transactions and forward call- and transaction-related data to an agent's desktop computer.

Pre-installation planning for CTI involves several tasks:

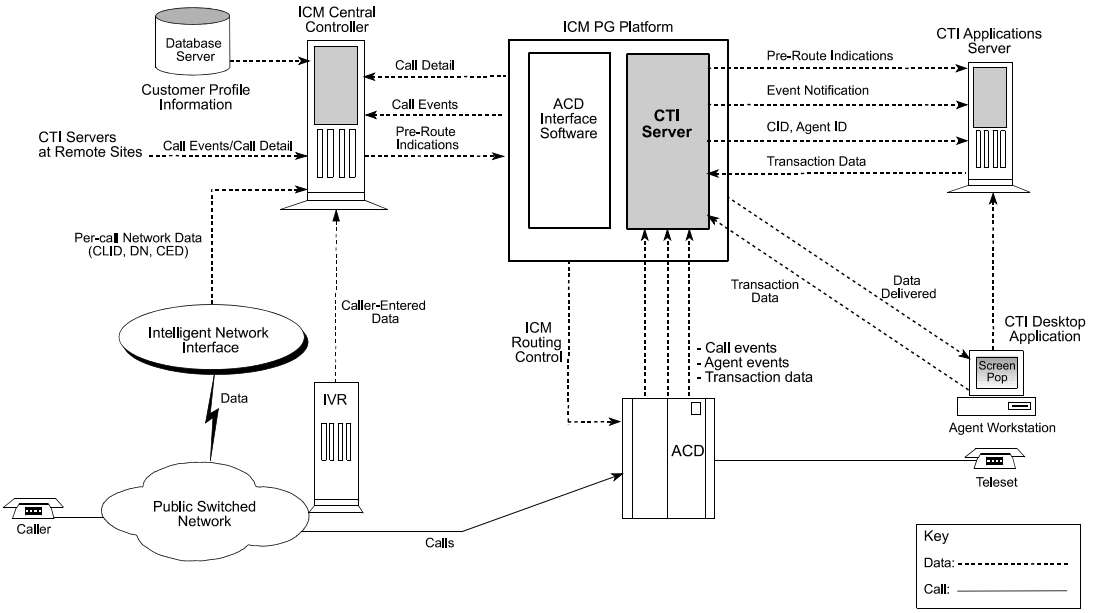
- Review CTI Server communications and platform options.
- Become familiar with the desktop options available with CTI Server.
- Estimate CTI message traffic.
- Plan fault tolerance for the CTI Server.
- Review ACD support for client control and third-party call control.

CTI Server

CTI Server, the basic server component of Cisco CTI, enables the ICM software to deliver agent, call, and customer data in real-time to a server and/or workstation application as events occur throughout the life of a call. The CTI Server is a software process that runs on a Peripheral Gateway (PG). It is the CTI gateway into the ICM software's data and services.

Figure 6-1 shows a sample CTI Server system. CTI Servers may be running at one or several call centers in the enterprise.

Figure 6-1 CTI Server Overview



One function of the CTI Server is to forward pre-route indications to CTI application servers. *Pre-route indications* identify the caller and provide CTI applications with other call attributes while the call is still in the public or private network (that is, before the call is connected to an agent or IVR resource).

CTI Server also reports call events and agent work state changes as they occur through each stage of the call flow—from the moment a call arrives at an answering resource (ACD, PBX, IVR), until the caller hangs up. In a desktop application environment, call event information is delivered to the targeted agent desktop at the same time the call is delivered.

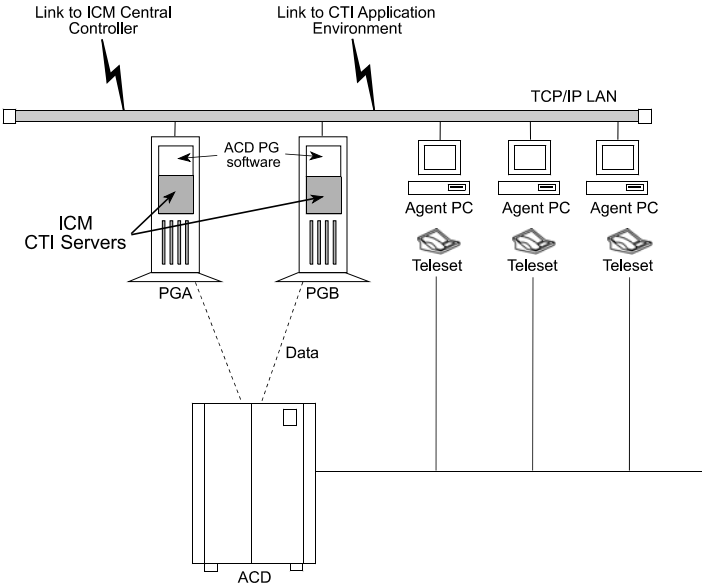
CTI Server Communications

The CTI Server uses TCP/IP Ethernet for communication with clients. Multi-protocol IP routers may be used to provide connectivity to clients on other types of LANs. The same LAN that is used for the Peripheral Gateway's visible network interface can also be used for CTI client-to-server communications.

CTI Server Platform Options

The CTI Server runs on a machine that is also running a Cisco ACD (or VRU) PG process. The shared platform option is shown in Figure 6-2.

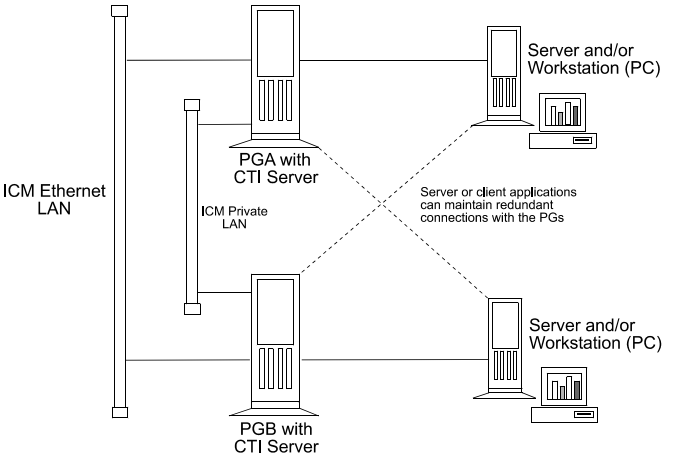
Figure 6-2 Shared CTI Server Platform



CTI Server Fault Tolerance

You can implement the CTI Server in a duplexed, fully fault-tolerant configuration. In a duplexed configuration, the CTI Server is installed on a pair of server platforms. In the event of a failed CTI client connection, the client process can automatically reestablish a connection to either side of the duplexed CTI Servers. The call's CTI client history list and any updates to call variables remain in effect when the connection is reestablished. Figure 6-3 shows a duplexed CTI Server configuration.

Figure 6-3 Duplexed CTI Server



Cisco CTI Object Server (CTI OS)

CTI Object Server (CTI OS) is a high-performance, scalable, fault-tolerant server-based solution for deploying CTI applications. CTI OS serves as a single point of integration for third-party applications, including Customer Relationship Management (CRM) systems, data mining, and workflow solutions.

Configuration data is managed at the server, which helps simplify customization, updates, and maintenance of CTI applications. Servers can be accessed and managed remotely. Thin-client and browser-based applications that do not require Cisco software on the desktop can be developed and deployed with CTI OS.

CTI OS incorporates the following major components:

- CTI OS Toolkit
- Client Interface Library
- CTI OS Combo Desktop for Agents and Supervisors

CTI OS is a client of CTI Server. It has a single all-events connection to Cisco CTI Server. In turn, CTI OS accepts client connections using session, agent, and call interfaces. These interfaces are implemented in .NET, COM, Java, C++, and C, allowing for a wide range of application development uses. The interfaces are used for call control, to access data values, and to receive event notifications.

For complete and current information about the number of agents supported for CTI OS and other hardware configurations, see the *Cisco Intelligent Contact Management Software Release 7.0(0) Bill of Materials (BOM)*. The ICM BOM is available at: http://www.cisco.com/univercd/cc/td/doc/product/icm/index.htm.

For new installations, Cisco recommends the CTI OS Server be co-resident with the PG.

For more information on CTI OS, refer to the Cisco ICM Software CTI OS document set.

CTI Server Client Application Models

You can use either of two client models to integrate call center applications with the ICM: *agent workstation* and *CTI Bridge*.

Agent Workstation (Desktop) Application

In the agent workstation model, the client is an application running on a personal computer on an agent's desktop. This client is interested in the call data and call events related to a single agent teleset. The agent workstation application might also be interested in agent state changes.

Typically, when the agent workstation application is informed of an incoming call, it will likely use the call data collected by the ICM system to retrieve caller-specific data from a database. This data is presented on the agent workstation screen at approximately the same time that the incoming call is connected to the agent.

While handling the call, the agent may wish to update some of the call data. For example, an agent who is processing an insurance claim may make some adjustments to the call data; an update ensures that the changes are not lost before the call is transferred to a second agent.

Upon completion of the call, the client may be used by the agent to add call-specific wrap-up information to the Termination_Call_Detail record logged in the ICM central database. This wrap-up data may be a key value that can help locate more detailed transaction information in some other database. If the agent should conference with or transfer the call to another agent on the same ACD with a CTI client workstation, then that agent's CTI client also receives the incoming

call data, including any updates made by the first agent. If the transfer or conference involves an agent on another ACD, the call data is provided to the remote CTI client if a translation route is used.

CTI Bridge (All Events) Application

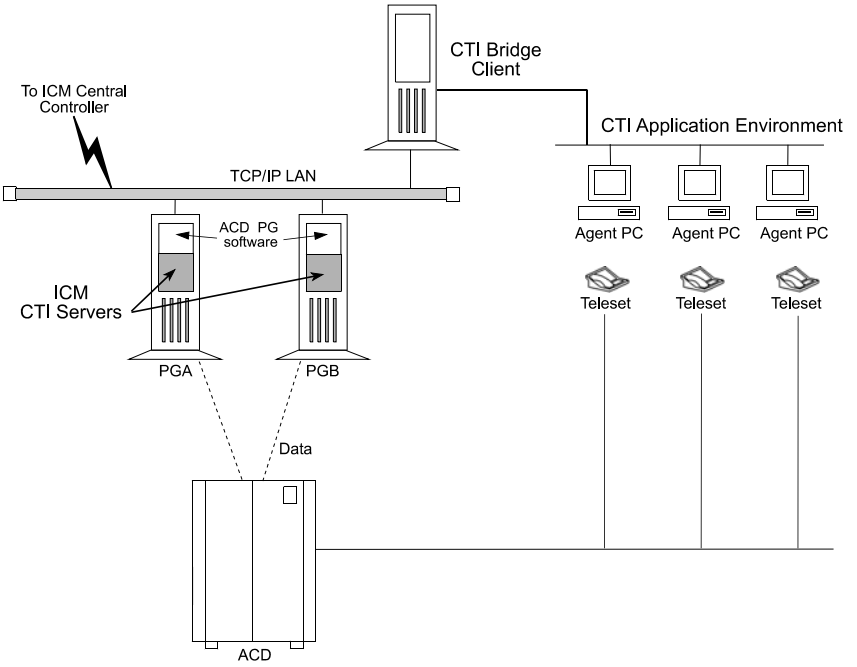
CTI Bridge applications are interested in all call and agent state events that are occurring on the ACD, unlike agent workstation applications that are interested only in the events associated with a particular teleset. The CTI Bridge application is a user-written program that converts or adapts some or all of the CTI Server messages into another format; a single CTI Bridge application provides such services for multiple agent desktops. The CTI Bridge application can be designed to interface with CTI Servers or similar applications on systems that are already in use in the call center.

Some examples of CTI Bridge applications include:

- Message converter applications. For example, an application may convert the CTI Server message set to the message set of a foreign telephony server.
- Server-to-server communication applications. For example, an application may enable the CTI Server to speak directly to a help desk application's middle tier server.

In a CTI Bridge configuration, a CTI Bridge application provides the connection between an existing desktop CTI application and the ICM (see Figure 6-4).

Figure 6-4 CTI Bridge Model



Note All of the functionality found in the agent workstation (desktop) model is also available in the CTI Bridge application model. However, the CTI Bridge application must be written to support this functionality.

CTI Server Network and Database Planning

Some pre-installation planning is necessary to prepare your CTI desktop and network environment for the introduction of a CTI Server.

Review the Desktop Network Environment

The machine running CTI Server connects to the CTI desktop environment via an Ethernet LAN. Therefore, the CTI desktop environment must reside on an Ethernet LAN. Other networks, such as Token-Ring, may require additional network hardware if they are to be connected to a CTI Server.

Review Network Security Issues

You need to be sure that the CTI desktop environment IP routing scheme is compatible with the ICM system and CTI Server. For example, you might currently have a firewall set up on the CTI environment LAN. If there is a firewall, you may need to change your system access setup or network configuration.

Address Desktop Software Roll-out and Distribution Issues

If you are going to be installing the CTI OS or CTI Desktop software components on multiple desktops, you need to create a distribution strategy. For example, you may decide to place the software on a centralized server and allow appropriate desktops from throughout the enterprise to download the software. In addition, if you use this strategy and will be installing software across distributed sites, you must ensure that all sites have access to the centralized server.

Select a Well-known Port for CTI Server

A well-known port number identifies CTI Server as an application running in your intranet. All CTI clients, as well as the system administrator, need to be aware of this well-known port number. If you do not want to use CTI Server's default port numbering scheme, you can choose a well-known port number that fits into your overall network environment. ICM Setup allows you to override the default port settings used to install the CTI Server PGs.

Plan a Fail-over Strategy for CTI Clients

Cisco CTI includes automatic fail-over and recovery mechanisms. Ensure that each CTI client has a clear and established network path to a CTI Server in case of a fail-over. For example, you might plan for each CTI client to have access to local and remote CTI Servers.

Develop a Database Strategy

You might have CTI applications that perform database queries to retrieve customer information for use in call processing. Some CTI applications might acquire database records “pre-call” (that is, before the call arrives at an agent’s desktop). Other applications might query a database immediately after the call arrives at the agent’s deskset. Plan a strategy for executing database queries in the most efficient and timely manner possible.

CTI Server Message Traffic

The CTI Server makes call data available to applications in real time. To accomplish this task, the CTI Server process responds to requests from clients and originates unsolicited messages. All messages share a common message header and use the same set of data types.

Table 6-1 groups the messages into broad categories based on the nature of the message data.

Table 6-1 CTI Server Message Categories

Category	Description
Session Management	Messages related to the establishment and maintenance of a client connection to the CTI Server. These messages typically happen at client startup, shutdown, and during auto-recovery.
Miscellaneous	Messages related to system-level events on the PG (for example, peripheral off-line, loss of PG-to-Central Controller communications).

Table 6-1 CTI Server Message Categories

Call Events	Messages related to call state changes.
Agent Events	Messages related to agent state changes.
Call Data Update	Messages related to CTI client modification of call data.
Client Control	Messages related to the direct control of agent state (for example, login, logout) as well as control of inbound and outbound calls.

CTI Server imposes varying degrees of message traffic against the PG based on the specific call center and CTI application environment in which it is deployed. Document a typical call scenario in your CTI application environment, prepare for adequate bandwidth, and order the proper server platform.

Note For a description of the session management messages, see the latest version of the *Cisco ICM Software CTI Server Message Reference Guide.*

Documenting a Typical Call Scenario

To estimate CTI Server message traffic, document a typical call scenario in your CTI application environment. The goal of this exercise is to account for all types of potential message traffic in the link between the CTI Server and the CTI application environment.

For example, a typical call might be handled as follows:

- The call is pre-routed.
- The call receives a call treatment such as a request to set call data.
- Next, maybe a simple call release, hold, transfer, or post-route request takes place.
- During this time an agent state may have changed (for example, from ready to work ready).

Estimating Required Bandwidth

You need to ensure that you have enough bandwidth in the datacom connection to handle the message traffic between the CTI Server and the CTI application environment. For example, are you sure that a 56-Kbps connection will be adequate for your environment?

The call scenario process helps you to estimate the message load and calculate how much bandwidth is required in the link between the CTI Server and the CTI application environment (for example, 56K, 256K, or more).

Choosing the CTI Server Platform

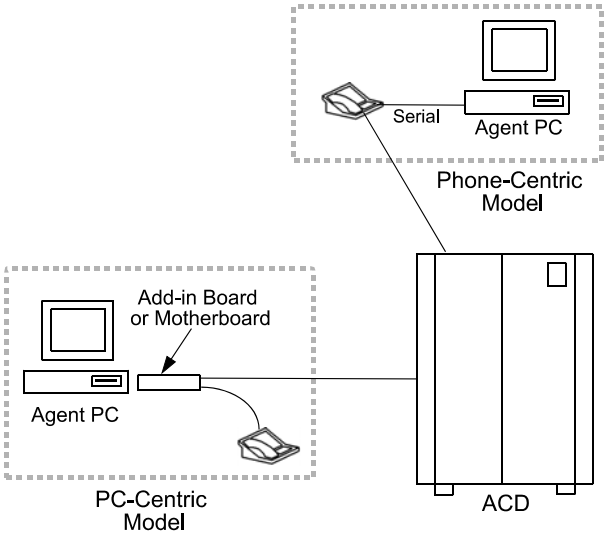
You also need to ensure that the CTI Server platform has adequate CPU processing speed and RAM to handle the message activity. You may require a high-end Cisco CTI Server/PG platform for the CTI Server.

Third-Party Call Control

The term *call control* refers to the ability of an application that is external to the ACD to programmatically control a telephone call. For example, a CTI application might put a call on hold, transfer the call, or hang up the call.

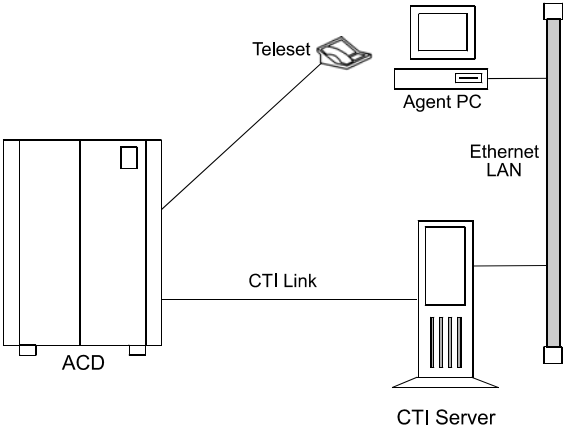
With *first-party call control*, the CTI application can control only the teleset that is physically connected to the computer running the CTI application. First-party call control requires a physical connection between the computer and the telephone and other add-on hardware (see Figure 6-5).

Figure 6-5 Desktop First-Party Call Control



CTI Server products support *third-party call control*. Any call control initiated outside the ACD/teleset domain is referred to as *third-party*. With third-party call control, there is no physical connection between the computer and the teleset (see Figure 6-6).

Figure 6-6 Desktop Third-Party Call Control



The desktop CTI application communicates with the Cisco CTI Server over a LAN. The CTI Server in turn communicates with the ACD to send call control requests. In this model, the CTI application is not bound to any particular teleset. The CTI application can control **any** teleset connected to the ACD and CTI Server.

Note Most, but not all, ACDs support third-party call control.

Depending on the specific ACD, the client application can perform all or most of the following telephony functions:

- Answer/Hang up
- Agent Login and Wrap-up data
- Consultative/Blind Conference
- Consultative/Blind Transfer
- Generate DTMF tones
- Get/Set Agent states
- Get/Set ICM call data (ANI, DNIS, CED, UUI, call vars)
- Hold/Unhold/Swap Hold
- Make a call

- Redirect

ACD Support for Client and Third-Party Call Control

Different peripheral types implement and support varying levels of CTI functionality. For example, a different set of client control requests and call event types may be available depending on the peripheral type. In addition, there may be other CTI-related restrictions and implementation differences based on the type of peripheral. You need to take these differences into account when you write a CTI client application that will interface with third-party switches and devices. For example,

- The Rockwell Galaxy does not have CTI Server support.
- The Siemens Rolm 9751 CBX does not have CTI Server support, but does support screen-pop applications.

As part of CTI pre-installation planning, you need to review ACD support for client control and third-party call control.

CHAPTER 7

IVR Planning

Cisco provides an option for running an interface to Interactive Voice Response (IVR) systems. The IVR interface software allows IVRs to take advantage of ICM call routing features. For example, an IVR can use Post-Routing capabilities to select targets for calls it needs to transfer.

The IVR interface software runs as a process on a standard PG hardware platform. It allows the ICM to route calls to targets on an IVR and collect data from an IVR for use in call routing, real-time monitoring, and historical reporting.

The IVR interface is not specific to a particular IVR system or manufacturer. It is based on an open IVR model. Many IVR systems support Cisco's Open IVR Interface Specification, including Cisco Customer Voice Portal (CVP). For a list of IVRs that support this interface, contact your Cisco representative.

To plan for this IVR option:

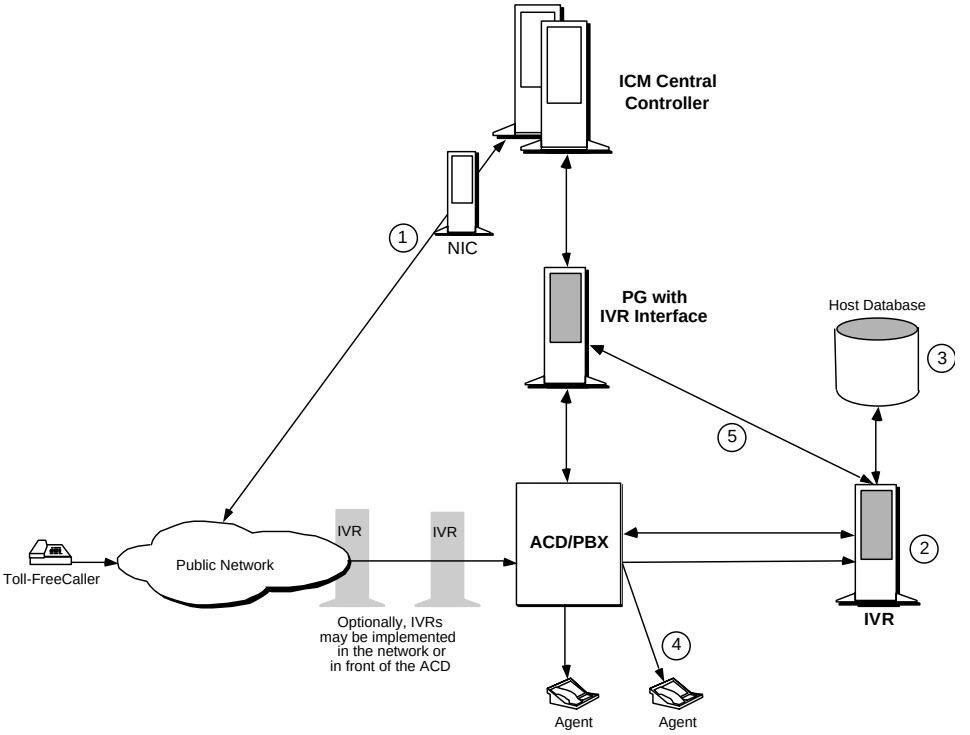
- Review the options for integrating IVRs into the ICM system.
- Determine if any IVR programming or application development is necessary.
- Review the Peripheral Gateway platform requirements.

Reviewing IVR Configuration Options

IVRs can be located at the customer's call center site or in the IXC network. At the call center, the IVR might be connected on the network side of the ACD or "behind" the ACD. In the IXC network, the IVR may be offered as a service by the network provider.

In an ICM configuration that includes an IVR, the ACD is configured so that it can send calls to the IVR. Figure 7-1 shows some of the capabilities of the IVR in an ICM system.

Figure 7-1 IVR/ICM Integration Overview



1. In most ICM/IVR configurations, calls continued to be Pre-Routed by the ICM system.
2. When a call is routed to an IVR, the IVR answers the call and interacts with the caller.
3. The IVR may access a host system (for example, a customer profile database) to retrieve more information to help process the call.

4. Often, the caller can get all the information he or she needs through simple interaction with the IVR. In some cases, however, the IVR needs to transfer the caller to an agent or another call resource.
5. In some configurations, the IVR can invoke Post-Routing to select an agent from anywhere in the call center enterprise. To do this, the IVR sends a route request to the PG. The PG forwards the request to the ICM system, which responds with a new destination for the call. The PG returns the new destination to the IVR. The IVR then signals the ACD or network to send the call to the specified destination.

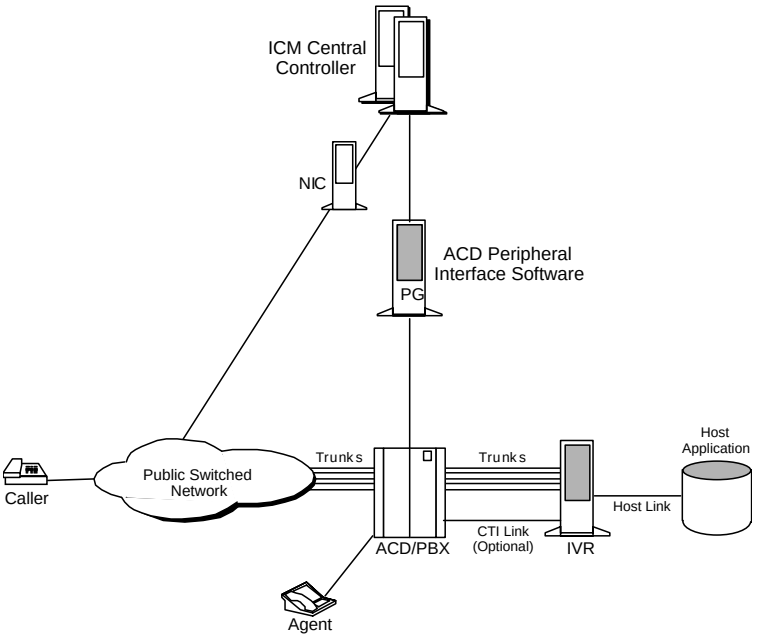
The way in which an IVR is integrated into the ICM system affects the flow of call processing and determines the types of data the ICM can collect from the IVR. For example, an IVR that has a direct interface to an IVR PG (as shown in Figure 7-1) provides the ICM system with data that can be used in call routing, monitoring, and reporting. A configuration in which the IVR has an interface only to the ACD has more limited capabilities.

You can integrate IVRs into the ICM system in several different ways. Each integration option provides a different set of ICM functionality.

Configuration with an ACD PG Only

In this option, the IVR is attached only to the ACD. The ACD, in turn, is attached to a PG. The PG is running the Cisco peripheral interface software (PG software process) required to communicate with the specific type of ACD. There is no direct interface between the IVR and the ICM system (in other words, an IVR process is not implemented). See Figure 7-2.

Figure 7-2 Configuration With an ACD PG Only



In this configuration, the IVR must be connected to an ACD that supports Post-Routing. The IVR and ACD cooperate so that calls can be transferred from the IVR to the ACD, and then post-routed by the ACD via the PG.

The PG in this configuration has only the ACD peripheral interface software. It does not have the IVR interface software. Therefore, it does not provide the IVR with full access to the ICM Post-Routing.

In Figure 7-2, the IVR can handle a call in two different ways:

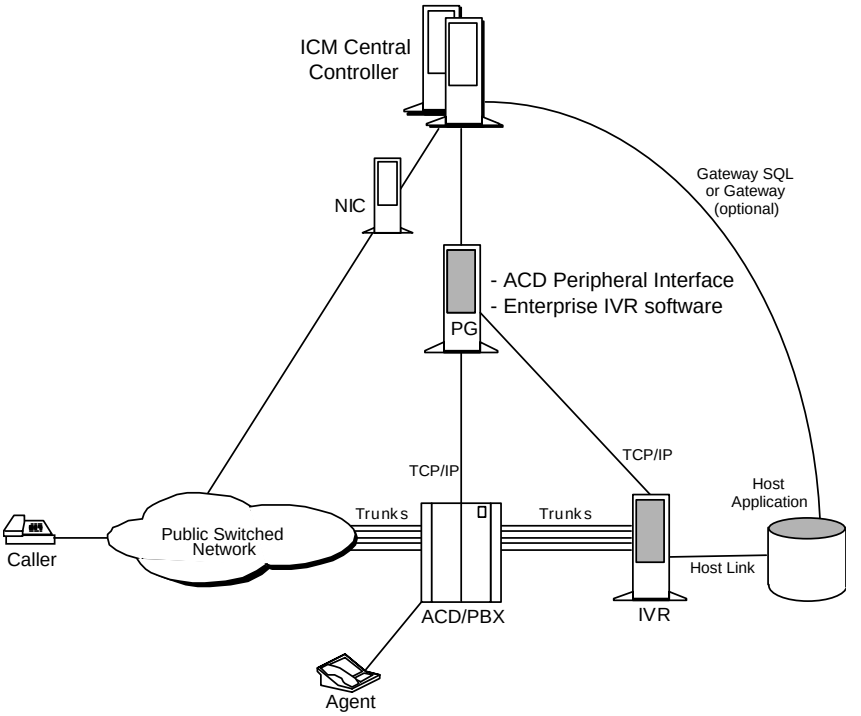
- The IVR can handle the call to completion (for example, if the caller wanted current billing information and needed no further assistance, the IVR could complete the call.)
- The IVR can transfer the call to the ACD. The ACD could then use the PG to post-route the call.

Configuration with IVR and ACD PGs

This configuration option is similar to the previous option except that an IVR process and host link to the IVR are implemented. In addition to monitoring the ACD for real-time agent and call event data, the PG can monitor the IVR for call and application data and control the movement of calls into and out of the IVR. The IVR data is also forwarded to the CallRouter for use in call routing and reporting.

As shown in Figure 7-3, the IVR and ACD interface software can be installed on the same PG hardware platform.

Figure 7-3 Configuration with IVR and ACD PGs

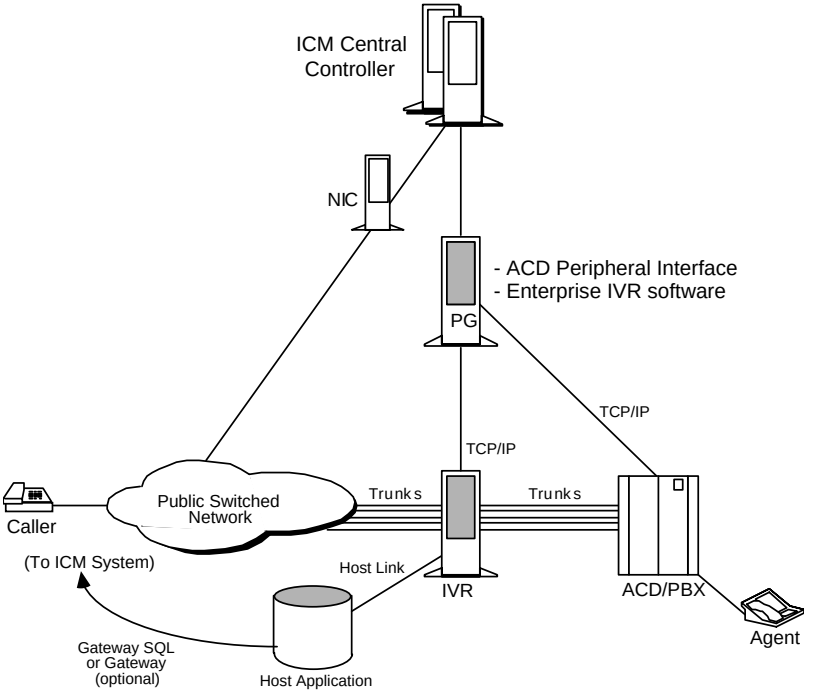


Network-Side IVR with IVR and ACD PGs

The next configuration option places the IVR on the network side of the ACD. In this configuration, the IVR is connected to the network and potentially to the ACD. The IVR can receive calls directly from the network without ACD involvement. These calls might be pre-routed by the ICM, but this is not a requirement.

The IVR may also receive calls from the ACD (for example, when an agent transfers a call to the IVR). Again, these calls may or may not have been routed by the ICM. Figure 7-4 shows an example.

Figure 7-4 Network-Side IVR with IVR and ACD PGs



Once the IVR receives a call, it may handle the call to completion or transfer the call off-IVR for subsequent handling. The IVR may also use Post-Routing to select a target for the transfer. If the IVR transfers the call to an ACD, the IVR may or may not request routing instructions from the ICM.

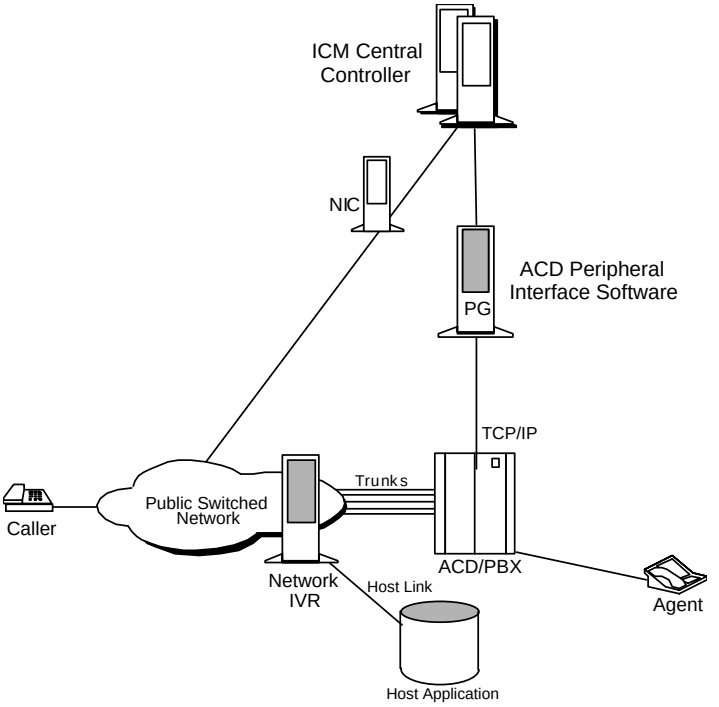
This configuration is different from the earlier options in several ways:

- The IVR is connected to both the network and the ACD.
- A call that originated in the network can be transferred to the local ACD by tandem connecting a second trunk with the original trunk. A network call can be transferred to a remote ACD either by connecting a second trunk in tandem with the original trunk, or by invoking a “call take-back” feature in the network.
- A call that originated at the local ACD can be transferred to any target using Post-Routing.

In-Network IVR with an ACD PG Only

In this configuration, the IVR is provided as a service by the network service provider. The PG monitors the ACD and forwards data to the ICM system for use in call routing and reporting (Figure 7-5).

Figure 7-5 In-Network IVR with ACD PG Only

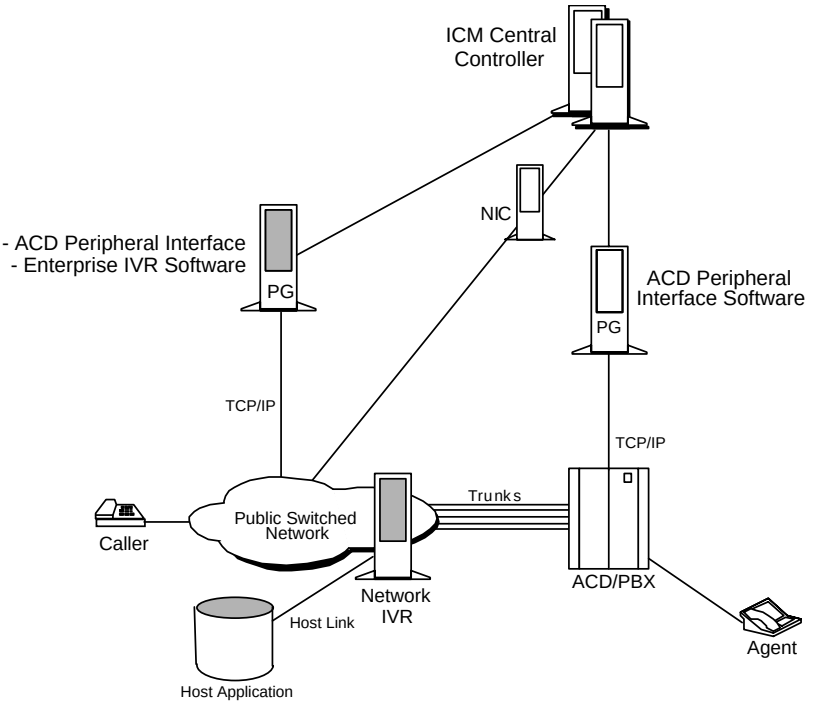


When the caller dials the toll-free number, the ICM instructs the network to send the call to the network-based IVR. The network IVR then prompts the caller for input. If the caller requires additional information (such as speaking to an agent), the IVR dials a "hidden" toll-free number. The network then queries the ICM system for a routing destination. The ICM system returns a routing label and the network sends the call to the specified ACD and DNIS. An agent at the ACD may handle the call to completion or transfer the call for subsequent handling.

In-Network IVR with IVR and ACD PGs

In this configuration, the IVR is provided as a service by the network provider. The network sends all calls to a destination IVR. The IVR is responsible for handling a call to completion or transferring the call to another resource (for example, an agent at an ACD). See Figure 7-6.

Figure 7-6 In-Network IVR with IVR and ACD PGs

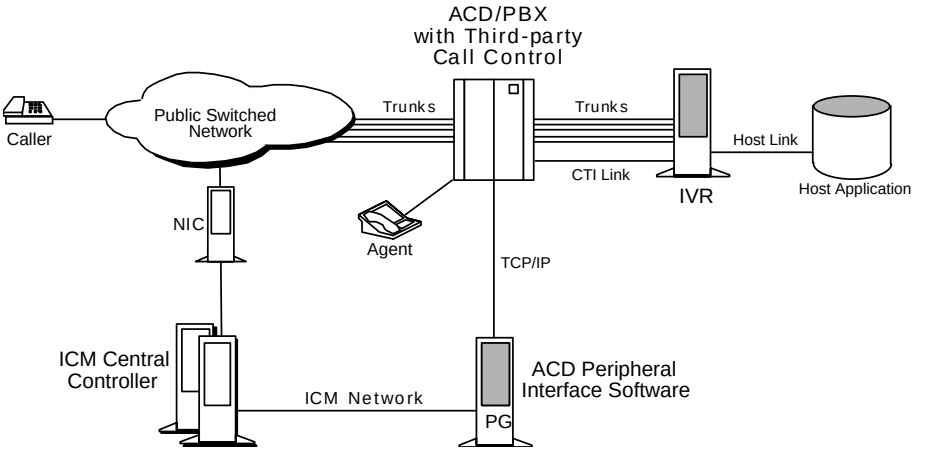


IVR Transfer Routing Using Third-Party Call Control

In this configuration, the IVR invokes a transfer request to transfer a call to the ACD. The IVR uses a CTI link to the ACD which allows it to set variables in the transfer request (for example, CED, DNIS, CLID, Social Security number, or

account number). This configuration is viable only if the IVR is attached to an ACD that supports Post-Routing. Figure 7-7 provides an example of this configuration.

Figure 7-7 IVR Transfer Routing with Third-Party Call Control



When the ACD receives the transfer from the IVR, it makes a route request to the PG in order to conduct an enterprise-wide agent selection. The PG routing client sends a route request to the CallRouter. The CallRouter passes a response to the PG and on to the ACD. The ACD then transfers the call to the specified destination.

IVR Programming and Application Development

The Open IVR Interface allows the ICM to see some level of IVR application-specific data (for example, menu selections). An IVR application developer can use the Open IVR Interface to implement call routing (routing client) and monitoring capabilities.

The IVR *routing client* allows the IVR to send route requests to the ICM via the PG. These requests can include data variables such as Customer ID and Menu Selections. The ICM system can use this data to instruct the IVR where to send

the call. The IVR *monitoring interface* allows the application developer to send IVR port and application activity data to the ICM system for use in call routing and reporting.

IVR Peripheral Gateway

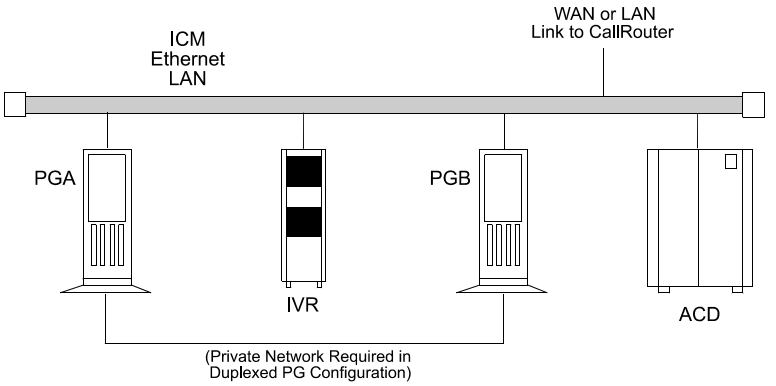
The Cisco IVR interface software runs as a logical PG on a standard Peripheral Gateway hardware platform. A single PG hardware platform can support a maximum of two logical PGs. A single PG platform might run one or two IVR PGs. Or it might run an IVR PG and an ACD PG. For example, you could have a PG hardware platform that runs an Aspect CallCenter PG and an IVR PG. A logical PG can have PIMs for one type of ACD, plus an IVR PIM. The hardware platform must have sufficient capacity to handle the aggregate load from all attached peripherals.

Note The 7.0 multi-instance CTIOS configuration supports up to ten logical PGs on a single PG platform. These PGs are configured as separate customer instances.

In Figure 7-8, a duplexed set of PGs serve both an IVR system and an ACD system. These PGs would be equipped with both ACD and IVR interface software.

Note The IVR can also be on a System IPCC PG or a IPCC Generic PG.

Figure 7-8 IVR-to-PG Interface



The IVR Peripheral Gateway can run in simplexed or duplexed configurations. In a duplexed configuration, only one side of the PG has an active connection to the IVR at a time.

Note When multiple IVRs are connected to a PG, IVRs that use poll-based monitoring **may not** be mixed with IVRs using any other kind of monitoring.

For information on how IVR systems fit into the ICM data communications networks, see Chapter 11, "Determining the Datacom Requirements".

CHAPTER 8

ICM Application Gateway and ICM Gateway SQL Planning

The ICM Application Gateway and ICM Gateway SQL options allow ICM to integrate external contact center applications into the Intelligent Contact Management enterprise. Each of these options involves some pre-installation planning. For example, you may need to prepare host systems and databases; review fault tolerance issues; and, in the case of ICM Gateway SQL, plan for data transfer.

ICM Application Gateway Planning

The ICM Application Gateway option allows the ICM system to interface with **any** external call center application. Within the ICM software, the ICM Application Gateway feature is implemented as a node in a call routing script. You add a *Gateway node* to a script to instruct the ICM to execute an external application. This allows the script to evaluate responses from an external application. The ICM can then base subsequent routing decisions on the results produced by the application.

A typical ICM Application Gateway application might return a variable to the CallRouter that identifies the caller as having a certain type of account. The script could then use this information to control where and how the call is routed. Optionally, the ICM software can pass the retrieved information to the site that is receiving the call. In this case, certain data such as account numbers, dates, billing phone numbers, and addresses are passed along with the call to an answering resource.

Preparing the Host System

To prepare for the ICM Application Gateway option, you must set up the host system to communicate with the ICM system. This involves configuring the host application to listen to a socket on the target ICM machine. You also need to configure a name and port number to be used to connect the host system to the ICM central database. These steps are performed at system installation. However, you can begin preparing the host applications ahead of time.

During system installation, when connectivity between the ICM system and host system is established, you need to identify the host system to be queried by entering data in the Application_Gateway table.

Fault Tolerance

You can configure access to a single host application or duplicate host applications. In a **single host** configuration, configure the same host for both CallRouters (Side A and Side B). The single host method provides no protection against host failures; however, it does protect against connection failures.

In order to achieve a higher level of fault tolerance in an ICM Application Gateway application, you can connect **duplicate host** applications to the CallRouter. For example, the Side A and Side B CallRouters can each manage a connection to one of the duplicated host applications. Each time a script initiates a request, both CallRouters query their corresponding host. The CallRouters use the response from the host that responds first. This method is highly reliable. Even if a host or a connection fails, all query requests are satisfied.

ICM Gateway SQL Planning

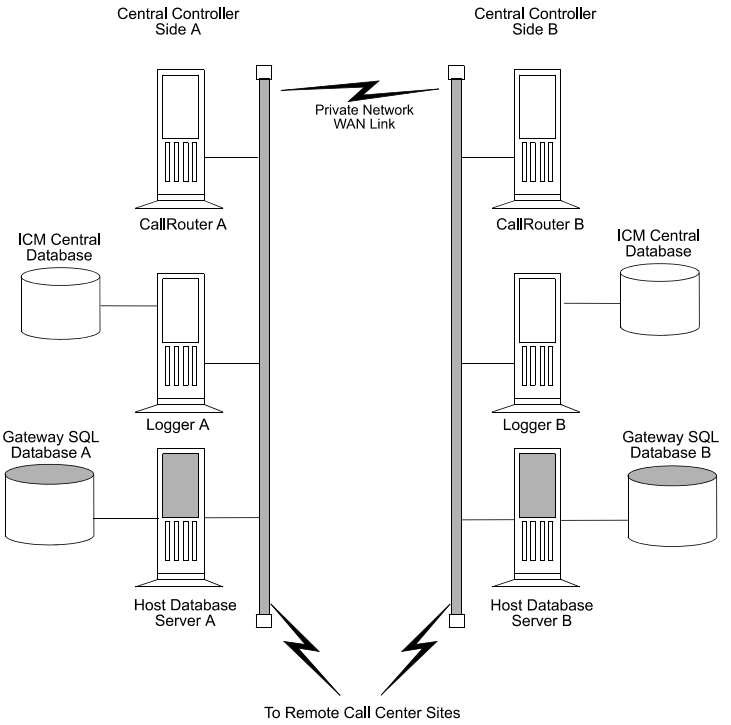
The ICM Gateway SQL option allows the CallRouter to query an external SQL Server database and use the data in call routing. If you are going to use the Gateway SQL option, you need to review several pre-installation planning issues:

- First, ICM Gateway SQL requires an additional Database Server hardware platform.
- You also need to be aware of the tasks involved in setting up the external host database and populating it with the data you want to use in call routing.

Database Server Platform

The ICM Gateway SQL option requires a host database server. The host database server can be duplexed in order to maintain ICM fault tolerance. A duplexed ICM Gateway SQL system requires two identical host database server platforms. Each host database server resides on the same LAN segment as its corresponding ICM CallRouter. Figure 8-1 shows a duplexed ICM system that has a duplexed ICM Gateway SQL host database server.

Figure 8-1 ICM Gateway SQL Duplexed Configuration



Planning for Data Transfer

To prepare an ICM system for ICM Gateway SQL, you need to make several decisions:

- Decide which data you want to use in the external database. For example, will you be using:
  - Customer records?
  - Account information?
  - Other types of data?
- Decide where the data is coming from:
  - Another database?
  - A flat file?
  - Other sources?
- Make a plan to transfer the data to the external database:
  - What type of media will you use to transfer the data (tape, disk, network)?
  - Will the transferred data be in a certain format (comma-separated values, text file, SQL Server syntax)?

Configuration Overview

For ICM Gateway SQL, you must set up and configure one or more host databases to function with the ICM system.

- **Choosing a host database server platform**. The host database server must have adequate processing power and disk space. Cisco can provide you with specifications for basic and high-end host database server platforms.
- **Setting up the host database**. This includes:
  - Installing SQL Server
  - Creating a database on the host database server platform
  - Defining fields and indexes
  - Setting up permissions and replication

- **Transferring data from a data source**. This task involves transferring data to populate the database with the data to be used in call routing (for example, you might want to transfer customer records to the database).
- **Configuring the ICM system to access the host database**. This task involves setting up user names and passwords that the ICM system can use to access the data in the host database.
- **Writing test scripts to test the ICM Gateway SQL option**. This task involves monitoring test scripts that use the Script Editor DB Lookup node. The monitoring results are captured and stored in the Route_Call_Detail table to validate that the ICM Gateway SQL feature is functioning.

CHAPTER 9

ICM Product Options

This chapter provides a brief mention of various ICM product options.

CTI

The various Cisco CTI options are discussed in Chapter 6, "CTI Planning".

IVR

Cisco IVR integration is discussed in Chapter 7, "IVR Planning".

ICM Application Gateway and ICM Gateway SQL

These options are discussed in Chapter 8, "ICM Application Gateway and ICM Gateway SQL Planning".

Internet Script Editor

Internet Script Editor is a web-based application you can use to work with routing and administration scripts. It provides the same functionality as the ICM Script Editor software, without the need for a full Admin Workstation (AW).

WebView

Cisco WebView is the reporting and event monitoring tool for ICM software. For more information on WebView, see the WebView document set.

Outbound Option

Cisco ICM Outbound Option provides outbound dialing functionality that can be "blended" with the existing inbound capabilities of ICM software. For more information on this option, see the Outbound Option document set.

Cisco ICM Web Collaboration Option

This option provides Web collaboration between a caller and a contact center agent. It allows agents to share information with customers over the Web, such as Web pages, forms, and applications, while at the same time conducting a voice conversation or a text chat.

This option consists of Cisco Collaboration Server, Cisco Dynamic Content Adapter (DCA), and Cisco Media Blender. For more information on this option, see the Web Collaboration Option document set.

Cisco ICM E-Mail Manager Option

Cisco E-Mail Manager manages high volumes of customer inquiries submitted to company e-mail boxes or a Web site. For more information on this option, see the E-Mail Manager Option document set.

Cisco Customer Voice Portal (CVP)

Note Previous to the 3.0 release, the CVP product was called Internet Service Node (CVP)

Cisco CVP is a Web-based platform that provides carrier-class Interactive Voice Response (IVR) and IP switching services over Voice Over IP (VoIP) networks. For more information on this product, see the Customer Voice Portal document set.

CHAPTER 10

Planning for ICM Platforms

Once you have the system sizing recommendations, you can begin to order the appropriate hardware configuration. First, however, you must determine how many ICM nodes you will need.

The number of servers required in an ICM system depends on the configuration of the Central Controller, PGs, NICs, and other nodes. For example, a duplexed Central Controller configuration requires additional servers because the CallRouter and Logger are duplicated.

Determining the Number of Servers Required

Table 10-1 shows how to determine the number of servers required in your system. The counts of servers in this example are based on an ICM configuration that has the following characteristics:

- The ICM system has a duplexed, geographically distributed Central Controller (in other words, each central site has a CallRouter and a Logger).
- One side of the Central Controller (Central Site 1) is located at a call center and consequently has a PG to serve one or more ACDs. The PG is duplexed (two servers) for fault tolerance.
- This ICM installation has three remote call center sites and two Admin sites.

Table 10-1 Sample Server Requirements

Sites	Node Types					
	CallRtr	Lgr	Call/Lgr	DB Server[1]	PG[2]	AW with HDS
Central Site 1	1	1	–	–	2	1
Central Site 2[3]	1	1	–	–	–	1
Remote Call Center 1	----------	------	----------	----------	2	–
Remote Call Center 2	----------	------	----------	----------	2	–
Remote Call Center 3	----------	------	----------	----------	2	–
Admin Site 1	----------	------	----------	----------	---------	1
Admin Site 2	----------	------	----------	----------	---------	1
Total Nodes:	2	2	–	–	8	4
Key: --------- These servers are not installed at this type of site. – Not selected as an option in this particular configuration.						

1. Required only in ICM Gateway SQL configurations.
2. Only installed at the central site if that site also serves as a call center or you are using the remote ACD option.
3. A second central site is not required in duplexed-collocated Central Controller configurations.

ICM Platform Considerations

The ICM software runs on Intel Xeon machines. The operating system for the ICM release 7.0 software is Microsoft Windows Server 2003. Windows 2000 Server will be supported for upgrades. The *Cisco Enterprise Contact Routing Bill of Materials* (BOM) contains information on server configurations and provides examples of supported server platforms. Refer to the BOM for all ICM Platform information.

Also, for release 7.0, Cisco supports only SQL 2000.

Processor Utilization

As a general rule for all ICM nodes, processor utilization should be kept below 60 percent at the maximum expected call load on the system. This is needed in order to smooth out call request "spikes" as well as to allow enough reserve capacity to perform activities such as re-synchronization and background cleanup. Non-ICM software can make up a part of the 60 percent maximum load. The processor utilization figure (60 percent) covers all software running on the platform.

In addition to the utilization requirement, it is necessary that no software on the system run at a priority equal to or higher than the ICM software for more than 100 milliseconds in uninterrupted bursts. In other words, the ICM software needs to run on the system at least as frequently as once every 100 milliseconds. This is usually not a problem unless device drivers or other kernel-level software is installed, or process/thread priorities have changed incorrectly.

Paging Requirements

The most time-critical component of the ICM system, the CallRouter node, must not be delayed due to disk I/O (that is, paging). The only disk I/O that should be occurring on ICM machines is for log file writes and database I/O. The database I/Os occur on Logger and Distributor AW machines. The simple rule is to provide enough main memory so that the entire working sets of critical processes remain in memory.

For complete and current information about RAM and other platform requirements, see the *Cisco Intelligent Contact Management Software Release 7.0(0) Bill of Materials (BOM)*. The ICM BOM is available at: http://www.cisco.com/univercd/cc/td/doc/product/icm/index.htm.

The database platforms (Loggers, Distributor AWs, and ICM Gateway SQL machines) should have enough main memory so that all first level index pages are kept in main memory cache.

Logger Expansion

The Logger platform you order may include a combination of internal and external SCSI hard drives. As your call center enterprise grows, your database requirements will typically grow as well. You might have more services, skill groups, and routes in your configuration, and you might be routing more calls each day. This will result in more historical data being stored in the central database.

When your database requirements change, contact your ICM software support provider to have the storage capacity of the central database increased.

Note Refer to the The *Cisco Enterprise Contact Routing Bill of Materials* (BOM) for more information on data storage specifications.

They can allocate more database space after your system is installed by:

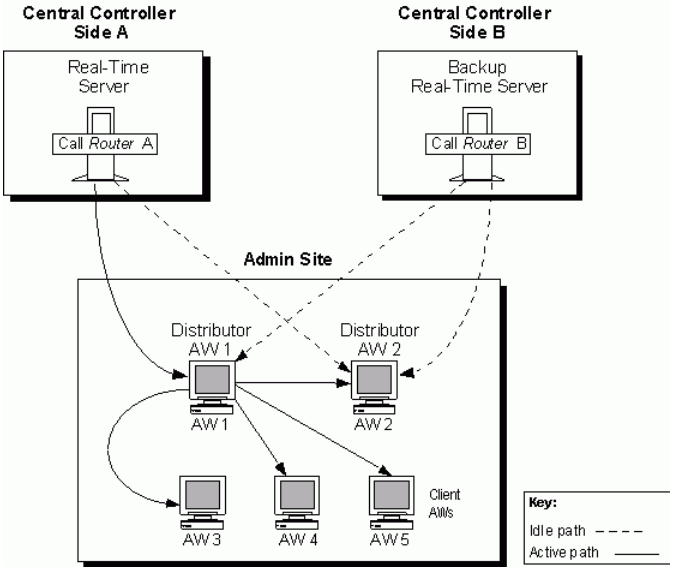
- Remotely adding database space (if current disk space allows).
- Installing “hot-plugable” disk drives and configuring the disks while the system is running.

Note The *Cisco ICM Enterprise Edition Administration Guide* provides information for managing database space once the ICM system is installed and running.

Planning for Distributor AWs

To allow users to monitor current call center activity, the ICM system forwards real-time data to Distributor Admin Workstations at selected sites throughout the call center enterprise. Figure 10-1 illustrates the real-time architecture of the ICM system.

Figure 10-1 Real-Time Data Architecture



Real-time call and agent group status data arrives at the Central Controller from the Peripheral Gateways, which are constantly monitoring activity at each call center. The CallRouter acts as the *real-time server*. The CallRouter for the other side of the Central Controller acts as a back-up real-time server.

The CallRouter is responsible for providing real-time data to one or more *Distributor AWs* at each admin site. Client AWs at the site receive their real-time data through a connection to a Distributor AW. These AWs are called *Client AWs* because they do not have the local database and Distributor processes required to receive real-time data directly from the CallRouter.

Distributors and Admin Sites

Admin Workstations can be located with one or both sides of the Central Controller, at a call center, or at another site. Any site that contains AWs is referred to as an *admin site*. Each admin site requires at least one Distributor AW. Two Distributor AWs should be used (as shown in Figure 10-1) to provide fault tolerance in the real-time data distribution architecture.

The primary Distributor AW maintains an active connection to the real-time server through which it receives real-time data. The secondary Distributor AW also maintains connections to the real-time server; however, these connections remain idle until needed (for example, in cases where the primary Distributor AW is unavailable for some reason). In sites that have two Distributor AWs, the Client AWs are configured to automatically switch to a secondary Distributor AW if the first distributor becomes non-functional for any reason.

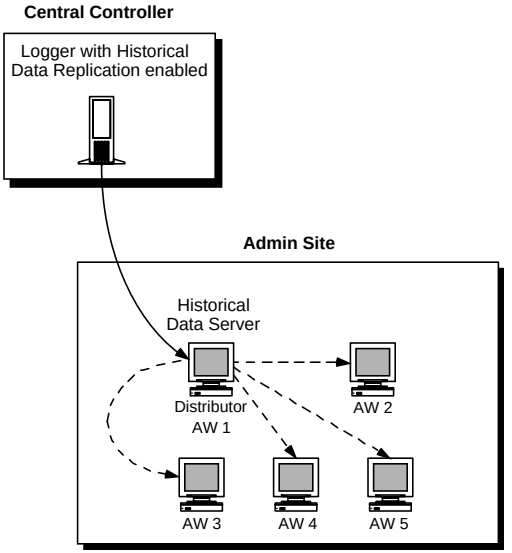
Distributor and Client AW Requirements

There is no set limit to how many Client AWs can be served by a Distributor AW. Refer to the *Cisco Enterprise Contact Routing Bill of Materials* (BOM) for information about requirements for Distributor and Client AWs.

Planning for Historical Data Servers

Historical data is stored both as individual call detail records and also rolled up and stored as interval records. A Distributor AW with a Historical Data Server (HDS) stores historical data that supports reporting queries. Admin Workstations at the site query historical data from the HDS rather than directly from the Logger (see Figure 10-2).

Figure 10-2 Historical Data Server Architecture



To set up a Historical Data Server, you must configure the Logger to perform historical data replication. You must also configure the real-time Distributor Admin Workstation to be an HDS. You can then create an HDS database on the real-time distributor.

Information in the real-time feed tells each client Admin Workstation where to obtain historical data. If the real-time distributor is a Historical Data Server, then it instructs its clients to get historical data from it. Otherwise, it instructs its clients to get historical data from the Logger.

Each Logger can support up to two HDS's. These servers can be configured either as two primary distributors or with one as a secondary distributor. If these systems are needed to support reporting requirements, review the "Primary/Secondary AW Deployment" section of the *WebView Installation and Administration Guide* to understand all of the factors for consideration before deciding the best deployment strategy for your organization. The same fault-tolerant strategy that applies to the real-time Distributor AW also applies to the HDS. That is, when the primary HDS fails, other Client Admin Workstations at the site automatically switch over to use the backup HDS.

HDS Features

The HDS eliminates the performance impact on the central database caused when multiple AWs need to access the central database to generate reports.

In systems that have multiple remote Distributor Admin Workstations, the HDS brings ICM historical reporting data closer to the end user.

Each HDS provides a set of database tables. You can set specific times for retaining data in these tables. These capabilities give you flexibility in setting up reporting capabilities on a site-by-site basis.

The Historical Data Server also provides:

- Greater flexibility in leveraging Internet applications.
- An open interface for data mining and data warehousing applications.
- The ability to host other database tables and have them work with the HDS.
- Improved security and data access capabilities.

The HDS Admin Workstation requires a high-end AW platform with a more powerful CPU, greater disk capacity, and more RAM. For complete and current information on HDS requirements, see the *Cisco Intelligent Contact Management Software Release 7.0(0) Bill of Materials* (BOM). The ICM BOM is available at: http://www.cisco.com/univercd/cc/td/doc/product/icm/index.htm

CHAPTER 11

Determining the Datacom Requirements

The ICM system needs highly reliable networks to ensure sufficient real-time responsiveness and fault tolerance. Because the ICM system is a mission-critical, fault-tolerant system, it must be able to respond quickly when a node goes off-line for any reason. Depending on the situation, the ICM system might need to switch communication paths or activate other nodes to keep the system running without interruption.

In addition to responding to node failures, the ICM system needs to perform diagnostics on failed nodes so they can be returned to service as soon as possible. Often, the ICM diagnostic procedures take place over a Wide Area Network (WAN).

The ICM system must also be able to respond to route requests from the Interexchange Carriers (IXCs) within a certain minimum time-out period. For example, the AT&T intelligent call processing network requires a response from the ICM system within 200 milliseconds of receiving a route request. In a geographically distributed ICM configuration, this means that the ICM system must perform communications between the NICs and CallRouters on both sides of the Central Controller and return a route response all within the 200 millisecond time-out period.

This chapter helps you to prepare network facilities for an ICM system installation. In this chapter, complete the following tasks:

- **Determine requirements for visible and private networking**. The ICM networks must meet certain minimum bandwidth and latency requirements.

- **Allocate IP addresses**. Assess the IP address requirements for ICM nodes at each site in the system.
- **Fill out IP address worksheets**. Use the worksheets in Chapter 13, "IP Address Worksheets" to assign IP addresses.
- **Order any additional network hardware**. To prepare the network facilities, you may need to order routers, bridges, or cabling.

This chapter also covers some of the options for configuring the ICM networks and integrating them with your existing networks.

ICM Sites

The ICM system consists of a number of computers, or nodes, which are typically located at more than one site. An ICM system can be distributed among anywhere from three to fifty sites or more. Each site might contain one or more nodes. The ICM system requires several networks to interconnect nodes within and among the sites.

ICM sites are of three basic types:

- **Central sites**. Contain one or both sides of the Central Controller (that is, the CallRouter and Logger) and possibly a separate Network Interface Controller. Central sites can also contain Admin Workstations and Peripheral Gateways.
- **Contact center sites**. Contain one or more Peripheral Gateways (PGs) and possibly Admin Workstations. Sites also support Agents, phone applications and CTI applications.
- **Admin sites**. Contain one or more Admin Workstations.

An ICM site might be a combination of any two or more of these. For example, a single location might be both a central site and a contact center site.

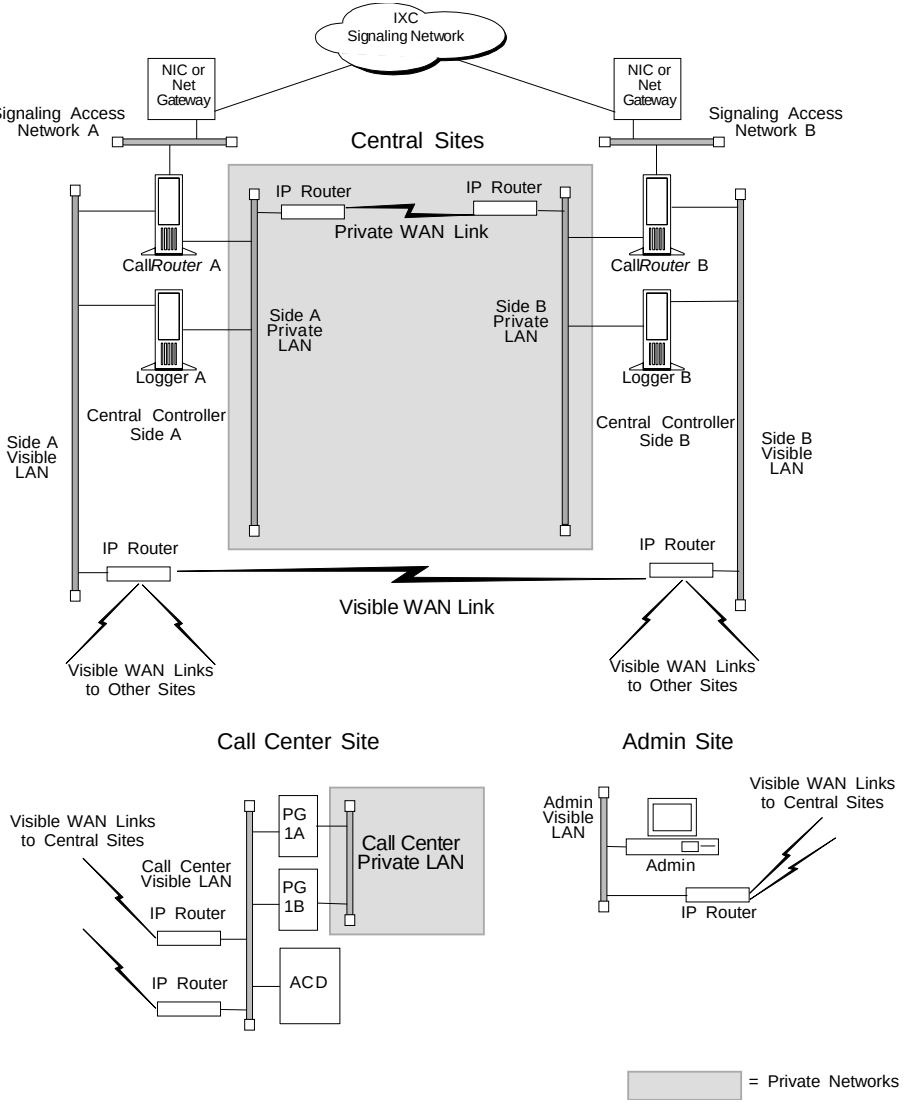
The ICM Networks

The ICM system uses three independent communications networks:

- **Private network**. This is a dedicated network that allows specific nodes to communicate with each other without outside interference. This network carries the data that is necessary to maintain and restore synchronization between the systems. The private network is not to be used for any other purpose.
- **Visible network**. This is a shared network that allows the Central Controller to communicate with local and remote nodes. It carries traffic between each side of the synchronized system and foreign systems. The visible network may also be used by the fault tolerance software as an alternate network to distinguish between node failures and network failures.
- **Signaling Access Network**. This network connects the ICM system to a carrier network or client network. When a SAN is implemented, the ICM system uses the SAN (not the private network) to communicate with the carrier network. Note that the Signalling Access Network in used only in hosted environments.

Figure 11-1 shows the two sides of the Central Controller, a contact center site, and an admin site. A private WAN links both sides of the duplexed Central Controller. A visible WAN links the contact center and admin sites to each side of the Central Controller. Nodes within each site are linked by a local area network (LAN).

Figure 11-1 ICM System Network Overview



In Figure 11-1, the two sides of the Central Controller are geographically separated. The wide area network connections in both the private and visible networks are referred to as *WAN links*. WAN links in the ICM system are typically high-availability provisioned circuits. These links must possess extremely low and extremely predictable latency characteristics. Therefore, some types of WAN service cannot be used for WAN links within the ICM system (for example, packet routing).

Private and Visible WAN Links

The two sides of the duplexed ICM Central Controller share a single private network and are linked via a *private WAN link*. They also share a visible network which connects the two sides via a *visible WAN link*. To ensure a high level of fault tolerance, the private WAN link and visible WAN links must be independent (that is, they must use different trunks and possibly even different service providers).

When the two sides of the Central Controller are co-located, the visible WAN link between the sites is not needed. The standard visible WAN links to remote contact center sites provide adequate connectivity between the two sides. In a co-located Central Controller configuration, the private network is implemented locally by using Ethernet switches.

Remote contact centers connect to each side of the Central Controller via the visible network. Each visible WAN link to a contact center must have adequate bandwidth to support PGs and AWs at the contact center (the bandwidth requirement varies greatly as the configuration changes, that is, the call load, the number of agents, etc.).

When a contact center is co-located with a side of the Central Controller, the PGs and AWs connect to the visible LAN on that side. The PGs and AWs connect to the other side of the Central Controller via a visible WAN link. In such a configuration, a direct visible WAN link between the sides of the Central Controller is required to ensure adequate connectivity between the two sides. LAN bridges may optionally be deployed to isolate PGs from the AW LAN segment and to enhance protection against LAN outages.

Note See the section titled Central Sites, page 11-22, for some examples of co-located Central Controller configurations.

Signaling Access Networking

The CallRouter machine connects to the IXC signaling network via the Signaling Access Network (SAN). A separate LAN interface card in the CallRouter is dedicated for use just by the SAN. The SAN connects the NICs on each side of the duplexed system to the IXC signaling network. In most cases, the NIC software runs on the CallRouter computer. For clarity, in Figure 11-1, the NIC is shown as a separate computer installed on the SAN.

A node called the ICM Network Gateway may also be installed on the SAN and used to interface to some SS7-based networks. The ICM Network Gateway is a dedicated machine that provides SS7 protocol handling services.

Local Area Networks

The ICM system uses Ethernet for local area network connectivity. The particular Ethernet topology used is immaterial from an architectural standpoint. However, the topology used may be relevant from a network or systems management perspective. Typically, UTP is used in the private, visible, and signaling access LANs.

The three networks (visible, private, and signaling) should be on separate LAN segments. This requires the use of three Ethernet cards in the CallRouter machine.

Network Bandwidth Requirements

The visible network bandwidth requirements for a typical ICM system are about 1,000 bytes of data per call over the networks that carry call data. For example, if a remote PG is managing 15 calls per second at a contact center site, it needs to transfer 15,000 bytes of data over the visible WAN to the central site every second (a total of 120,000 bits per second, ignoring packet overhead).

The bandwidth for the private WAN between the two sides of a duplexed Central Controller must support the total sustained call load for all ACD sites. In addition, bandwidth on this private WAN must provide some degree of burst resilience and enough reserve capacity to perform fault tolerant messaging and synchronization.

Table 11-1 summarizes the network circuit requirements for visible and private networks within the ICM system.

Table 11-1 Network Circuit Requirements

Network	Purpose	Facilities	Min. Bandwidth
Private WAN	Dedicated path that connects both sides of a duplexed, distributed ICM Central Controller.	T1	T1 dedicated
Visible WAN	Circuits that connect PGs and AWs at remote sites to each side of the ICM Central Controller.	Typically, a T1 or a fractional T1.	128-Kbps dedicated.[1]
Signaling Access Network	Local area network that connects the NIC to the IXC carrier network or client network.[2]	Ethernet Unshielded Twisted Pair (UTP).	100 Mbps
Visible and private LANs	Local area networks that connect ICM nodes at a central site and PGs and AWs at remote contact center sites. (See Figure 11-1 for examples.)	Ethernet Unshielded Twisted Pair (UTP). Cisco requires using manageable hubs.	100 Mbps

1. Variable, depending on load. See the section Calculating QoS Bandwidth Requirements, page 11-16, for a means of calculating the minimum required bandwidth for a Quality of Service (QoS) compliant network.
2. For the Sprint NIC, the local Ethernet Signaling Access Network is not implemented. Instead, X.25 WAN cards in the CallRouter platform serve as the Signaling Access Network and allow the CallRouter-NIC machine to connect to the IXC signaling network.

You may require additional bandwidth on the visible WAN. The actual requirement depends on a number of factors, including call load, the number of ACDs, the number of agents, and the number of Admin sites.

Note If your network will be utilizing the Cisco ICM Quality of Service (QoS) feature, see also the section Cisco ICM QoS, page 11-12, for additional bandwidth considerations.

Network Latency Requirements

The ICM system is a real-time, fault-tolerant distributed system. To guarantee the real-time nature of the system and to support the methods used in fault tolerance, the WAN links in the ICM system must have extremely low and predictable message latency characteristics, especially in these critical areas:

- Route requests and route responses between the CallRouter/NIC and IXC. This communication must meet the strict message latency requirements of the carrier networks.
- Communications involving Post-Routing requests from PGs and route responses from the CallRouter. This communication must also be extremely fast since callers are on-line expecting the call to be answered by an appropriate agent.
- Communications from the PGs to the CallRouter concerning the real-time status of the contact center. The CallRouter needs this information to base its routing decisions on the latest data available from the contact center.

Three fault tolerance mechanisms of the ICM system require reliable, low latency communications. These are heartbeat detection, synchronization, and state transfer.

Note If your network will be utilizing the Cisco ICM Quality of Service (QoS) feature, see also the section Cisco ICM QoS, page 11-12, for additional latency considerations.

Heartbeat Detection

As part of its fault-tolerant design, the ICM system must be able to quickly respond when a component goes off-line for any reason (typically, because of a failure in the node or in a network link). Each critical component in the system periodically sends short messages through the network to indicate that it is still on-line. These messages are called *heartbeats*.

Communicating ICM components send heartbeats to each other at regular intervals. If a component fails to receive a heartbeat for five consecutive intervals, it assumes that the component or a network link has failed and it initiates recovery actions. Table 11-2 lists some of the nodes that send heartbeats, the network on which they are sent, and how often they are sent.

Table 11-2 Heartbeat Configuration

Node	Medium	Interval
AT&T NIC (or Network Gateway) to CallRouter	Signaling Access Network	200 milliseconds
CallRouter to CallRouter	Private network	100 milliseconds
PG to CallRouter	Visible network	400 milliseconds
PG to PG (if duplexed)	Private network	100 milliseconds

The two sides of a duplexed ICM Central Controller periodically test each other to see if the other side is operating correctly. As shown in Table 11-2, network latency from CallRouter-to-CallRouter over the private network must support round trip messaging of 100 milliseconds. If the bandwidth of the private network is not adequate, packets may need to be fragmented by IP routers in order to prevent long messages (greater than 1,500 bytes). Such long messages can delay transmission of User Diagram Protocol (UDP) packets, which indicate that the other side of the Central Controller is still operating.

Note In ICM 7.0, a consistent heartbeat or keep-alive mechanism is enforced for both the public and private network interface. When QoS is enabled on the network interface, a TCP keep-alive message is sent; otherwise UDP heartbeats are retained.

Another requirement of fault tolerance is that messages cannot be released back to a NIC or PG until the other side of the Central Controller has acknowledged receipt of a copy of the message. Therefore, in order to meet the 200 millisecond response times established by the carrier networks, and to leave some margin for queuing, a 100 millisecond round trip requirement is established.

Heartbeats from a remote PG to the CallRouter must compete with other network traffic on the visible WAN.

Synchronization

In a duplexed Central Controller configuration, the private network allows the CallRouters and Loggers on each side to run in a synchronized fashion. This means that the CallRouter and Logger processes on each side of the system receive the same input and generate the same output.

To ensure synchronization, each message intended for the CallRouter or Logger is received by a Synchronizer process that runs on the CallRouter node. The *Synchronizer* forwards the message across the private network to the Synchronizer on the other side. The Synchronizers then remove any duplicates before passing the messages on to the CallRouter processes. If a message is intended for the Logger, the CallRouter passes it along (Figure 11-2).

Figure 11-2 Role of Synchronizers

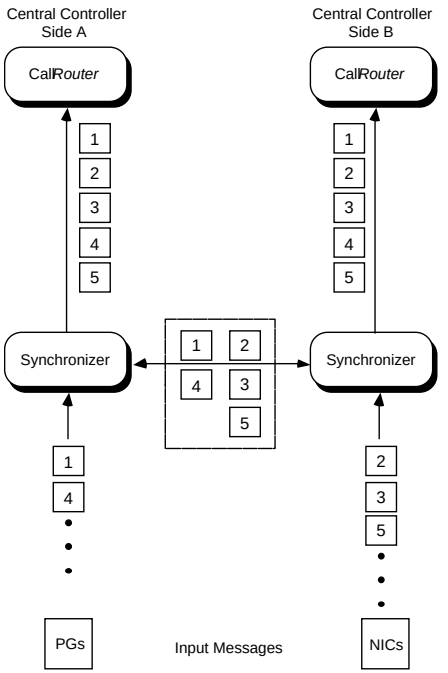


Figure 11-2 shows how the Synchronizers combine input messages and send the messages in the same order to each side of the Central Controller. Both CallRouters receive the same input and generate the same output. The Synchronizers ensure that both sides of the Central Controller return identical destinations for the same call and write identical data to the databases.

State Transfer

The fault tolerance of the ICM system enables nodes to restart after a failure. However, when a failed node restarts, the values of variables in its memory are out-of-date. Before returning the node to service, the ICM system must copy the values from its peer on the other side to the recovering node. That is, it must transfer the state of the running machine to the recovering machine. This transfer takes place over the private network.

Note that such state transfers occur after the failure and restart of any synchronized MDS client: PG, Logger, CallRouter, etc.

Diverse Facilities

The private WAN between Central Controllers (when the Central Controllers are geographically separated) and the visible WAN **must** be on separate facilities. They must use different circuits and different IP routers. As added protection, you might also want to use diverse routes or even different service providers for the private and visible WAN links. Otherwise, you run the risk of having a single network failure disable both the ICM private and visible WANs.

For example, if the private WAN failed, or a visible WAN link to one side of the Central Controller failed, the ICM system would continue to route calls and function normally. However, if the private WAN **and** the visible WAN were on the same facilities and failed simultaneously, the fault tolerance of the system would be compromised. In such a scenario, the failure of any single node on either side of the Central Controller would interrupt system processing. By provisioning the private WAN and visible WAN on separate facilities, you can eliminate this potential point of failure.

Cisco ICM QoS

This section describes the Cisco ICM Quality of Service (QoS) feature, and discusses considerations to take into account when planning for and deploying ICM networks that will utilize QoS.

What Is Quality of Service?

Quality of Service is a set of capabilities that enables you to define a level of performance in a data communications network. QoS allows you to create differentiated services for network traffic, thereby providing better service for selected network traffic. For example, with QoS, you can increase bandwidth for critical traffic, limit bandwidth for non-critical traffic, and provide consistent network response. This enables you to use expensive network connections more efficiently, lets you establish service level agreements with customers of the network, and eliminates the need of having dedicated leased lines for connection with ICM components.

QoS capabilities enable ICM software to overcome the following architectural limitations:

- ICM software requires dedicated leased lines. This means that ICM cannot be deployed in a converged network, which is more cost-effective and has more transmission capacity.
- Lack of a congestion control mechanism over the LAN segment. This is often considered not important because LAN resources tend to be less costly than WAN resources. However, with the increasing usage of multimedia applications on LANs, delays through LAN switches do become problematic. The QoS technology 802.1p tackles these delays.
- Lack of support for Cisco's AVVID (Architecture for Voice, Video and Integrated Data) enterprise network architecture. AVVID defines the network design principles to optimize the integration of mission-critical applications in a convergent network environment. QoS is a key technology for AVVID. ICM should be AVVID compliant to be better deployed in a Cisco AVVID network.

- Problematic UDP heartbeats. The use of UDP heartbeats creates unnecessary complexity for ICM deployment in firewall and NAT (Network Address Translation) environments. For this reason, UDP heartbeats are replaced by TCP keep-alive messages in ICM QoS implementation.

To implement QoS, you define QoS policies on network devices (routers and switches), and apply the policies to traffic based on DSCP markings, IP precedence, IP address, port, etc.

QoS primarily comes into play when the amount of traffic through an interface is greater than the interface's bandwidth. When the traffic through an interface exceeds the bandwidth, packets form one or more queues from which the device selects the next packet to send. By setting the queuing property on a device or interface, you can control how the queues are serviced, thus determining the priority of the traffic.

ICM 7.0(0) supports DSCP and 802.1p markings for both the public network link (connecting the PG to the CC) and the private network link (connecting the duplexed sides of PG or CC).

Deploying Cisco ICM QoS

The process of deploying and implementing QoS is a combined effort supported by Cisco System Engineers, ICM Deployment Groups, and Cisco Partners. These Cisco representatives provide customers who plan to deploy QoS with the following assistance:

- Defining customer requirements. Cisco Professional Services and Cisco Partners utilize their historical knowledge of the customer's ICM deployment, and QoS bandwidth calculation tools (see the section Calculating QoS Bandwidth Requirements, page 11-16), to assess these requirements.
- Reviewing the ICM portion of the customer's QoS migration plan.
- Meeting with the customer to prepare a statement of work that defines the level of support Cisco will provide.

Alongside these steps, there are the following tasks to consider when planning to implement a QoS-compliant network in your ICM environment.

- Where to mark traffic
- Determining QoS markings.

- Projecting bandwidth requirements.
- Installing Microsoft Packet Scheduler (optional).
- Installing and configuring 802.1p-capable network components (optional).
- Configuring QoS on IP routers.

Where to Mark Traffic

In planning QoS, a question often arises about where to mark traffic, in the application or at the network edge. Marking traffic in the application saves the access lists for classifying traffic in IP routers/switches, and it may be the only option if traffic flows can not be differentiated by IP address, port and/or other TCP/IP header fields. As mentioned earlier, ICM currently supports DSCP markings on the visible network connection between the central controller and the PG, as well as on the private network connection between duplexed sides of the Router or PG. Additionally, when deployed with Windows Packet Scheduler, it offers shaping and 802.1p.

Traffic can also be marked or remarked in edge IP routers/switches if it is not marked at ICM servers, or if the QoS trust is disabled. QoS trust may be disabled in an attempt to prevent nonpriority users in the network from falsely setting the DSCP or 802.1p values of their packets to inflated levels so that they receive priority service. For classification criteria definitions on edge routers and switches, refer to Table 11-3 and Table 11-4 in next section.

Determining QoS Markings

The default ICM QoS markings are set in compliance with Cisco AVVID recommendations (but can be overwritten if necessary). See *Cisco AVVID Solution IP Telephony QoS Classification* for details about Cisco AVVID packet classifications.

Before QoS implementation, IP-based prioritization is used to provide two externally visible priority levels: high and non-high. Internally, however, there are three different priorities for application messages: high, medium, and low. In the public network, medium priority messages are sent through the same high IP connection as the high priority messages; yet in the private network, they are sent through the non-high IP connection.

Table 11-3and Table 11-4 list the IP address & port, latency requirement, default marking under each priority for the public network connection and the private network connection respectively.

Table 11-3 Public Network Traffic Marking (default) and Latency Requirements

Priority	IP Address & Port	Latency Requirement	DSCP / 802.1p Marking
High	Public high IP and high priority connection port	200 ms	AF31 / 3
Medium	Public high IP and medium priority connection port	1,000 ms	AF31 / 3
Low	Public non-high IP and low priority connection port	5 seconds	AF11 / 1

Table 11-4 Private Network Traffic Marking (default) and Latency Requirements

Priority	IP Address & Port	Latency Requirement	DSCP / 802.1p Marking
High	Private high IP and high priority connection port	100 ms (50ms preferred)	AF31 / 3
Medium	Private non-high IP and medium priority connection port	1,000 ms	AF11 / 1
Low	Private non-high IP and low priority connection port	1,000 ms	AF11 / 1

Note Microsoft Packet Scheduler supports at most two marking levels excluding best effort, and therefore the medium priority traffic is either marked same as the high priority traffic (in public network) or marked same as the low priority (in private network). This is similar to the IP-based prioritization approach and no priority level is lost from the network perspective. When Packet Scheduler is bypassed, however, three marking levels are available and the medium priority messages can be marked differently.

Note Cisco makes the QoS marking recommendation for Call-Signaling traffic to DSCP CS3 because Class-Selector code points, defined in RFC 2474, are not subject to markdown and aggressive dropping as Assured Forwarding Per-Hop Behaviors are. Some Cisco IP Telephony products already have begun transitioning to DSCP CS3 for Call-Signaling marking. During this interim period, both code points (CS3 and AF31) should be reserved for Call-Signaling marking until the transition is complete. The ICM QoS markings are configurable through the ICM setup and the default Assured Forwarding code points can be replaced with the Class-Selector code points to fit into the existing QoS infrastructure.

Calculating QoS Bandwidth Requirements

Although QoS alleviates bandwidth usage and increases network throughput, network congestion is still unavoidable unless sufficient physical bandwidth is available along the path. For ICM, the bandwidth requirement at each priority is a function of traffic volume and latency requirement. It varies greatly for ICM systems depending on factors such as call load, traffic composition, call context information, and configuration settings.

Cisco provides the following QoS bandwidth calculators and sizing worksheets to help Cisco System Engineers, ICM Deployment Groups, and Cisco Partners project traffic volume as well as bandwidth requirement.

- ACD/CallManager PG to CC Bandwidth Calculator.
- VRU PG to CC Bandwidth Calculator.

- Router Private Link Sizing Worksheet.
- PG Private Link Sizing Worksheet.

Note The network administrator should clearly understand the bandwidth requirement of ICM flows under each priority and factor it in the bandwidth definition of QoS policies configured on network routers/switches.

Note ICM applications are not RSVP (Resource Reservation Protocol) aware and therefore IntServ (Integrated Service) is not supported. If Packet Scheduler is used, the QoS bandwidth reservations are only made within the local box for the purpose of shaping; no reservations are made in the network.

Installing Microsoft Packet Scheduler

Note The ICM DSCP markings can be done with or without Packet Scheduler. Cisco recommends that you do not use Packet Scheduler unless:

1. Bandwidth requirements are clearly understood and correctly configured, and

2. the convergent network link is occasionally congested and shaping ICM traffic at the source can be helpful.

Caution While using the Microsoft Packet Scheduler does provide shaping and 802.1p features, there are significant risks when using this option with ICM 7.0, as follows:

1. Multiple defects have been submitted to Microsoft. Currently, some fixes are have been released by Microsoft, but some have not.

2. If the shaping bandwidth is configured too low, Packet Scheduler may introduce excessive delay and as a result it may cause timed-out calls, queue overflows and buffer exhaustion.

3. Shaping at the ICM server may neither be necessary or helpful given that the LAN is rarely the bottleneck of communications over WAN and a QoS-enabled network is more capable of shaping/queuing/policing traffic based on the resource usage.

Microsoft Packet Scheduler is a key component in creating the Windows Server 2003 QoS solution. It regulates how much data a given flow is allowed, when those packets are put onto the network, and in which order such packets (those ready for transmission) are sent.

The Packet Scheduler installation is not strictly required, nor is it recommended for ICM 7.0. However, some benefit may be gained from the following:

- The Packet Scheduler's shaping functionality mitigates the burst nature of ICM transmissions by smoothing transmission peaks over a given period of time, and thereby smoothing out network usage to affect a more steady use of the network.
- 802.1p tagging on Windows Server 2003 is available only if the Packet Scheduler is installed. Without the use of 802.1p, there is no physical guarantee that any prioritized data transmissions will receive a better service than best-effort transmissions receive in the LAN segment.

To install Microsoft Packet Scheduler, perform the following steps *on both the CallRouter machines and the PG machines*.

Note All current TCP connections are terminated when the Packet Scheduler is installed. Therefore, even though a reboot of the machine is not required when the Packet Scheduler is installed, current TCP connections are terminated. You should not install the Packet Scheduler if important connections are in progress.

Step 1 Open **Network and Dial-up Connections**.

Step 2 Right click the Network Connection (Public Visible) on which you want to install the QoS Packet Scheduler. Select **Properties**.

Step 3 Click the **Install** button. The Select Network Component Type dialog box appears.

Step 4 Select **Service** and click the **Add** button. The Select Network Service dialog box appears.

Step 5 Select **QoS** Packet **Scheduler**. Click **OK** to begin the installation process.

Installing and Configuring 802.1p-Capable Components

Note 802.1p is optional. However, see the section Installing Microsoft Packet Scheduler, page 11-17, for reasons why you might want to use it.

802.1p expresses priority class by setting three bits in the Layer 2 MAC header, whose binary values 0 through 7 represent eight distinct priority classes (named as Class of Service). For ICM, the default 802.1p settings are compliant with Cisco AVVID recommendations. Specifically, the high and medium traffic uses the value of 3, and the low priority traffic uses the value of 1. See *Cisco AVVID Solution IP Telephony QoS Classification* for details about Cisco AVVID packet classifications.

If you wish to enable 802.1p marking capabilities as part of your QoS implementation, you must perform the following tasks:

- Install and enable Microsoft Packet Scheduler, as discussed in the section Installing Microsoft Packet Scheduler, page 11-17.
- Install 802.1p-capable NICs in the QoS-enabled ICM computers (the Router and the PG)
- Enable 802.1p on the NICs, through the Advanced tab on the NIC Properties screen. This is done by enabling a selection most often referred to as **QoS Packet Tagging**.
- Install 802.1p-capable switches on the LAN segment.
- Configure 802.1p-capable switches and coordinate their configuration with the settings on the Router and/or the PG.

Note You should install NIC cards *before* you install ICM software. If you add a NIC card after you install ICM software, you will need to reinstall ICM software.

Refer to *Cisco AVVID Network Infrastructure Enterprise Quality of Service Design* for details about AVVID-Enabled campus network design, switch selection, and QoS configuration commands.

Configuring QoS on IP Routes

See *Cisco AVVID Network Infrastructure Enterprise Quality of Service Design* for details about AVVID-Enabled WAN design, router selection, and QoS configuration commands.

Additional Tasks

This section briefly discusses a few additional tasks that you need to perform, after the deployment tasks listed in the previous sections, to ensure that your QoS-enabled network runs correctly and efficiently.

ICM QoS Setup

Refer to the *Cisco ICM Enterprise Edition Installation Guide* for details about ICM QoS setup.

Performance Monitoring

You can use the Windows Performance Monitor to track the performance counters associated with QoS-enabled connections. Refer to the *Cisco ICM Enterprise Edition Administration Guide* for information on using the Windows Performance Monitor.

Note Depending on your operating system version, this tool may be named System Monitor

For More Information on QoS

The following are Cisco documents that contain additional information on QoS. You can access most Cisco documentation from the Cisco corporate website at http://www.cisco.com.

- *Cisco IP Contact Center Enterprise Edition Releases 5.0 and 6.0 Solution Reference Network Design (SRND)*
- *Cisco IP Contact Center Enterprise Edition Releases 7.0 Solution Reference Network Design (SRND)*
- *Cisco AVVID Network Infrastructure Overview*
- *Cisco AVVID Network Infrastructure Enterprise Quality of Service Design*
- *Cisco AVVID Solution: IP Telephony QoS Classification*
- *Planning for Quality of Service*
- *Quality of Service Networking*
- *Cisco IP Telephony QoS Design Guide*

Active Directory Model

Microsoft Windows Active Directory provides a central repository for managing network resources. ICM software uses Active Directory services to control users' access rights to perform setup, configuration, and reporting tasks. Active Directory services also grant permissions for different components of ICM software to interact; for example, it grants permissions for a Distributor to read the Logger database.

In ICM release 7.0(0) supports both Windows 2000 and Windows 2003 Active Directory domains. Native mode is required. ICM user configuration data is stored in Active Directory Organizational Units (OU).

For more information see the *Staging Guide for Cisco ICM/IPCC Enterprise & Hosted Editions.*

TCP/IP Configuration

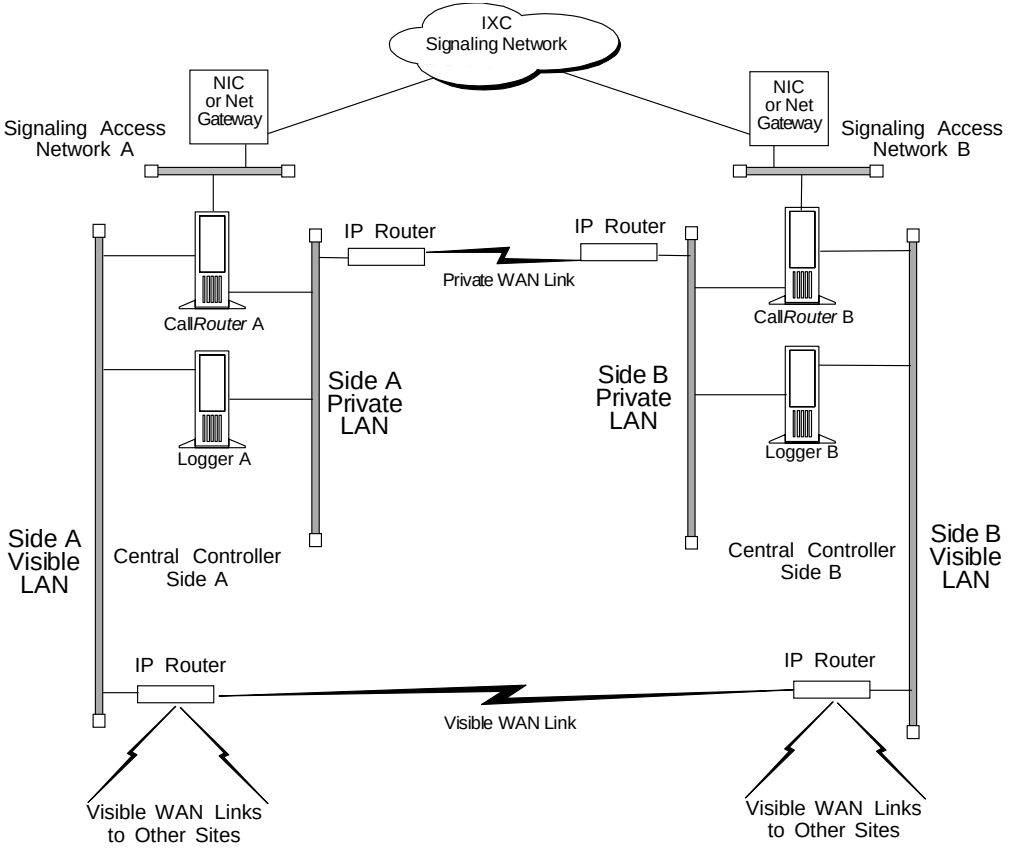
To set up IP addresses for Windows Server 2003 nodes, use the TCP/IP Properties dialog box. To display this dialog box, go to the Windows Server 2003 Start menu and choose **Settings > Network and Dialup Connections > Local Area Connection**. In the Local Area Connection Status window, click on Properties. Select Internet Protocol (TCP/IP) and click on Properties.

Select "Use the following IP address." Enter the IP address and click OK. To enter additional IP addresses, open the TCP/IP Properties window again and click the Advanced button. The Advanced TCP/IP Settings window allows you to enter additional IP addresses.

Central Sites

Each side of the Central Controller includes the CallRouter, Logger, and Network Interface Controller (NIC). These may be on three separate nodes, two nodes, or a single node. Although the NICs are indicated as separate nodes for clarity, in fact a NIC is implemented as a process within the CallRouter node. The two sides of the Central Controller may be at two different central sites as shown in Figure 11-3.

Figure 11-3 Geographically Distributed Central Controller



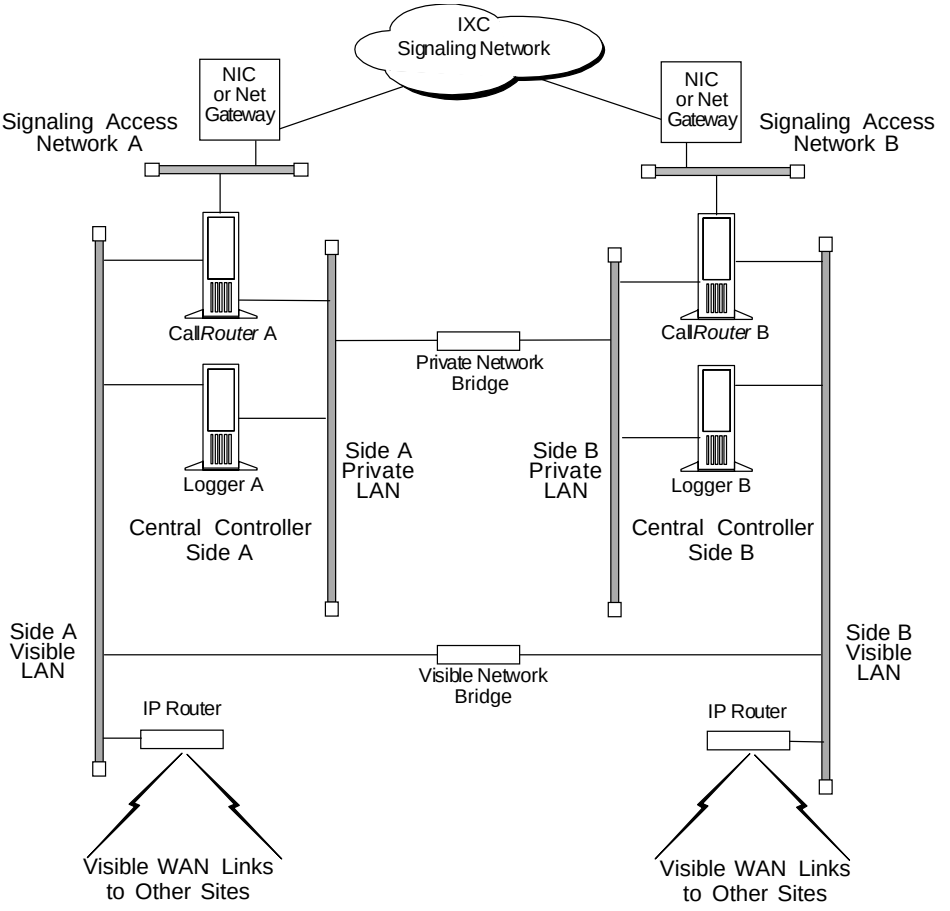
The private network carries ICM system traffic between the nodes on one side of the Central Controller and between the nodes on both sides of the system. The traffic between the two sides of the Central Controller consists of synchronization and state transfer messaging between the CallRouters and Loggers. Most communications between the CallRouter and Logger on one side take place over the private network.

The private WAN link (see Figure 11-3) is critical to the overall responsiveness of the ICM system. First, it must provide sufficient bandwidth to handle simultaneous synchronizer and state transfer traffic. It must also have enough bandwidth left over in case additional data must be transferred as part of a

recovery operation. Since the private WAN link is **the only link** that carries Central Controller synchronization and state transfer traffic, you may want to provision backup service of some kind as a contingency for network outages.

The IP routers in the private network always use traffic prioritization, and frequently use IP fragmentation, to ensure that high priority ICM system traffic does not experience excessive queuing delay. Alternately, both sides of the Central Controller may be co-located at a single site as shown in Figure 11-4.

Figure 11-4 Collocated Central Controller



In a co-located Central Controller configuration, Ethernet switches separate the Side A and Side B private Ethernet LANs for fault tolerance. This private network bridge replaces the private WAN link shown earlier in Figure 11-3. A visible network bridge also connects the Side A and Side B visible networks.

The Visible Network

Each central site has a visible network that connects nodes within that site. To allow communication between sites, each side of the Central Controller must have one IP router on its visible LAN.

Note When a Peripheral Gateway is co-located with one side of a duplexed, geographically distributed Central Controller, you must have a direct connection between the visible WAN IP routers at the two central sites. This ensures that there is adequate visible network connectivity between the sides of the Central Controller.

The IP router requires a single address on the LAN. It also requires that you define a **static route** on the IP router for each contact center's visible LAN and for each admin site's visible LAN.

Visible IP Router Configuration

To allow optimal tuning of the network, Cisco requires using IP routers that allow you to prioritize packets based on a range of source or destination port numbers. Typically, you need to set up the IP router to give higher priority to certain outgoing network packets. Also, depending on the bandwidth available on the visible WAN, you may need to set up IP fragmentation. Table 11-5 summarizes the configuration for the visible network IP router.

Table 11-5 Central Site Visible IP Router Configuration

Attribute	Requirements
IP Addresses	One address required.

Table 11-5 Central Site Visible IP Router Configuration (continued)

Default Gateway	The network bridge (or the IP router used as bridge), if any. Otherwise, the IP router does not have a default gateway.
Static Routes	Define one static route for the visible LAN at each remote contact center site and each admin site. If the central sites are geographically separated, add a static route for the other central site.
Other	Turn off any preset routing protocols. Give higher priority to specific network packets. Use fragmentation if necessary to limit the queuing delay.

You may need to prioritize packets as described in Table 11-6.

Table 11-6 Visible Network Packet Priorities from Central Site

Packet Type	High Priority	Low Priority
TCP	If received from the CallRouter's high priority address (as derived from the packet's source address).	If received from any other address.
UDP[1]	If source or destination port number is in the range 39000–39999.[2]	All other UDP packets.

1. When both CallRouter and PG are running ICM Release 5.0(0) or later, heartbeats are not used; TCP is used instead. This is determined on a PG path basis.
2. If you cannot configure the IP router to assign priority based on a range of port numbers, then assign a high priority to all UDP packets.

The maximum queuing delay is 50 milliseconds to contact center sites that use Post-Routing or translation routes and 200 milliseconds to other contact center sites. You may have to implement fragmentation to meet these limits.

The Private Network

Each central site must also have its own private LAN. If the sides of the Central Controller are geographically separated, each private LAN has one IP router to communicate with the private WAN that connects the two sides.

If the two sides of the Central Controller are co-located, the IP router on the private LAN is not needed. If two central sites are geographically separated, each side requires an IP router on the private network.

Table 11-7 summarizes the configuration for the private network IP router.

Table 11-7 Central Site Private IP Router Configuration

Setting	Requirements
IP Addresses	One address required on the private LAN.
Default Gateway	None.
Static Routes	Define one static route for the private LAN at the other central site.
Other	Turn off any preset routing protocols. Give higher priority to specific network packets.

Table 11-8 describes how private network packets must be prioritized.

Table 11-8 Private Network Packet Priorities from Central Site

Packet Type	High Priority	Low Priority
TCP	If the source address is the local CallRouter's high priority address or the destination address is the other CallRouter's high priority address.	All other TCP packets.
UDP	If source or destination port number is in the range 39000–39999.[1]	All other UDP packets.

1. If you cannot configure the IP router to assign priority based on a range of port numbers, then assign a high priority to all UDP packets.

The Signaling Access Network

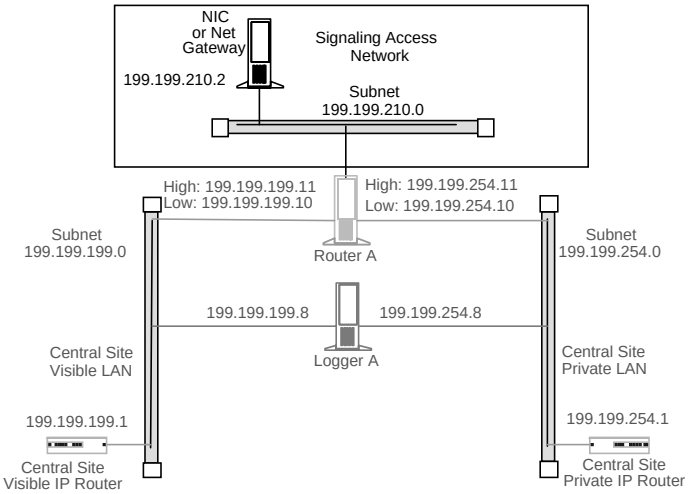
Each central site must have its own Signaling Access Network (SAN). The ICM system uses the Signaling Access Network to communicate with the IXC signaling network. The Signaling Access Network for the MCI, AT&T, Nortel, and Stentor NICs is implemented as an Ethernet LAN. This LAN is separate from the ICM private LAN.

In Sprint NIC configurations, the Signaling Access Network is implemented via Eicon X.25 WAN cards on the CallRouter platform. These cards allow the ICM system to connect the IXC signaling network. The X.25 links to the IXC signaling network are considered the Signaling Access Network. In these configurations, the separate Ethernet Signaling Access Network is not required.

Figure 11-5 shows a typical Signaling Access Network for a single central site. It assumes that the two sides are geographically separated.

Note The IP addresses shown in this and subsequent figures are examples only. Use addresses specific to your networks.

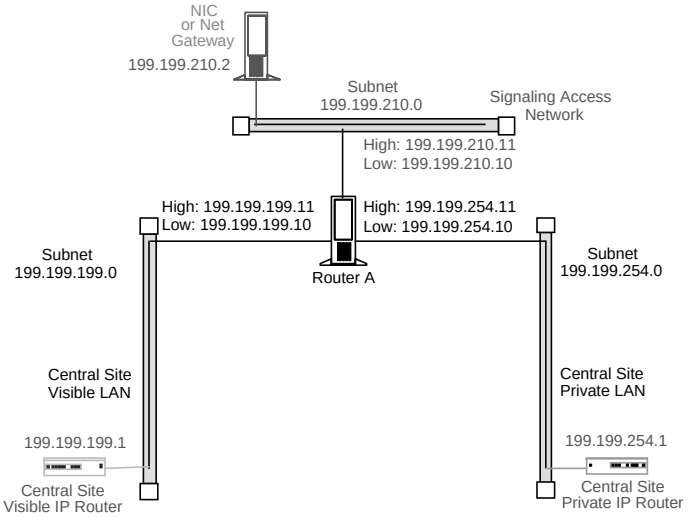
Figure 11-5 Central Site Signaling Access Network



The CallRouter Node

The CallRouter connects to the visible network through the visible LAN; and to the private network through the private LAN. The CallRouter also has a connection to the Signaling Access Network. (See Figure 11-6.)

Figure 11-6 CallRouter Network Connections



As shown in Figure 11-6, the CallRouter requires two addresses on the visible LAN; two addresses on the private LAN; and two addresses on the signaling access LAN. This allows the ICM system to separate high-priority network traffic from low-priority traffic.

Table 11-9 summarizes the visible network configuration for the CallRouter.

Table 11-9 CallRouter Visible Network Configuration

Setting	Requirements
IP Addresses	Two required: one for high priority data; one for low (normal) priority data. Note that only one address is required if you are using QoS.
Default Gateway	Visible network IP router.
Static Routes	None.
Other	Preferred and alternate DNS server. See Active Directory Model, page 11-21.

Table 11-10 summarizes the private network configuration for the CallRouter.

Table 11-10 CallRouter Private Network Configuration

Setting	Requirements
IP Addresses	Two required: one for high priority data; one for low (normal) priority data.
Default Gateway	None. (The default gateway is on the visible LAN.)
Static Routes	If the sides of the Central Controller are geographically separated, define one static route for the subnet address of the private LAN on the **other** side of the Central Controller.
Other	Disable Windows Server 2003 networking on the private LAN.

Note Instructions on disabling Windows Server 2003 networking on the private LAN appear later in this section.

Table 11-11 summarizes the Signaling Access Network configuration for the CallRouter.

Table 11-11 CallRouter Signaling Access LAN Configuration

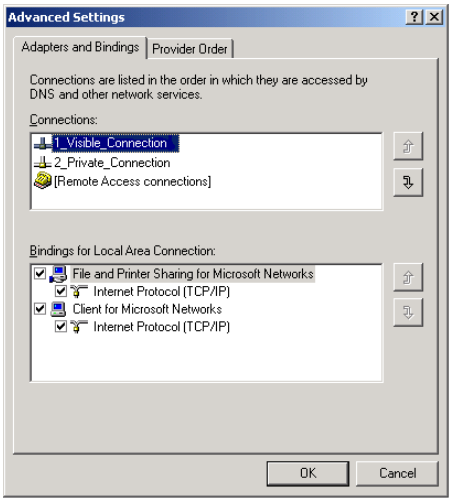
Setting	Requirements
IP Addresses	Two may be required, the second functioning as a serviceability interface for your ICM service provider.
Default Gateway	None.
Static Routes	None.
Other	Disable Windows Server 2003 networking on the Signaling Access Network.

Disabling Windows 2000 Server and Windows Server 2003 Networking

You need to disable network bindings for the private LAN adaptor on machines that connect to the ICM private network.

You can disable Windows 2000 Server and Windows Server 2003 networking on the private LAN interface through the Network and Dial-up Connections window. Right click on the My Network Places icon on the Windows 2000 Server or 2003 desktop. The Network and Dial-up Connections window appears. (Optionally, you can right-click on the My Computer icon, select Explore, then right click on My Network Places and select Properties.)

Choose Advanced > Advanced Settings to display the Advanced Settings window:

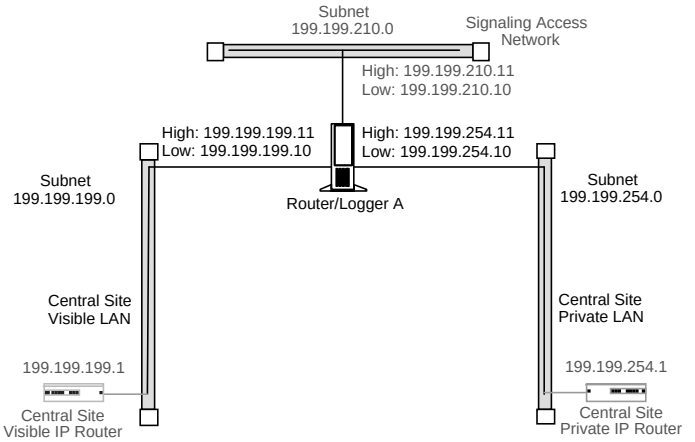


Make sure that the visible network connection appears first in the list, followed by the private network connection. You can change the order in which the network connections appear by using the arrow buttons on the right side of the window. Select the private network connection and disable both “File and Printer Sharing for Microsoft Networks” and “Client for Microsoft Networks.”

The Logger Node

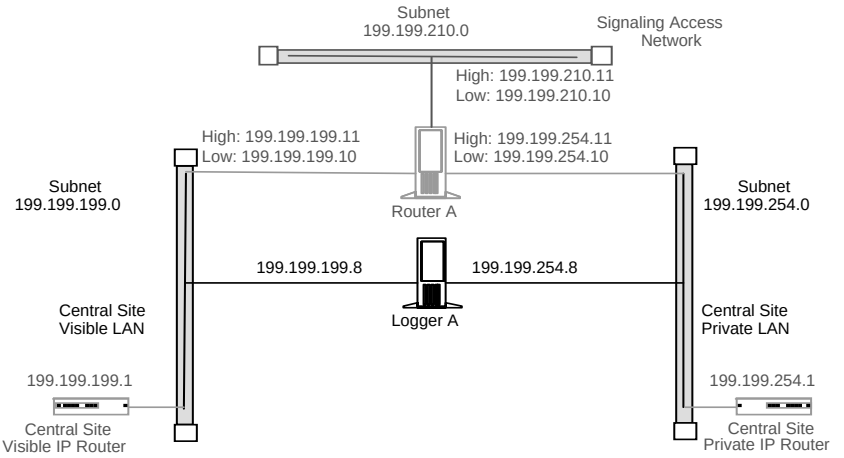
The Logger can be on the same node as the CallRouter, as shown in Figure 11-7, or it can be a separate node as shown in Figure 11-8.

Figure 11-7 CallRouter and Logger Combination



If the CallRouter and Logger are on the same node, then the Logger has no specific requirements; it uses low priority addresses defined for the node on the visible and private networks. If the two are on separate nodes, then the Logger requires its own connections to both the visible and private LANs (see Figure 11-8).

Figure 11-8 Logger as a Separate Node



In addition to the IP addresses shown, the Logger node may require two additional addresses on the visible network. These addresses allow for dial-in connections by your ICM support provider's Distributed Diagnostic and Service Network (DDSN).

Table 11-12 summarizes the visible network connections for the Logger.

Table 11-12 Logger Visible Network Configuration

Setting	Requirements
IP Addresses	Three addresses may be required: one for normal data; two more for DDSN dial-up connections.
Default Gateway	Visible network IP router.
Static Routes	None.
Other	Preferred and alternate DNS server. See Active Directory Model, page 11-21.

Table 11-13 summarizes the private network configuration for the Logger.

Table 11-13 Logger Private Network Configuration

Setting	Requirements
IP Addresses	One address required.
Default Gateway	None. (The default gateway is on the visible LAN.)
Static Routes	If the two sides of the Central Controller are geographically separated, define one static route for the subnet address of the private LAN for the **other** side of the Central Controller.
Other	Disable Windows 2000 Server or Windows Server 2003 networking on the private LAN interface. (See Disabling Windows 2000 Server and Windows Server 2003 Networking, page 11-31, for more information.)

If the Logger is on the same computer as the CallRouter, then the visible and private network IP configuration for the CallRouter is all that is required.

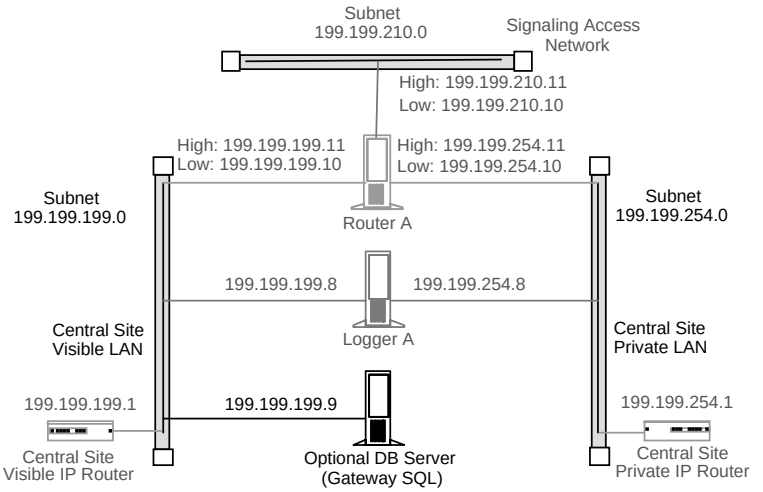
If the Logger is a separate node, you must disable networking on the private LAN interface (as was required for the CallRouter*)*.

Define a static route in ICMEXEC.BAT, as for the CallRouter.

Optional Database Server Platform

If you order the Cisco ICM Gateway SQL option, you need to set up an additional SQL Server database platform. The database server requires one IP address and one connection to the ICM visible network (Figure 11-9).

Figure 11-9 Optional Database Server



ICM Network Gateway

An ICM Network Gateway may be deployed on the Signaling Access Network in SS7 network environments. The ICM Network Gateway is a dedicated Windows Server 2003 machine that provides SS7 protocol handling. When an ICM Network Gateway is used, the NIC software is installed on the CallRouter machine and a separate Gateway machine is used as the interface between the CallRouter and the carrier's SS7 signalling network

The Network Gateway is installed on a dedicated machine. It connects to both the Signaling Access Network (SAN) and to the ICM visible network. The visible network connection is used strictly for management and maintenance. The ICM Network Gateway does not connect to other nodes at the central site or to nodes at other sites. For example, it **does not** communicate over the private network with a network gateway on the other side of the system.

The ICM Network Gateway can support up to sixteen signaling links (four PCI cards) to the IXC signaling network. Therefore, the host server must have one free PCI slot for every four signaling links. Each adapter card supports four links with an individual V.35 interface for each link.

Table 11-14 summarizes the Signaling Access Network requirements for an ICM Network Gateway.

Table 11-14 ICM Network Gateway Signaling Access Network Configuration

Setting	Requirements
IP Addresses	One address required.
Default Gateway	None.
Static Routes	None.
Other	A HOSTS file is set up and changes are made to the CONFIG.SYS and AUTOEXEC.BAT files. Consult with your ICM support provider before changing these settings.

Table 11-15 summarizes the visible network requirements for an ICM Network Gateway.

Table 11-15 ICM Network Gateway Visible Network Configuration

Setting	Requirements
IP Addresses	One address required.
Default Gateway	Visible network IP router.
Static Routes	None.
Other	A HOSTS file is set up and changes are made to the CONFIG.SYS and AUTOEXEC.BAT files. Consult with your ICM support provider before changing these settings.

Admin Workstations at a Central Site

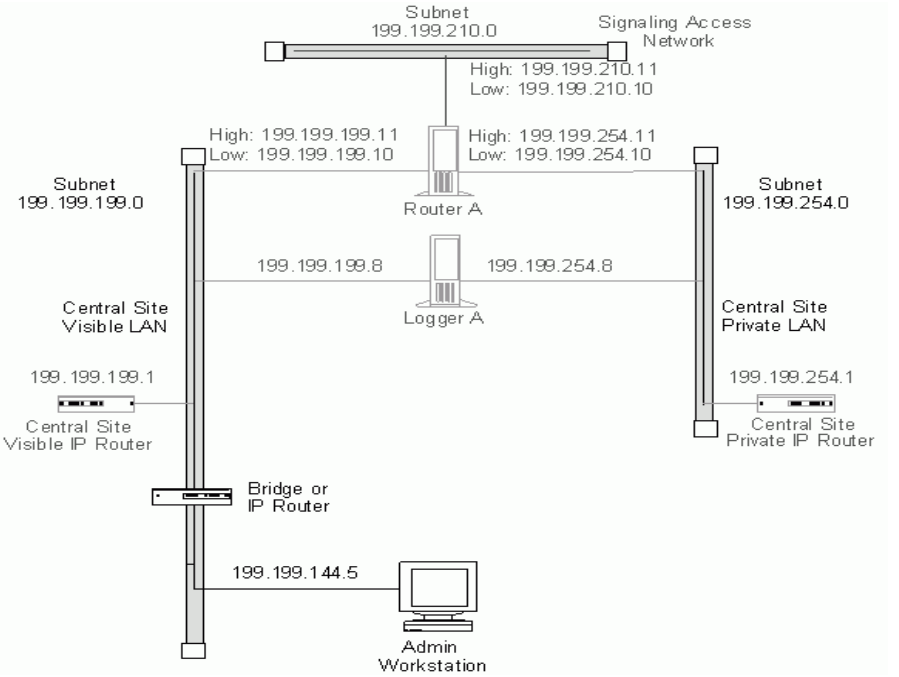
Cisco requires that you isolate the CallRouter, Logger, and PGs from the Admin Workstation LAN segment by using Ethernet switches. This limits the impact of one network's problems on another. By isolating the Central Controller and PGs from the Admin Workstation LAN segment, you can protect critical components from network hardware and software failures (for example, an open Ethernet tap or a network error burst).

For further protection against LAN outages, you can use an IP router instead of a bridge. You can then place the Admin Workstation on a separate LAN with other contact center computers and applications. The IP router is a better option in this situation. LAN bridges tend to forward network error bursts from one side of a LAN to the other. IP routers provide a better fire wall, since they do not forward network errors to other LANs.

The Admin Workstation must reside on a network visible to the ICM software.

Figure 11-10 shows how you can use a LAN bridge or an IP router to isolate PGs and the Central Controller from the Admin Workstation LAN segment.

Figure 11-10 Admin Workstation at a Central Site



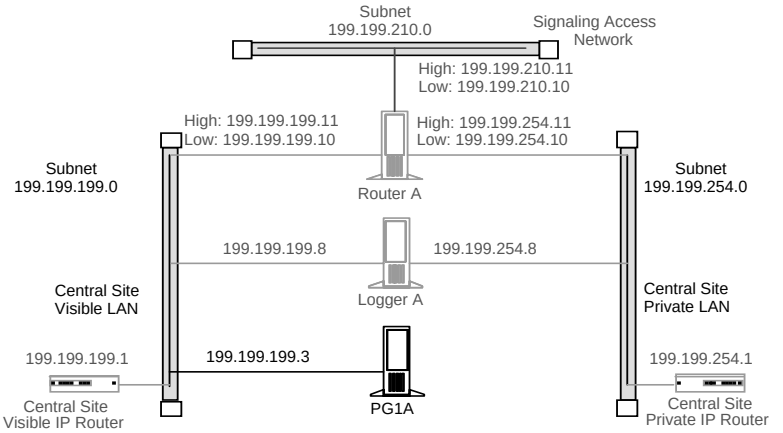
Note For specific information about configuring an Admin Workstation, see Admin Sites, page 11-48.

Peripheral Gateways at a Central Site

A Peripheral Gateway (PG) that is co-located with one or both sides of the Central Controller can share the same visible LAN segment as the CallRouter and Logger nodes. The PG can communicate with the local CallRouter through the visible LAN. If the sides of the Central Controller are geographically separated, the PG communicates with the other side through the visible IP router and a WAN link. (If both sides of the Central Controller are co-located with the PG, then the PG communicates with both sides through the visible LAN.)

Figure 11-11 shows the network connection for a PG at a central site.

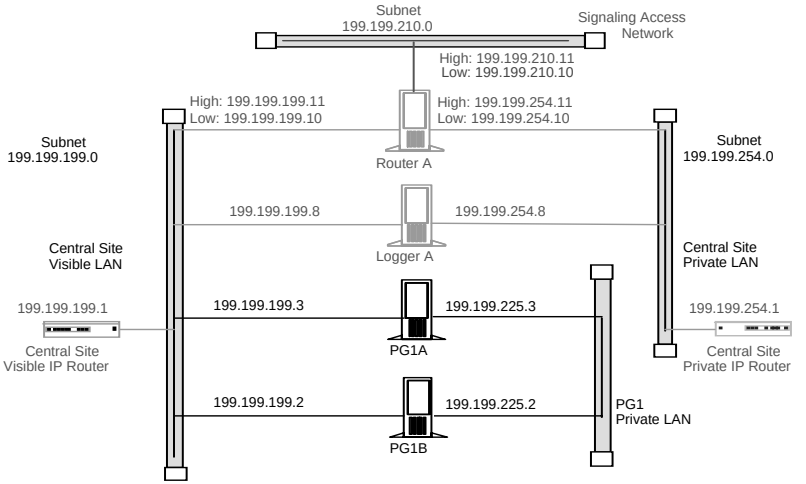
Figure 11-11 Peripheral Gateway at a Central Site



The ACD itself can also be on the visible LAN.

If the PG is duplexed, then the two duplexed PGs must be connected through a separate private network. (They cannot use the same private network as the CallRouter and Logger.) See Figure 11-12.

Figure 11-12 Duplexed Peripheral Gateways at a Central Site



If you have more than one pair of duplexed PGs at a site, each pair requires its own private LAN. The private LAN for the PGs allows for synchronization and state transfer between the PGs. It is not used for any other purpose.

Note When a Peripheral Gateway is located with one side of a geographically distributed Central Controller, you must have a WAN link directly connecting the visible WAN IP routers at the two central sites. This ensures that there is adequate visible network connectivity between the sides of the Central Controller. For more information on PG networking requirements, see the next section, "Contact Center Sites."

Contact Center Sites

Each contact center site includes at least one ACD, at least one Peripheral Gateway (PG), and optionally, one or more Admin Workstations. Contact centers may also have an Interactive Voice Response (IVR) unit. For fault-tolerance, the contact center site must include a duplexed pair of PGs.

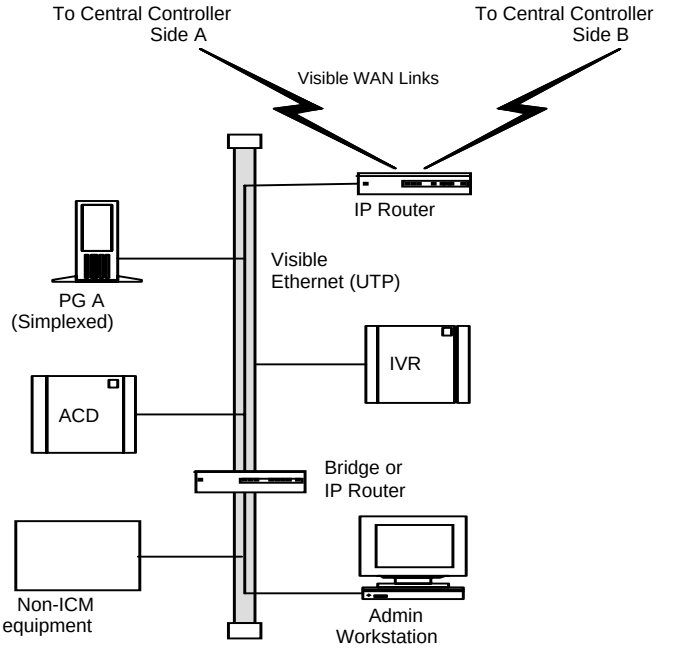
A remote contact center complex is reached via the visible network, often with multiple access paths and through multiple IP routers. The contact center site must have at least one IP router on the visible network for communication with the Central Controller. For maximum fault-tolerance, the site should have two IP routers, each connecting to one side of the Central Controller.

Note For information on installing and configuring the ICM Peripheral Gateway software, see the *Cisco ICM Enterprise Edition Installation Guide*.

Simplexed PG Site

Figure 11-13 shows one option for a contact center configuration with a simplexed PG and an Admin Workstation. This site contains an ACD and an IVR system. The IVR PG software and the ACD PG software may be installed on the same server hardware platform.

Figure 11-13 Contact Center with Simplexed PG



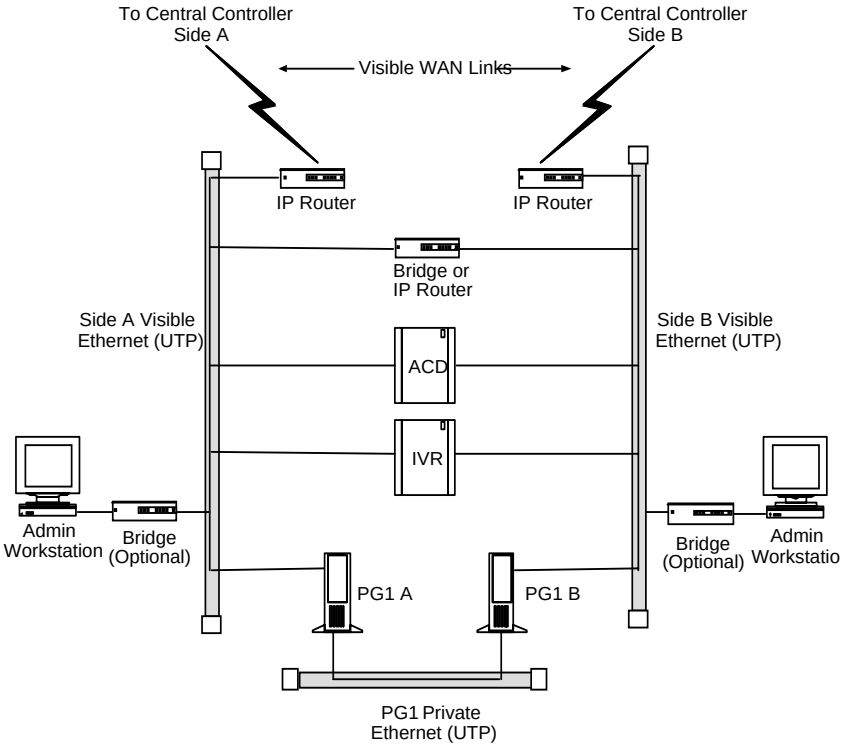
As shown in Figure 11-13, the PG and AW share a single Ethernet LAN and an IP router. The IP router uses prioritization and IP fragmentation to minimize queuing delays for high-priority ICM system traffic. Cisco requires that the PG, ACD, IVR, and IP router be separated from other devices by a bridge or IP router. This isolates the critical ICM components from outages that might be caused by other equipment and networks.

The contact center example shown in Figure 11-13 is a low fault tolerance configuration. It is recommended only for non-fault tolerant sites (for example, for contact center sites with one PG or admin sites with AWs only). A simplexed PG configuration can represent a single point of failure. Loss of the only PG would stop the flow of real-time data from the contact center to the CallRouter and prevent the use of Post-Routing and translation routes. You can protect against possible failures by using duplexed PGs.

Duplexed PG Site

A duplexed PG configuration provides enhanced fault-tolerance. See Figure 11-14.

Figure 11-14 Fault Tolerant Contact Center



Note that a PG private LAN is added to allow direct communication between the two PGs. If you have more than one duplexed pair of PGs at a site, each PG pair requires its own private LAN.

To further enhance the fault-tolerance of the contact center, you can configure each PG with its own visible LAN and IP router. This eliminates the LAN as a single point of failure. Each PG communicates with one side of the Central Controller using its own LAN and IP router.

If you used a single IP router instead of two, you introduce a potential single point of failure to the contact center site. Loss of the one IP router would stop the flow of real-time data from the contact center to the CallRouter and stop the flow of monitoring data from the Central Controller to the Admin Workstation. It would also prevent the use of Post-Routing and translation routes for this contact center.

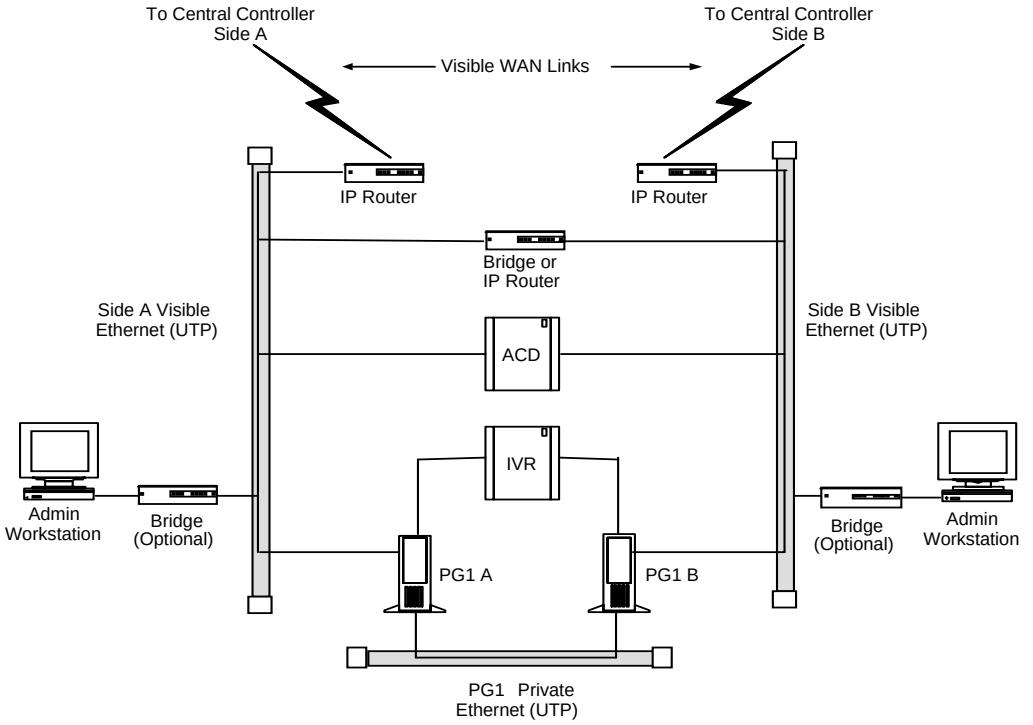
One of the two IP routers shown in Figure 11-14 serves as the default gateway for the PG. By default, the PG communicates with that side of the Central Controller. The PG must have a static route defined to the other side of the Central Controller through the **other** IP router.

Each PG may contain a modem to allow dial-in access through your ICM support provider's Distributed Diagnostic and Service Network (DDSN). In addition to its normal address on the visible network, the PG would then require two additional visible LAN addresses for this dial-in access.

Duplexed PG Site with Separate IVR LAN

Another contact center configuration may be used in cases where IVR systems need to be separated due to security concerns or when management of the IVRs must be carefully protected. Figure 11-15 shows an example of such a fault tolerant contact center site.

Figure 11-15 Fault Tolerant Contact Center—IVR on Separate LAN



With this option, the ACD is on the visible LAN under the assumption that another CTI application needs to interface to the ACD. An alternative would be to have the ACD on the same LAN as the IVR system.

PG Network Configuration

Table 11-16 summarizes the network configuration for a simplexed PG.

Table 11-16 Simplexed PG Network Configuration

Setting	Requirements
IP Addresses	Three addresses may be required on the visible LAN: one for normal data and two for use by the DDSN.
Default Gateway	Define one of the visible network IP routers as the default gateway for the PG.
Static Routes	Define one static route to the visible LAN at the central site that is not targeted by the default gateway IP router.
Other	Preferred and alternate DNS server. See Active Directory Model, page 11-21.

Table 11-17 summarizes the network configuration for a duplexed PG.

Table 11-17 Duplexed PG Network Configuration

Setting	Requirements
IP Addresses	Each PG may require three addresses on the visible LAN (one for normal traffic plus two addresses for DDSN dial-up connections) and two addresses on the private LAN (one for high priority and one for low priority data).
Default Gateway	Define one of the visible network IP routers as the default gateway for each PG. Do **not** use the same IP router as the default gateway for both PGs.
Static Routes	Each PG requires a static route to the side of the Central Controller that is not targeted by its default gateway IP router.
Other	Preferred and alternate DNS server. See Active Directory Model, page 11-21.

Note For more information on how Peripheral Gateways connect to ACDs, see Chapter 5, "Peripheral Gateway Configurations".

Contact Center IP Routers

The IP router requires a single address on the LAN. It also requires that you define a static route on the IP router to the side of the Central Controller (central site visible LAN) that is not targeted by the PG's default gateway IP router.

To allow optimal tuning of the network, Cisco requires that you use IP routers that allow you to prioritize packets based on a range of source or destination port numbers. Typically, you need to set up the IP router to give higher priority to certain outgoing network packets. Also, depending on the bandwidth available on the visible WAN, you may need to set up IP fragmentation.

Table 11-18 summarizes the configuration for the IP routers.

Table 11-18 Contact Center IP Router Configuration

Setting	Requirements
IP Addresses	Each IP router requires one address on the visible LAN.
Default Gateway	Network bridge or IP router used as bridge, if any. Otherwise, the IP router does not have a default gateway.
Static Routes	Each IP router must have a static route to reach one central site visible LAN.
Other	Turn off any preset routing protocols. Give higher priority to specific network packets. Use fragmentation if necessary to limit the queuing delay.

See Table 11-19 for information about packet priorities.

Table 11-19 Contact Center Packet Priorities

Packet Type	High Priority	Low Priority
TCP	If sending to the CallRouter's high priority address (as derived from the packet's destination address).	If sending to any other address.
UDP	If source or destination port number is in the range 39000–39999.[1]	All other UDP packets.

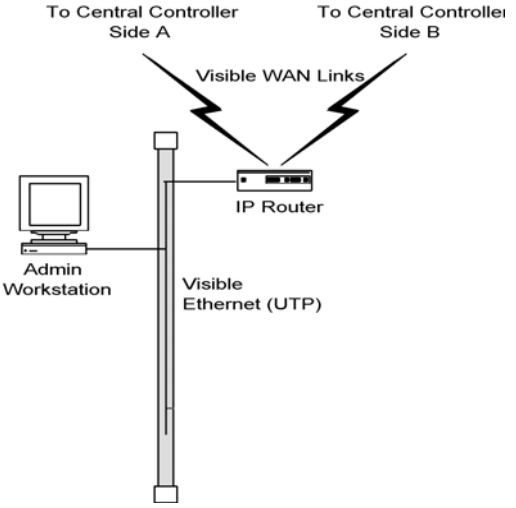
1. If you cannot configure the IP router to assign priority based on a range of port numbers, then assign a high priority to all UDP packets.

The maximum queuing delay is 50 milliseconds if the site uses Post-Routing or translation routes; 200 milliseconds otherwise. You may have to set up fragmentation to meet these limits.

Admin Sites

An admin site contains one or more Admin Workstations. Each admin site must have a visible LAN and an IP router to communicate with the central sites. An admin site does not require a private LAN (see Figure 11-16).

Figure 11-16 Admin Site Configuration



You can have multiple Admin Workstations on a single LAN.

CHAPTER 12

Site Preparation

Once you have provisioned IXC access, ordered the required ACD/PBX options, ordered the server platform, and determined your data communications requirements, you can begin preparing for the arrival of the ICM equipment. You need to prepare each site that is to contain ICM equipment. The sites must have adequate power facilities, security, and space for equipment layout.

Be sure to consider the following site preparation tasks:

- **Meet basic site requirements**. Prepare for the arrival of equipment; provide a secure staging area; ensure that sites are ready for occupancy; order and assemble equipment racks.
- **Design a floor plan for each site**. Consider operator workspace, cabling distribution, and maintenance access to ICM nodes.
- **Meet the power and environmental requirements at each site**. Review the server hardware documentation for specifics on power and environmental requirements.
- **Provide adequate security for the ICM system**. Allow only authorized access to the ICM system and any backed-up data.
- **Determine additional cabling or other equipment required**. You may need equipment such as rack-mounting hardware or an uninterruptible power supply (UPS).
- **Order any additional cabling or equipment**. Order any additional equipment in time for the arrival of the ICM system components.

CHAPTER 13

IP Address Worksheets

This chapter provides worksheets you can use to record IP addresses for the visible and private networks. You also need to define static routes for some of the nodes in the ICM system.

Visible Network IP Address Requirements

Table 13-1 lists the IP address requirements for ICM node connections to the visible network. The ICM nodes are listed as duplexed pairs (for example, CallRouter A and CallRouter B). You may or may not have duplexed nodes in your configuration. Supply IP addresses only for the nodes you have in your configuration.

Table 13-1 Visible Network IP Address Requirements

Node	Location	Address Type	IP Address
CallRouter A		High Priority	
		Low Priority	
		Default IP Gateway[1]	
		Netmask	
CallRouter B		High Priority	
		Low Priority	
		Default IP Gateway[1]	

Table 13-1 Visible Network IP Address Requirements (continued)

Node	Location	Address Type	IP Address
		Netmask	
Logger A		Normal data	
		RAS 1	
		RAS 2	
		Default IP Gateway[1]	
		Netmask	
		Modem Tel. Number	
Logger B		Normal data	
		RAS 1	
		RAS 2	
		Default IP Gateway[1]	
		Netmask	
		Modem Tel. Number	
Central Site IP Router		Normal data	
Remote Contact Center Site IP Router		Normal data	
PG1A		Normal data	
		RAS 1	
		RAS 2	
		Default IP Gateway[2]	
		Netmask	
		Modem Tel. Number	
PG1B		Normal data	
		RAS 1	
		RAS 2	
		Default IP Gateway[2]	

Table 13-1 Visible Network IP Address Requirements (continued)

Node	Location	Address Type	IP Address
		Netmask	
		Modem Tel. Number	
PG2A		Normal data	
		RAS 1	
		RAS 2	
		Default IP Gateway[2]	
		Netmask	
		Modem Tel. Number	
PG2B		Normal data	
		RAS 1	
		RAS 2	
		Default IP Gateway[2]	
		Netmask	
		Modem Tel. Number	
PG3A		Normal data	
		RAS 1	
		RAS 2	
		Default IP Gateway[2]	
		Netmask	
		Modem Tel. Number	
PG3B		Normal data	
		RAS 1	
		RAS 2	
		Default IP Gateway[2]	
		Netmask	
		Modem Tel. Number	
AW 1		Normal data	

Table 13-1 Visible Network IP Address Requirements (continued)

Node	Location	Address Type	IP Address
		Default IP Gateway[3]	
		Netmask	
AW 2		Normal data	
		Default IP Gateway[3]	
		Netmask	

1. This is the visible network IP address for the central site IP router.
2. This is the IP address of one of the visible network IP routers. In a duplexed PG configuration, **do not** use the same IP router as the default gateway for both PGs.
3. This is the IP address of the local IP router on the visible LAN.

Private Network IP Address Requirements

Table 13-2 lists the IP address requirements for ICM node connections to the private network. The ICM nodes are listed as duplexed pairs (for example, CallRouter A and CallRouter B). You may or may not have duplexed nodes in your configuration. You need to supply IP addresses only for the nodes you have in your configuration.

Table 13-2 Private Network IP Address Requirements

Node	Location	Address Type	IP Address
CallRouter A		High Priority	
		Low Priority	
CallRouter B		High Priority	
		Low Priority	
Logger A		Normal data	
Logger B		Normal data	
Central Site Private Net IP Router		Normal data	
PG1A[1]		High Priority	

Table 13-2 Private Network IP Address Requirements (continued)

Node	Location	Address Type	IP Address
		Low Priority	
PG1B		High Priority	
		Low Priority	
PG2A		High Priority	
		Low Priority	
PG2B		High Priority	
		Low Priority	
PG3A		High Priority	
		Low Priority	
PG3B		High Priority	
		Low Priority	

1. PGs require private network IP addresses **only** when they are duplexed.

Signaling Access Network IP Requirements

Table 13-3 lists the IP address requirements for ICM node connections to the Signaling Access Network. The ICM nodes are listed as duplexed pairs (for example, CallRouter A and CallRouter B). You may or may not have duplexed nodes in your configuration. You need to supply IP addresses only for the nodes you have in your configuration

Table 13-3 Signaling Access Network IP Address Requirements

Node	Location	Address Type	IP Address
CallRouter A		High Priority	
		Low Priority	
CallRouter B		High Priority	
		Low Priority	

Table 13-3 Signaling Access Network IP Address Requirements

Node	Location	Address Type	IP Address
Network Gateway 1A		Normal data	
Network Gateway 1B		Normal data	

Static Route Requirements

The IP routers used in the ICM networks must have static routes defined in order to provide the necessary connectivity between the visible LAN at the central site and the visible LANs at remote contact center sites. The static route ensures that the IP router can forward traffic from the central site to the remote site. In addition, CallRouters and Loggers must have a static route defined for the remote private LAN. This static route ensures that private network traffic is segregated from visible network traffic.

All the static routes required in your configuration must be defined. However, these static routes cannot be defined until all ICM nodes have been assigned IP addresses.

Table 13-4 Static Route Requirements

Node	Network	Static Route
Central Site Visible Network IP Router—Side A and Side B	Visible	Define one static route for the visible LAN at each remote contact center site and each admin site. If the central sites are geographically separated, add another static route for the other central site.
Central Site Private Network IP Router—Side A and Side B	Private	Define one static route for the private LAN at the other central site.
CallRouter—Side A and Side B	Private	If the sides of the Central Controller are geographically separated, define one static route for the subnet address of the private LAN on the **other** side of the Central Controller.

Table 13-4 Static Route Requirements (continued) (continued)

Node	Network	Static Route
Logger—Side A and Side B	Private	If the sides of the Central Controller are geographically separated, define one static route for the subnet address of the private LAN on the **other** side of the Central Controller.
PG (all PGs)	Visible	One of the two IP routers at a contact center is targeted as the default gateway for the PG. However, the PG needs IP connectivity to both sides of the Central Controller. Therefore, for each PG you must define a static route to the other IP router (that is, to the IP router that is not targeted as the PG's default gateway IP router).
Remote Contact Center IP Routers	Visible	For each IP router, define a static route to one side of the Central Controller (to the central site visible network IP router).
Admin Site IP Routers	Visible	For each Admin Site IP router, define a static route to one side of the Central Controller (to the central site visible network IP router).

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