



# CHAPTER 3

## Design

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### Introduction to Design

Using the project plan that was developed in the Plan phase, your team should have enough information to develop a detailed design for each site and the entire network. The network design should contain, at a minimum:

- Routing and switching component connectivity
- WAN connectivity for intra- and inter-sites
- Software applications and configurations for routers and switches
- Power and environment
- Security
- Redundancy and failover
- Disaster recovery

For each site, in addition to the above, your design should include telephone circuitry, equipment racks with cabinet locations, and layouts. Each site should have a design that encompasses your network call processing, conferencing, and messaging requirements. The design should be scalable for future growth.

For specific deployment steps, see [Deployment Methodology](#) in the Cisco Unified Communications System Description.



#### Tip

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You can navigate to any topic on this tab by using the tab navigation pane at the left of the content pane. This navigation pane contains the table of contents (TOC) for the active tab.

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#### Before You Begin

Review Solution Reference Network Design (SRND) documents and design tools. Gather requirements and data, which can include:

- Business and system requirements
- Service-level agreements
- Capacity (bandwidth) requirements
- Site survey and proposal from the project plan

#### When You Are Done

The main deliverable of the Design phase is the detailed design:

- Network diagrams (see [Network Topology Resources](#) on the Resource Library tab for editable Microsoft Visio network drawings)
- Routing strategy
- Redundancy
- Call flows
- Traffic flows
- Equipment list
- Bill of materials

#### Major Concepts and Tasks in This Process

Go directly to the main design concepts and tasks:

- [Design Concepts](#)
- [Design Tasks](#)

## Design Concepts

Read these conceptual, overview topics for the background knowledge you need to build an intelligent design.

- [Using SRND Documents](#)
- [Using Design Tools and Templates](#)

## Using SRND Documents

Solution Reference Network Design (SRND) documents provide guidelines, recommendations, and best practices for implementing enterprise networking solutions. The following SRNDs are recommended for designing Cisco Unified Communications systems:


- [Cisco Unified Communications SRND Based on Cisco Unified Communications Manager 6.x](#)
- [Cisco Unified Communications SRND Based on Cisco Unified CallManager 5.x](#)
- [Cisco Unified Communications SRND Based on Cisco Unified CallManager 4.x](#)
- [Cisco Unified CallManager Express Solution Reference Network Design](#)
- [Cisco Unified Contact Center Express Solution Reference Network Design](#)

**Note**

Additional SRND resources are available at <http://www.cisco.com/go/srnd>.

## Using Design Tools and Templates

Use these design tools to assist you in sizing your network:

- Cisco CallManager Capacity Tool  
<http://www.cisco.com/cgi-bin/CT/CCMCT/ct.cgi> 

The Cisco CallManager Capacity Tool calculates the minimum number of active subscribers that are required to support a given installation. The inputs consist primarily of quantity and usage information on the various device types that are supported in a Cisco Unified Communications Manager system.

- IPC Tools

<http://tools.cisco.com/partner/ipccal/index.htm> 

The IPC Tools, such as the IPC Resource Calculators, are intended to simplify and automate the process of sizing IP resources that are required for specific business operations. They are also useful for verifying and troubleshooting existing installations.

The output from these tools can also be used as input to the contact center Express Configuration Tool and the Cisco CallManager Capacity Tool.

- Solution Expert tool

<http://www.cisco.com/go/sx> 

Solution Expert is a web-based tool that assists in the design, configuration, quoting, and ordering of Unified Communications products. Solution Expert is available for Cisco sales and partner systems engineers who have Unified Communications specializations.

With the Solution Expert tool, users can generate a recommended solution based on their requirements. Users can modify the recommended configuration if desired. Solution Expert validates any changes when it presents the new solution. Solution Expert also generates a bill of materials with list pricing, a Visio diagram, and other design documentation. For an overview of how to use the tool, see the introductory PDF on the home page.

- Quote Builder Tool

<http://www.cisco.com/web/partners/quotebuilder/index.html> 

The Quote Builder tool is a solutions quoting application for Cisco Unified Communications products. Quote Builder is available to specialized partners and Cisco employees.

With Quote Builder, users can build a system quote with design documents to aid in the implementation of the solution. Quote Builder also validates designs for common deployments. Quote Builder generates a bill of materials, a network diagram, and design guides for deployment.

## Design Tasks

This topic contains an overview of the design tasks for the following systems:

- [Small Business Systems](#)
- [Medium Business Systems](#)
- [Enterprise Systems](#)

## Small Business Systems

The following list is an overview of tasks for small business systems and is not meant to represent an ordered sequence of tasks.

- [Identify the Components That You Need](#)
- [Review Tested Site Models](#)
- [Review System Caveats](#)

- [Review System Test Results](#)
- [Develop Traffic Engineering Specifications](#)
- [Define Security Policies](#)

## Medium Business Systems

The following list is an overview of tasks for medium business systems and is not meant to represent an ordered sequence of tasks.

- [Identify the Components That You Need](#)
- [Review Tested Site Models](#)
- [Review System Caveats](#)
- [Review System Test Results](#)
- [Develop Traffic Engineering Specifications](#)
- [Define Security Policies](#)

## Enterprise Systems

The following list is an overview of tasks for designing enterprise systems and is not meant to represent an ordered sequence of tasks.

- [Identify the Components That You Need](#)
- [Review Tested Site Models](#)
- [Review System Caveats](#)
- [Review System Test Results](#)
- [Develop Traffic Engineering Specifications](#)
- [Define Security Policies](#)
- [Design for High Availability](#)

## Identify the Components That You Need

This topic provides links to descriptions of components, component documentation, and matrixes.

- [IP Telephony Overview](#)—Describes the primary Cisco software components in IPT systems.
- [Review Release Matrix](#)—Identifies the components and their software versions that you need.
- [Component Resources](#)—Lists the component documentation.
- [Cisco Unified Communications Compatibility Tool](#)—Provides tables that identify the compatible software release versions for each product in each Cisco Unified Communications release.
- [Cisco Interoperability Portal](#)—Provides information about configuring Cisco technologies with third-party products and lists features that interoperate between Cisco solutions and other vendors.

For an additional overview of primary components that can be installed and configured in the IPT environment, see [Component Installation and Upgrade](#) and [Component Reference Configurations](#) in the Implement tab.

## Ordering Tools

- Solution Expert is a web-based tool that assists in the design, configuration, quoting, and ordering of Unified Communications products. Solution Expert is available for Cisco sales and partner systems engineers who have Unified Communications specializations. To access Solution Expert, go to the following URL:

<http://www.cisco.com/go/sx> 

- The Quote Builder tool is a solutions quoting application for Cisco Unified Communications products. Quote Builder is available to specialized partners and Cisco employees. With Quote Builder, users can build a system quote with design documents to aid in the implementation of the solution. Quote Builder also validates designs for common deployments. Quote Builder generates a bill of materials, a network diagram, and design guides for deployment. To access the Quote Builder tool, go to the following URL:

<http://www.cisco.com/web/partners/quotebuilder/index.html> 

## Review Tested Site Models

For Release 6.0(1), Cisco developed a variety of site models as standard architectures. These models were tested and optimized for maximum efficiency and performance. You can derive your network design by choosing the deployment model that most closely matches your business and then adding the specific features and applications that meet your business needs. Review the following information:

- [Tested Deployments and Site Models](#)
- [Purpose of Solution Tests](#)
- [Multisite Distributed Deployment Options](#)
- [North America Site Models](#)
- [Europe and Emerging Markets Site Models](#)

## Review System Caveats

System caveats are system limitations and restrictions. Check the latest release notes to make sure that your design has taken all system caveats into consideration. System caveats are listed under the [Limitations and Restrictions](#) section of the release notes.

## Review System Test Results


System test results show the scope and extent of the testing conducted for Cisco Unified Communications systems in a test environment that is modeled on real-world deployments.

Depending on the network you are designing and your specific environment, use the system test results as a guide and supplement for your own site test and turn-up plan.

For the results of testing for Cisco Unified Communications Release 6.0(1), see [System Test Results](#) in the Resource Library.

## Develop Traffic Engineering Specifications

For background information on various traffic analysis concepts and features that are applicable to Voice over IP (VoIP), see [Traffic Analysis for Voice over IP](#). This document presents fundamental traffic theory, several statistical traffic models, application of traffic analysis to VoIP networks, and an end-to-end traffic analysis example.

Use the [Cisco CallManager Capacity Tool](#)  to calculate the minimum number of active subscribers that are required to support a given installation. Inputs consist primarily of quantity and usage information on the various device types that are supported in a Cisco Unified Communications Manager system.

The following third-party traffic engineering tools are provided for your reference:

- [VoIP Bandwidth Calculator](#)
- [Online Erlang Traffic Calculators](#)

## Define Security Policies

Refer to security policies in these guides:

- [Cisco Unified CallManager Security Guide, Release 6.0\(1\)](#)
- [Cisco Unified CallManager Security Guide, Release 5.0\(4\)](#)

Additional IP security information is included here for your reference:

- [Enhanced Security for Unified Communications](#)
- [Integrated network security—SAFE Blueprint](#)
- [Expanding the Self-Defending Network](#)
- [Design Zone for Security](#)
- [Cisco Security Center](#)

## Design for High Availability

Cisco IP telephony systems are designed for high availability. In order to achieve this, the design must include redundancy for failover and rapid recovery. For recommendations and design assistance from Cisco Advanced Services, see [Navigating the Road to Five Nines](#).

The Unified Communications Manager plays the key role in maintaining call processing following a failure in an IP telephony environment. This topic describes the following high-availability features that are built into Unified Communications Manager:

- [Unified Communications Manager Clusters](#)
- [Unified Communications Manager Redundancy Groups](#)
- [Keepalive Mechanism](#)



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**Note**

The information in this topic applies to multiple Unified Communications Manager server clusters in a large enterprise environment and does not apply to Cisco Unified Communications Manager Business Edition. Cisco Unified Communications Manager Business Edition is a single-server solution designed for medium businesses up to a maximum of 500 employees and does not offer redundancy.

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## Unified Communications Manager Clusters

A cluster comprises a set of Unified Communications Manager servers (or *nodes*) that share the same database and resources. Unified Communications Manager servers can be configured to perform the following functions: database server, TFTP server, or application software server. You can dedicate a particular server to one function or combine several functions on one server, depending on the size of your network and the level of redundancy desired.

Each cluster can have only one database server (also called the *first node*) and usually one TFTP server (either separate or combined with another function). Cisco Systems recommends that large enterprise networks contain a dedicated Unified Communications Manager database server with other servers (called *subsequent nodes*) running the Unified Communications Manager application software. The Unified Communications Manager application software performs all call control, including signaling of endpoints, feature invocation, and calling restrictions. Large-scale networks typically use paired redundant application software servers, running in an active-active configuration, with endpoints evenly distributed across the two servers. The TFTP server provides configuration files for the endpoint devices and the associated firmware loads. Large enterprise networks typically use redundant TFTP servers.

## Unified Communications Manager Redundancy Groups


A redundancy group comprises a prioritized list of up to three Unified Communications Manager servers. You can associate each group with one or more device pools to provide call processing redundancy. Each group must contain a primary Unified Communications Manager, and it may contain one or two backup Unified Communications Manager servers. If the primary Unified Communications Manager fails for any reason, the first backup Unified Communications Manager in the group takes control of the devices that were registered with the primary Unified Communications Manager. If you specify a second backup Unified Communications Manager for the group, it takes control of the devices if both the primary and the first backup Unified Communications Manager servers fail.

When a failed primary Unified Communications Manager comes back into service, it takes control of the group again, and the devices in that group automatically reregister with the primary Unified Communications Manager.

## Keepalive Mechanism

A keepalive mechanism is an essential part of an IP telephony solution. Keepalives ensure that endpoints (typically phones and gateways) retain their communications path to a Unified Communications Manager server. Keepalives not only determine when the primary Unified Communications Manager server is no longer available, they also determine when the site has become completely isolated from a centralized call control system and must revert to some form of remote survivability capability such as Cisco Unified SRST. Keepalives avoid delays in establishing a call caused by searching for an available Unified Communications Manager server.

## Additional Sites and Services

Steps to Success is a Cisco methodology that outlines the tasks required to complete a successful customer engagement. Registered users can visit the [Steps to Success](#)  resource site for Cisco Unified Communications process flows.

Cisco Unified Communications Services is a Cisco service offering that provides engineering expertise and best practices.

- Registered users can visit the [Cisco Unified Communications Services](#)  partner site.
- Nonregistered users can visit the [Cisco Unified Communications Services](#) site.

For a solution that may fit your network design requirements, see Industry Solutions at <http://www.cisco.com/web/strategy/index.html>.