SURVIVABILITY OF REMOTE BRANCH OFFICES

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Survivability of Remote Branch Offices
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Chapter 1

INTRODUCTION

Introduction and Purpose

Designing your network takes careful thought—there are many variables to consider—and designing the network for a branch office has additional challenges, as compared to the head office. For example, the head office usually has IT staff, and maybe a resilient LAN, and so on, while the branch office often has none of these.

In addition, the resiliency requirements for the branch office may be higher or lower than that of the head office network.

At one end of the spectrum, for example, you could have a couple of people working out of a garage. All they need are a couple of phones and Internet access. Most of their calls are outgoing, and they use the Internet only for e-mail, so bandwidth requirements are low. In this case, the telephones and Internet are used only 8 hours a day, 5 days a week, and short outages would cause only a minor inconvenience. The only uninterruptible service you need to consider in your network design is emergency services like 911 or 999.

At the other end of the branch office spectrum, the network must provide service to a support center that operates 24 hours a day, 7 days a week, and offers both Web site and telephone support. The operation is a critical one with hundreds of agents, and even short outages are very costly. The Web site and the phone service must be accessible 24/7 and bandwidth requirements are high.

This guide describes the questions to ask before designing a survivable branch office and how the answers affect the design of the branch office network.

For detailed information about network reliability and availability, also see the following Mitel white papers. The first document in the list illustrates the full list of Mitel white papers related to telephone system availability:

• List of Telephone System Availability Documents

• Geographically Distributed IP Phone Systems

• Telephone System Availability

• Network Design for Availability

• High Availability Solutions for the Hospitality Market

• IP Telephony Architecture

For more information about network design for reliability, see the following Guides:

• *3300 ICP/MiVoice Business Engineering Guidelines*

• *MiVoice Business Resiliency Guide*

Terms and Acronyms

The following terms and acronyms are used in this Guide.

Table 1:   Terms and Acronyms

ACRONYM/TERM	DESCRIPTION
DSL	Digital Subscriber Line
HSRP	Hot Standby Routing Protocol (Cisco version of VRRP)
ICP	Mitel IP Communications Platform
LIM	Line Interface Module
MBG	Mitel Border Gateway (now called MiVoice Border Gateway)
MCD	Mitel Communications Director (now called MiVoice Business)
MCPH	Maximum Calls Per Hour
MTBF	Mean Time Between Failures
MTTR	Mean Time To Repair
OC-3	Optical Carrier 3: OC-3 is a network line with transmission data rate of up to 155.52 Mbit/s (payload: 148.608 Mbit/s; overhead: 6.912 Mbit/s, including path overhead) using fiber optics.
ONS	ON-premise Station (a POTS phone)
OSPF	Open Shortest Path First
POTS	Plain Old Telephone Service; used to describe TDM telephone and connection.
PSTN	Public Switched Telephone Network
QoS	Quality of Service
SOHO	Small Office/Home Office
VRRP	Virtual Router Redundancy Protocol
WAN	Wide Area Network
UPS	Uninterruptible Power Supply

Chapter 2

SURVIVABILITY OF BRANCH OFFICES

Designing a survivable branch office

Telephone system reliability, redundancy, and resiliency are all interrelated, and they directly affect system availability. A highly reliable, non-redundant system will provide users with a high level of availability. Redundant and resilient design techniques can provide users with a higher reliability system than non-redundant systems by providing continued availability, even when a system component failure occurs.

It is common practice within the industry to refer to the reliability level of a product or system as 5 9s or 5 x 9. This is used as a measure of the availability of the product or system, expressed as a percentage. When a product has an availability of 5 9s it is available 99.999% of the time. Standard availability is considered to be 3-9s, or 99.9% availability

When you start planning to provision a branch office, the first thing you should consider is how to ensure the required availability.

Use the following sections to determine the required availability and plan how to design a branch office with that availability:

Gathering information about the branch office

Before you can design a survivable branch office, you need to know the requirements of the users at the branch office and the level of service they need. The answers to the questions in the following table will guide the design of your survivable branch office.

In Table 2 Service Level Agreement (SLA) means: In data communications, a contract between the service provider and the customer that defines the availability of the communication service being provided. This may include guarantees for the time to restore service, plus the Quality of Service (QoS). For instance, do they support diffserv (prioritizing traffic over the WAN)?

Table 2:   Information gathering

	OPTIONS	YOUR PLANS
How many users work from your branch office?	full-time vs. part-time workers	
What are the hours of operation?	weekday vs. 24/7 operation	
What is the nature of the business?		
What is the expected call volume at the branch office? (MCPH) What percentage of the calls will be: • within the branch office? • to the local PSTN? • to the head office?		
What network availability (up-time) is needed? Is there a Service Level Agreement (SLA) with the service provider? What does the SLA define?	(3-9's vs. 5-9's, for example)	
What additional services are needed at the branch office?	• e-mail • Internet fax (T.38)	
Web site: How much traffic is expected at the Web site?	• mission-critical applications? (for example, a billing system) • non-mission-critical	
If you already have connectivity to the head office, what type is it?	DSL/cable - What are the speeds in both directions? Type of WAN link (e.g. T1, OC3)	
What level of local system (MiVoice Business) availability is required?	This will help determine the power backup, call processing, and redundancy needed. Note: Refer to the availability white papers; see the list below.	
How are the databases backed up, and how often?	• local backup? • across the WAN? • daily, weekly, monthly?	

For detailed information about network reliability and availability, see the following Mitel white papers. The first document in the list illustrates the full list of Mitel white papers related to telephone system availability, and how they fit together:

- List of Telephone System Availability Documents

- Geographically Distributed IP Phone Systems

- Telephone System Availability

- Network Design for Availability

- High Availability Solutions for the Hospitality Market

- IP Telephony Architecture

For more information about network design for reliability, see the following Guides:

- *3300 ICP/MiVoice Business Engineering Guidelines*
- *MiVoice Business Resiliency Guide*

Determining the required branch office availability

The answers to the questions in the previous section will help determine your design choices. The topics in this section describe how to use the answers to plan your branch office.

What level of availability is needed?

Use the following section to help you design your branch office. This is a high-level guide to the kinds of things you should consider; in many cases, the combination of requirements defines the availability features you should implement.

For the purposes of this document, the different availability levels are defined as follows:

• High availability: 5-9s or better

• Medium availability: 3-9s to 5-9s

• Basic availability: 3-9s or worse

Table 3 describes some factors in determining the level of availability you need to design into the branch office. If you have multiple branch offices, you might find that you use all three types of branch offices, all connected to one or more head offices.

Table 3: What level of availability is needed?

NETWORK AVAILABILITY REQUIRED	UNDER THESE CONDITIONS...
You should set up the branch office for high availability (5-9s +) if:	
	The branch office includes a call center that must be available 24/7. In this case, voice functionality is mission-critical.
	The branch office uses mission-critical applications that are hosted at the head office. **Note:** You should have duplicate applications running at the branch office, and you may also need a duplicate WAN, run along a different route.
	The branch office hosts a Web site that must be available 24/7.
You should set up the branch office for medium availability (3 to 5-9's) if:	
	The branch office runs 40 hours a week or less. This could still require a high availability branch office, depending on how critical the branch office functions and applications are. **Note:** Higher availability is easier to maintain when weekends and/or evenings are available for scheduled maintenance, so for a high or medium-availability branch office that runs only 40 hours per week, you may not need to provision full resiliency and redundancy to maintain the availability you need.
	The branch office Web presence is important to customers, but not mission-critical.
	The branch office will host many employees who will be inactive if service is lost.
You should set up the branch office for basic availability (3-9s or less) if:	
	The branch office does not handle mission-critical customer calls or applications.
	The employees in the branch office are able to perform many of their functions, even if voice and data service is lost.

Features to implement for the required availability

For each level of availability described in the previous section, different design considerations become important, especially with respect to voice calls or other mission-critical services.

Table 4: Branch office requirements by availability requirements

NETWORK USE AND REQUIREMENTS	HIGH AVAILABILITY REQUIRED	MEDIUM AVAILABILITY REQUIRED	BASIC AVAILABILITY REQUIRED
Resiliency	X	X	
Emergency Services	X	X	X
PSTN at Branch Office	X	X	optional
Two different ISPs	X		
Apps duplicated at Branch Office	X		
UPS	X	optional	

What additional services are needed at the branch office?

In most branch offices, the minimum requirements are voice and e-mail, and perhaps fax, along with connection to data and applications at the head office, plus basic Internet and Web access.

If you are hosting a Web site at the branch office, especially a high-traffic Web site, you must plan for additional bandwidth to accommodate the traffic.

Will the branch office be a call center that requires access to the following services during an outage?

- call recording

- Unified Communications

- Web Collaboration

Providing connectivity to service provider and head office

If you will be getting your Internet connection through the head office, you need to consider what kind of connection or connections will supply the bandwidth and reliability you need to maintain the operation of the branch office.

If you already have a connection set up, is it sufficient for your projected throughput? If not, you will need to upgrade your connection.

If you are setting up the branch office for the first time, consider the type and volume of the expected traffic.

- Are you operating only phone, fax, and e-mail, or is there a significant amount of data transfer as well?

- Are you hosting a high-traffic call center, Web site, or similar from the branch office?

- Are you using head office-hosted operating applications over the connection?

If high availability is needed, consider provisioning duplicate connections from the head office and use an appropriate routing protocol to switch from the main connection to the backup connection. Cabling for the two connections should not be in the same trench or use the same route to avoid both being cut at the same time. It is also recommended that the two connections enter the buildings at different locations, and use different service providers. For more information, see IP Telephony Architecture.

Protecting services in the case of power outages (UPS)

Although the power grid has a reliability of 99.9% (3-9s), there are occasional outages, and at minimum, you should ensure uninterrupted emergency telephone service.

Protecting emergency telephone service

Although your branch office may be able to tolerate some down-time due to power outages, you should have a plan for your emergency service (911 or 999, for example). You should use at least one of these emergency service options:

- one or more standard POTS telephone sets with a local connection to the PSTN

- an IP phone with a Line Interface Module (LIM) with a separate connection to the PSTN

- an analog gateway with a PSTN connection and a power fail transfer relay that allows a POTS phone to be connected to the PSTN during a power outage

Protecting branch office controllers and application servers

If your branch office network design includes an on-site MiVoice Business controller to ensure that you have service when the head office is not available, you should consider providing a UPS or generator to supply the branch office controller, in the event of a power outage. You may also want to provide backup power for any application servers, if they exist at your branch office.

If the branch office must operate with high availability, any redundant equipment should be powered from separate branch circuits. If the equipment has redundant power supplies with separate AC power inputs, these power supplies should be powered from different branch circuits.

Defining required time to effect repairs

Mean Time To Repair (MTTR) can be a big factor in the amount of down-time your branch office experiences, whether the problem is equipment, Internet, or power outages. The time to repair depends on the availability of staff and spare parts, the service agreement with the supplier (for example, 24/7 on-site vs. next business day), and the distance to the nearest dealer.

If you need high availability—usually possible only with very short repair times—you must either have an emergency service contract with a local dealer, or you must have on-site and on-call staff who can make repairs quickly. You must also have an inventory of spare parts to avoid having to wait for parts to be delivered. For more information on this subject, see Network Design for Availability.

Example network configurations for required availability levels

The following sections show examples of network configurations you could use for the various required availabilities.

Basic availability with Small Office/Home Office (SOHO) or Teleworker

You can achieve basic availability with an IP phone connected to your head office MiVoice Business controller.

To provide local emergency service, you must have a POTS phone connected to a local carrier, or you can use an IP phone with a Line Interface Module (LIM), which is connected to the PSTN.

MCD 6.0 introduced Location-based call routing. With Location-based call routing, a call from an extension to a service or destination such as Emergency (911 or 999), Directory Assistance (411), or a corporate Help Desk is sent to the service located in the same network zone (Network Zones) as the-originating device. For example, when a New York-based hot desk user logs into a phone in Chicago and dials 911, the system routes the call to the Chicago Public Safety Answering Point (PSAP), not the New York PSAP. For detailed information about configuring Location-based call routing, refer to the System Administration Tool Online Help.

**Figure 1: Basic availability with SOHO or Teleworker**
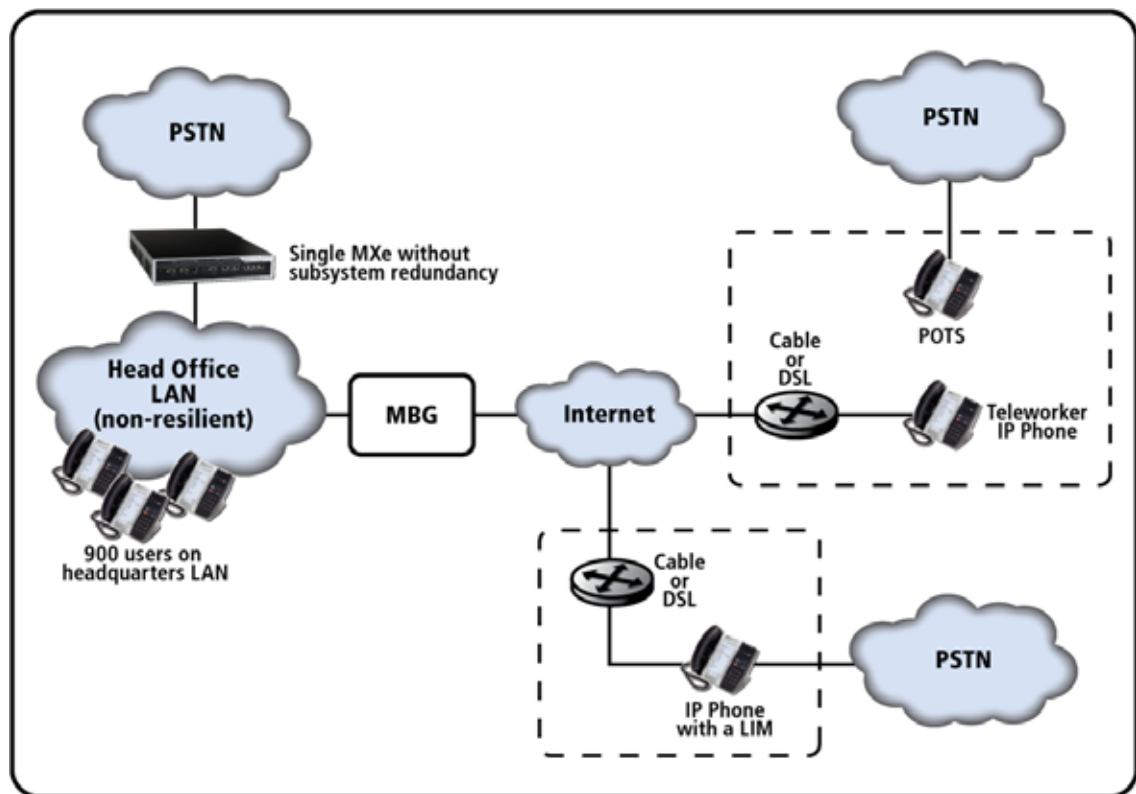
Basic availability

For a larger branch office with more telephones you can set up a branch office with basic availability, with the phones connected through the head office controller.

To provide local emergency service, you must have a POTS phone connected to a local carrier, or you can use an IP phone with a Line Interface Module (LIM) that connects to the PSTN, as shown in Figure 1.

MCD 6.0 introduced Location-based call routing. With Location-based call routing, a call from an extension to a service or destination such as Emergency (911 or 999), Directory Assistance (411), or a corporate Help Desk is sent to the service located in the same network zone (Network Zones) as the-originating device. For example, when a New York-based hot desk user logs into a phone in Chicago and dials 911, the system routes the call to the Chicago Public Safety Answering Point (PSAP), not the New York PSAP. For detailed information about configuring Location-based call routing, refer to the System Administration Tool Online Help.

**Figure 2: Basic availability**
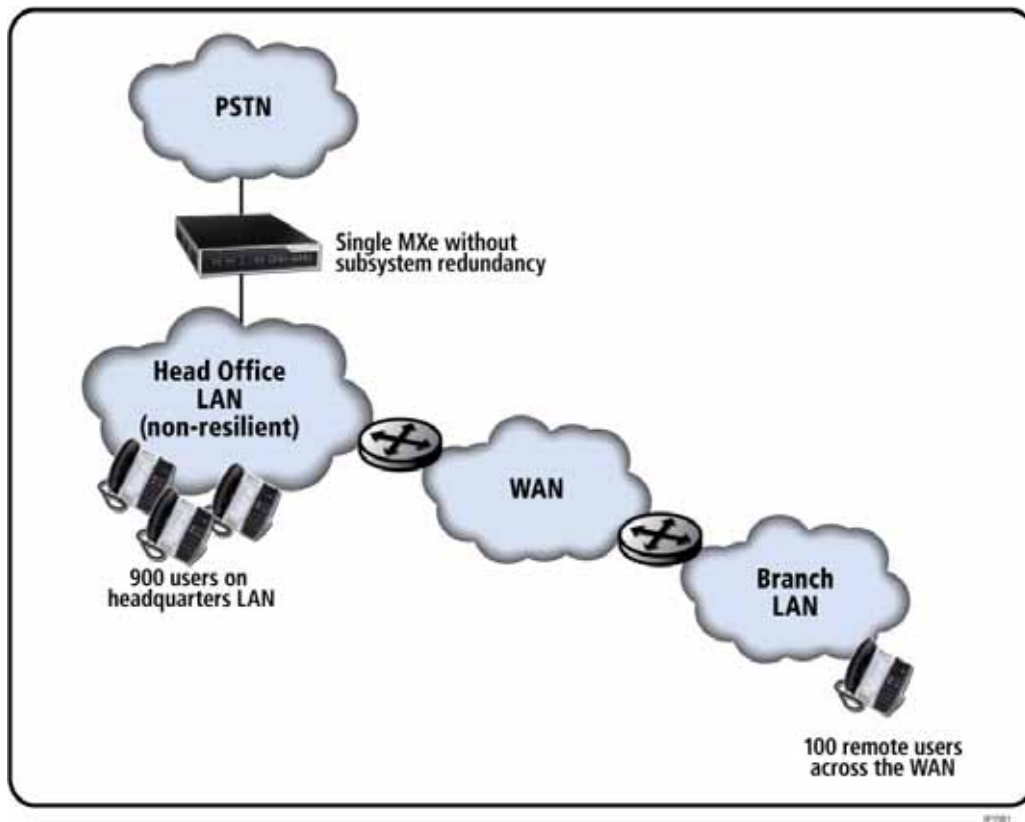
Medium Availability

For medium availability, create a resilient head office by adding another MiVoice Business controller and setting up the branch office phones for resiliency. If the primary controller fails, the branch office phones fail over to the secondary controller.

If the WAN fails, the branch office loses service, so you must ensure that you have at least one telephone connected directly to a local carrier for emergency services. This can be a POTS phone, or an IP phone with a LIM connected to the PSTN, as illustrated in Figure 1.

MCD 6.0 introduced Location-based call routing. With Location-based call routing, a call from an extension to a service or destination such as Emergency (911 or 999), Directory Assistance (411), or a corporate Help Desk is sent to the service located in the same network zone (Network Zones) as the-originating device. For example, when a New York-based hot desk user logs into a phone in Chicago and dials 911, the system routes the call to the Chicago Public Safety Answering Point (PSAP), not the New York PSAP. For detailed information about configuring Location-based call routing, refer to the System Administration Tool Online Help.

Figure 3: Medium availability
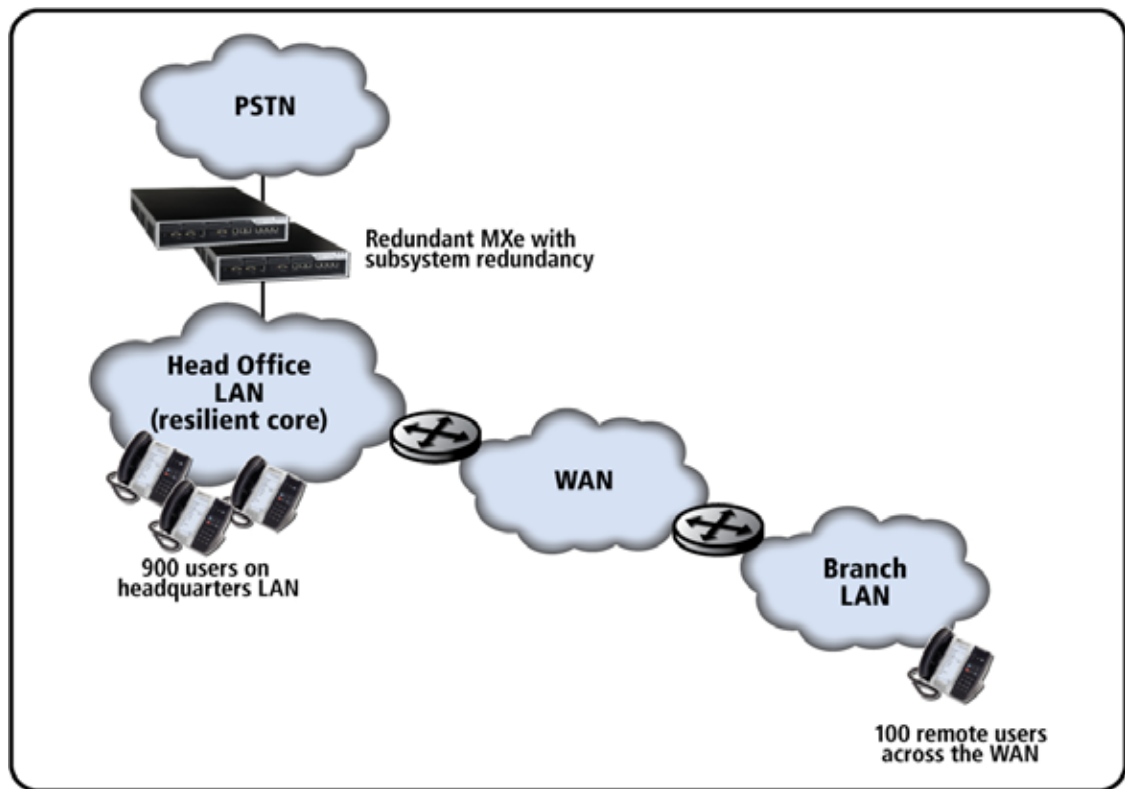
High Availability

There are many different ways to increase the availability. Figure 4 illustrates high availability using resilient controllers at the head office, and redundant WAN links to the branch office.

The two WAN links should be run over different routes, and use different network service providers to avoid them both going down at the same time in the case of a backhoe cutting across the WAN trench, or a network service provider failure, for example.

Local PSTN connectivity for 911 is always advised.
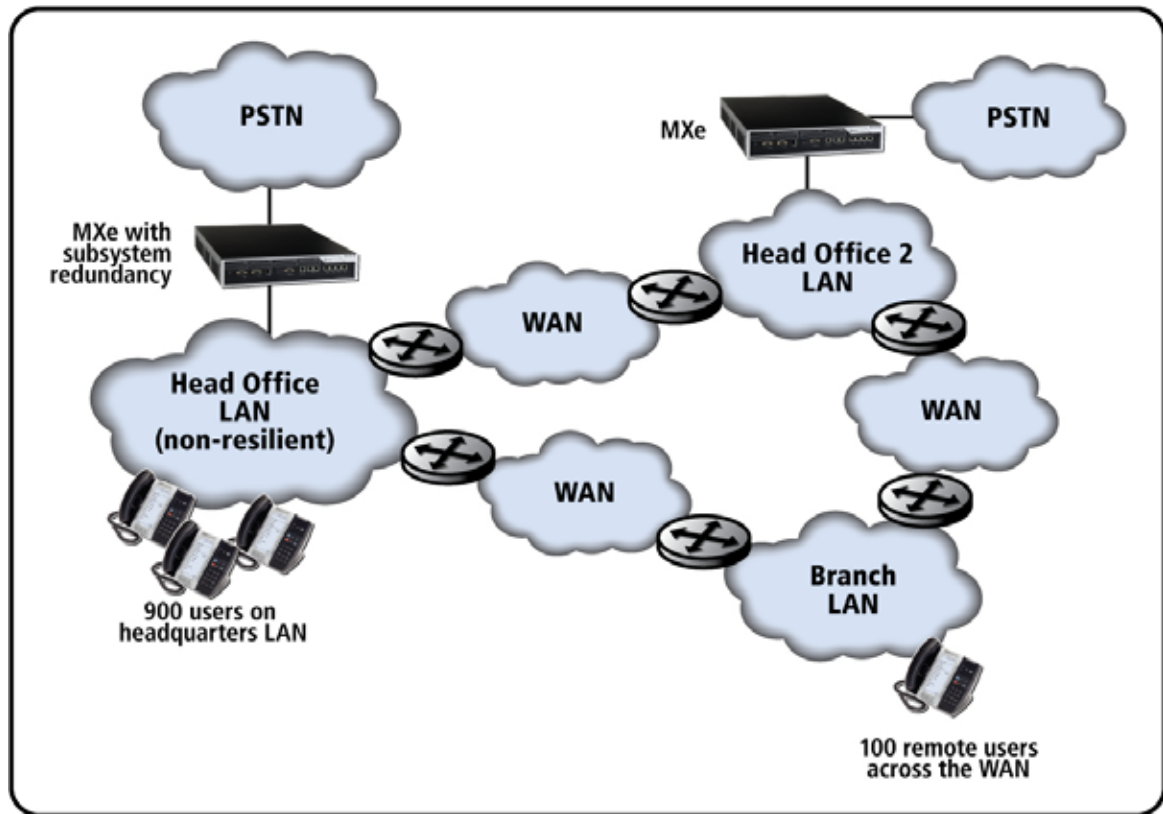
Figure 4: High availability
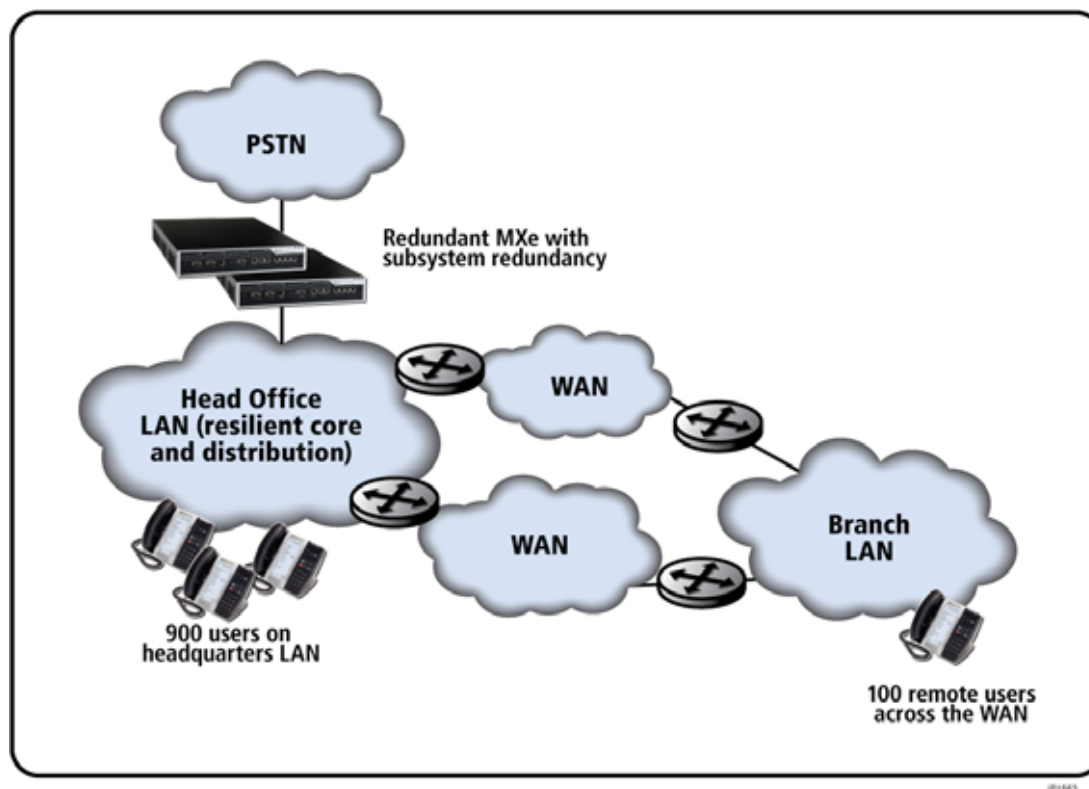
High Availability with geographic distribution

Figure 5 illustrates high availability with connections to geographically separated head offices.

The branch office is connected to both head offices. If service from the primary fails, the branch office phones fail over to the secondary head office.

Local PSTN connectivity for 911 is always advised.

Figure 5: High availability with geographic distribution

# Alternate High Availability with local 3300 ICP Controller

In this topology, one of the head office MiVoice Business controllers is designated as the Primary for the branch office, with a resilient Secondary ICP controller located on-site at the branch office. PSTN access could also be added at the branch office.

In case of failure of the WAN, the head office MiVoice Business controller, or its network, the local ICP controller in the branch office takes over, possibly with reduced service.

Alternatively, if the local ICP controller fails, service remains on the head office controller, with possible loss of local call routing.

Local PSTN connectivity for 911 is always advised.

Figure 6: Alternate high availability
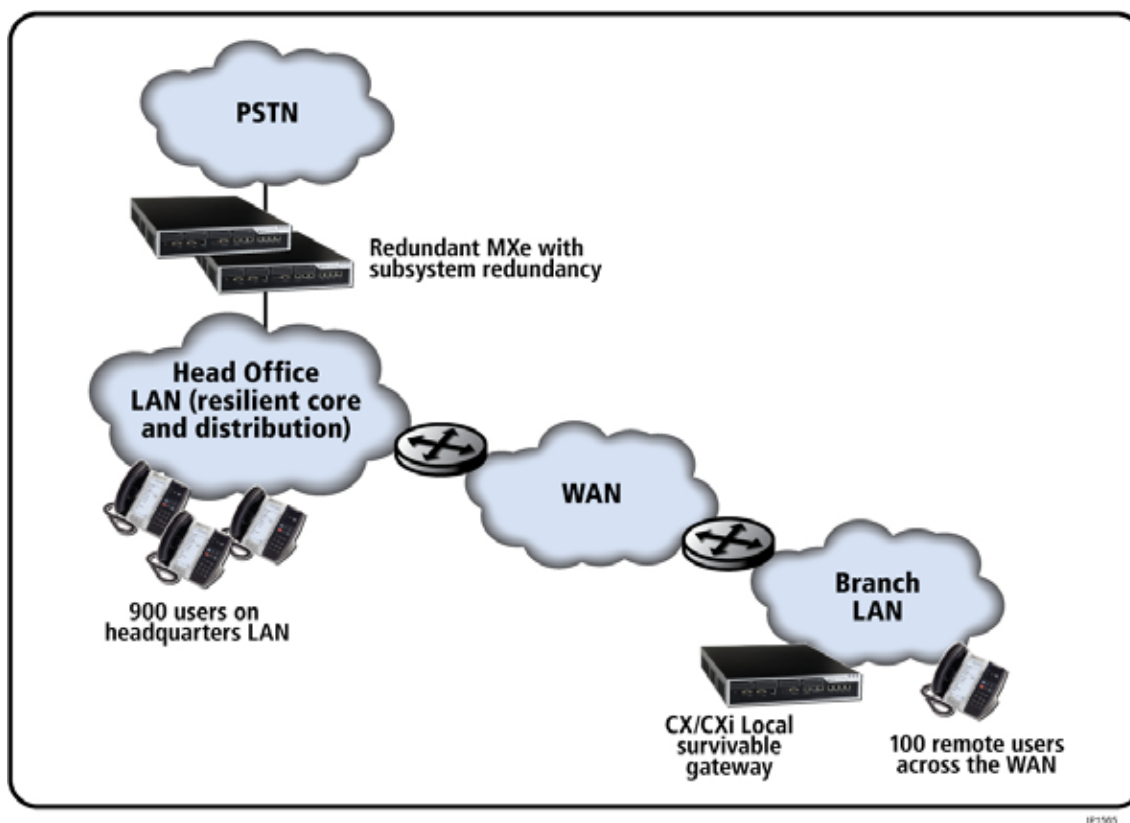
Maintenance

In addition to designing the branch office for availability, scheduled maintenance also improves availability. You should schedule the following tasks:

- Perform frequent database backups on a regular schedule.

- During scheduled maintenance, test failover of the MiVoice Business controllers and re-dundant links. During scheduled down time, shut down the 3300 ICPs (or MiVoice Business controllers) in an orderly fashion, or otherwise isolate them from the LAN to verify that resilient operation behaves as expected.

- Remove logs periodically.

- Test the UPS devices regularly, and keep spare batteries for quick recovery in case of battery failure.

You must have resiliency in place or maintenance operations will have a service impact. Without resiliency, maintenance, whether planned or otherwise, reduces overall availability.