Avaya S8300 and Avaya S8500 Media Server Local Survivable Processor Issue 4.0

Abstract

This document presents a discussion about the Avaya S8300 and S8500 Media Server configured as a Local Survivable Processor (LSP). This discussion is intended to describe how the LSP provides the added layer of survivability and how to design a network to take full advantage of the LSP's capabilities.

1. Introduction

Communication is the life-blood of any company, and ensuring that communications will be available at any time is critical. This is increasingly difficult to provide in today's changing environment from pure voice networks to converged data and voice networks. Avaya offers a strong line of products to assist in creating the most robust network possible. This portfolio of solutions includes the Avaya S87xx Media Server , Avaya S8500 Media Server and the Avaya S8300 Media Server. The S87xx Media Server runs in duplex mode with a standby server ready to take control with no loss of communication should a cataclysmic event occur to the primary server. The duplicated S87xx Media Server protects the network against a server failure, but increasing distances between headquarters and remote branch offices increases the chance of a network facilities outage causing loss of communications. Avaya offers the Local Survivable Processor (LSP), and as of CM3.1 Standard Local Survivability (SLS) to continue to provide service in the case of broken connectivity between remote sites and main locations. In addition, Avaya empowers the administrator with the ability to define how the system behaves in the case of lost network connectivity. The priority can be placed on maintaining a solid network or on a speedy switch to the LSP and short downtime.

This document is intended to describe how the LSP provides the added layer of survivability, how to administer the behavioral priorities, and how to design a network to take full advantage of the LSP's capabilities.

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2. Overview

The Avaya Local Survivable Processor (LSP) solution utilizes the Avaya S8300 (or S8500 Media Server as of CM 3.1) hardware and software components and requires an Avaya Communication Manager software license to activate the LSP feature. This software license allows the S8300 Media Server to be a survivable call-processing server for remote/branch customer locations, as well as a redundant call controller for a standalone S8300 Media Server.

Capacities are shown in table 1.

Server-role	Capacities of IP Stations + IP trunks	Maximum Capacity H.248 Media Gateways per server
S8300 - main	900	50
S8300 - LSP	900	50
S8500 - main	3,200 (2,400 stations + 800 trunks)	250
S8500 – LSP	2,500	250
S8500 – ESS	3,200	250
S87xx - main	12,000	250
S8400 - main	1,500	5

Table 1: LSP Capacities

In the event that the communication link is broken between a remote Avaya Media Gateway [1] and the primary call controller the LSP will provide service for the Avaya IP Telephones and H.248 Media Gateways that were controlled by the primary call controller. A large enterprise customer may have a main media server controlling multiple remote Media Gateways configured with LSPs.

The strategy by which H.248 Media Gateways and IP endpoints change control from the primary gatekeeper to the LSP is driven by the Media Gateways and endpoints themselves, which each use a list of gatekeepers. During initialization, each IP endpoint receives a list of gatekeepers. Initially, the IP endpoints ask each gatekeeper in the list for service until one responds with a Gatekeeper Confirm (GCF) which load balances the IP phones. The IP phone then makes a Registration Request (RRQ) which Avaya CM

[1] "Media Gateway" in the context of this paper refers explicitly to the H.248 type of Avaya Media Gateway. At the time of publishing, this includes G150, G250, G350, and G700 Media Gateways. Most of these models can host an S8300 media module, in which case they can host an LSP. All of these models can register to an LSP.

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responds to with a Registration Confirm (RCF) which includes a list of alternate gatekeeper addresses. This list overrides the list previously received via DHCP/TFTP/HTTP. Each gateway is initially administered with a list of gatekeepers. If the link to the primary call controller fails at some later time, the Media Gateways and IP endpoints will try to receive service from the other gatekeepers in the list, including the LSP(s). An LSP will provide service to all Media Gateways and IP endpoints that register with it. The LSP can be administered to either fail-back to the primary automatically, or be moved back manually. This fail-back process will inform the IP endpoints to try their gatekeeper list again, and return to the primary call controller for service.

The LSP provides redundancy in a variety of configurations and can be located anywhere in a network of H.248 Media Gateways.

The LSP does not currently provide support for traditional port networks, such as the MCC, SCC or G650, and it is not intended be the only vehicle to provide reliability for an entire large network. The design intent of an LSP is to serve a subset of the network, such as a remote geographic location with a small or mid-sized office. For support of larger portions, or the entire network, Avaya has developed the ESS which is covered in another white paper.

Standard Local Survivability (SLS) is a new option as of CM3.1. It is supported initially on the Avaya G250 Media Gateway. It provides minimal call control, built into the G250, without using an S8300, and is intended to provide a low-cost alternative for survivability of small branch offices. More information can be found at support.avaya.com in G250 documentation.

3. Definitions

CLAN : Control LAN, the TN799 circuit pack
DHCP : Dynamic Host Configuration Protocol
MGP : Media Gateway Processor
SAT : System Access Terminal
SNMP : Simple Network Management Protocol

4. Configurations

The LSP can support an Avaya S87xx, S8500, S8400 or S8300 Media Server. The diagram below shows LSPs in both a branch office and a mid-size office.

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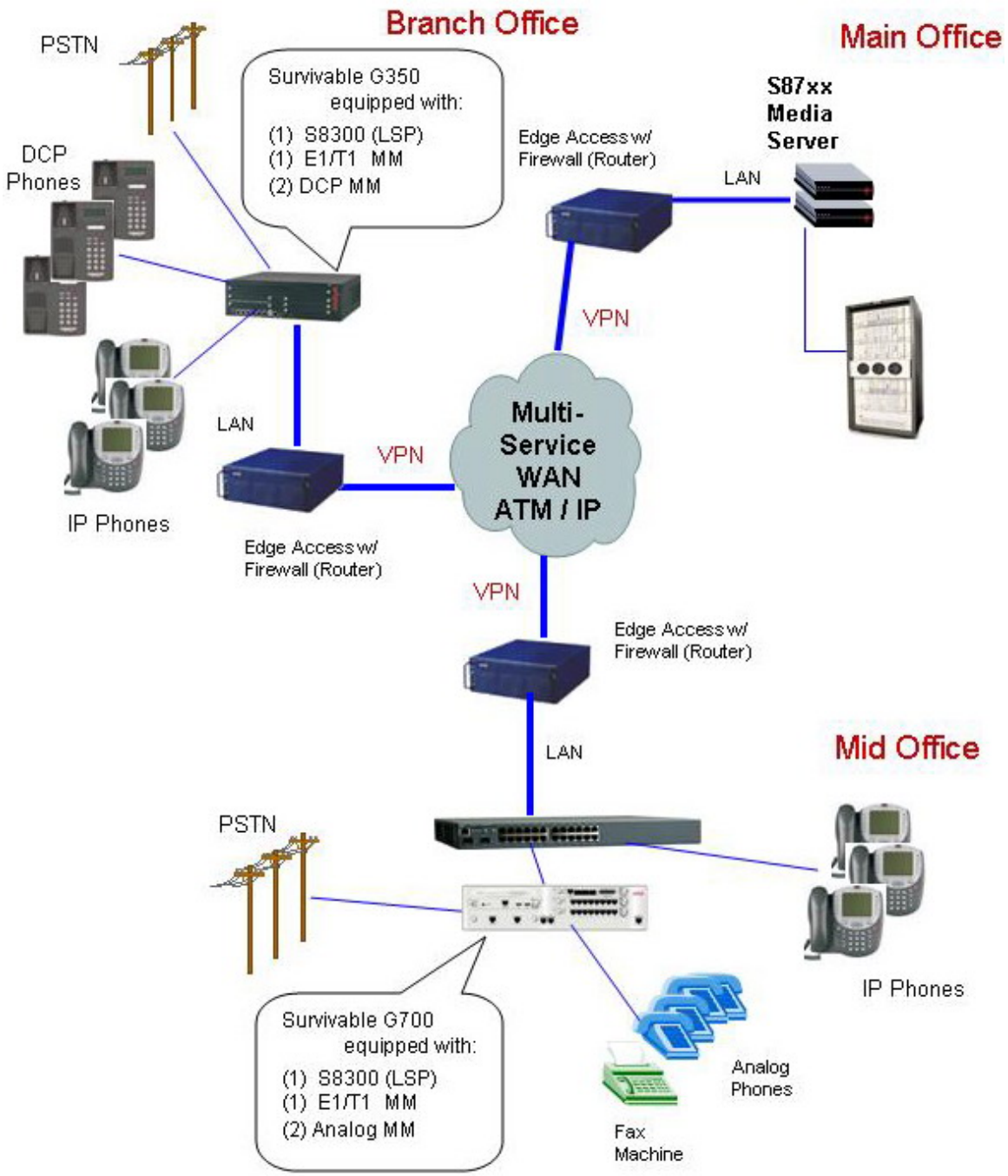

Figure 1: Examples of various locations of LSPs within a network

5. Translations

Once the LSP has registered with the primary call controller, the primary call controller saves the location of the LSP and records that it is ready for translations to be

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transferred. The primary call controller sends a complete copy of the Media Server translations to the LSP. Then, subsequently, when a save translations command is run (either manually or through the scheduled maintenance), a file transfer occurs to each of the LSPs that are in the primary call controller's list. Once the transfer has completed to the LSP, a reset of Avaya Communication Manager software automatically occurs on each LSP in order for the LSP to read in all changes made to translations.

The translation synchronization link between the primary call controller and its LSP are direct from server to server, through the IP network (not through CLANs). The firewall port associated with this "filesync" is 21874/tcp.

Each LSP is running Avaya Communication Manager software all the time, but it is only when the Media Gateway registers that the LSP becomes active and begins processing calls. When the LSP is active, translations may still be transferred from the primary gatekeeper, but the LSP will recognize that it is active and will not read in new translations until it is no longer performing call processing.

The translation transfer will only happen from the primary call controller to the LSPs. Translations are not transferred back to the primary call controller from the LSPs. The LSP allows administration changes, allowing for a flexible emergency system, but those changes cannot be saved on the LSP.

6. Preparing for transition to an LSP

The LSP will serve any registering IP endpoints in the event of a network failure or when the primary call controller is unable to provide service, and once a Media Gateway has successfully registered to the LSP first. The fail-over transition sequence is driven by the alternate gatekeeper lists in the Media Gateways and IP endpoints, as discussed above.

6.1 IP Telephones

Initially, the IP endpoints ask each gatekeeper in the list for service until one responds with a Gatekeeper Confirm (GCF) which load balances the IP phones. The IP phone then makes a Registration Request (RRQ) which Avaya CM responds to with a Registration Confirm (RCF) which includes a list of alternate gatekeeper addresses. This list overrides the list previously received via DHCP/TFTP/HTTP.

The IP telephones perform a DHCP discovery sequence to obtain their own IP addresses during initialization. During this dialog with the DHCP server, the IP telephones obtain a list of the call server addresses that may include LSPs. It is recommended that each LSP serve all the telephones within a subnet or a group of subnets and the DHCP server should have each subnet administered with its own LSP in the list of call server addresses.

Since the list of call server addresses is searched sequentially, any CLAN desired for registration is listed first, followed by the LSP that is serving that subnet. When the telephone registers with a CLAN, the telephone and the Avaya Communication Manager software exchange a series of messages. From these messages, the telephones are load-balanced across CLANs in network regions. Once registered, the telephone is also given a list of alternate gatekeepers that can include other CLANs and LSPs. These can be used in the case of a loss of communication later.

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Each network region can be assigned up to six (6) LSPs. On the SAT of the main server, each network region will accept a list of LSPs, and that list of LSPs will be sent to the IP phones in that network region as part of the alternate gatekeeper list. Each network region can be defined to have multiple LSPs as backups, and each LSP can be administered to support multiple network regions.

6.2 Avaya Media Gateways

Avaya Media Gateways must be administered manually through the command line interface (CLI) of the media gateway processor (MGP). The media gateway controller (MGC) list holds up to four (4) IP addresses. This list must be carefully configured since it is the only list the Media Gateway uses for recovery. There are several attributes associated with this list that determine how the Media Gateway searches for alternate call control resource(s) during a recovery situation. These attributes are discussed in sections 6.2.1 to 6.2.3.

6.2.1 Transition Point

The transition point designates a subset of alternate gatekeepers as having a higher priority for the Avaya Media Gateway to reach. For example, to avoid possibility of network fragmentation and loss of main system trunk resources, it may be desirable to attempt connecting with different CLANs on the main system before going to remote LSP operation. If the transition point is designated to be two, for two alternate CLANs, the Media Gateway will attempt to contact these first two addresses on the list for the duration of the primary search time, after which it will begin a circular search of the entire list for the duration of the Total Search time. Examples are shown in 6.2.4.

6.2.2 Primary Search Time

This defines the amount of time the Avaya Media Gateway will search the addresses that are above the transition point. When the Media Gateway is searching the addresses in the primary portion of the list (i.e., the list of addresses before the transition point), it tries each address once and continues down the list. When it hits the transition point, it starts again at the beginning of the list. Once the primary search time expires, the Media Gateway continues past the transition point and tries the remaining addresses once each before returning to the top.

6.2.3 Total Search Time

This time defines how long the Avaya Media Gateway will search its list before performing a hard reset of the MGP and a restart of the search process.

6.2.4 Failover Examples

The following examples use the same primary and total search times, and are used to illustrate the effect of changing the transition point on the overall recovery time and how an administrator can control the connectivity priorities for each location in a system.

<u>Example 1:</u>

Primary search time: 1 minute

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Transition point: 1
Total search time: 30 minutes
1. CLAN1
Transition point
2. LSP

The emphasis in Example 1 is to transfer control to the LSP quickly and reduce the downtime during the transfer by having a single CLAN above the transition point and the LSP after. If the Avaya Media Gateway is registered to CLAN1 when there is a network outage between the Media Gateway and the primary gatekeeper, the Gateway will first attempt re-registration with the CLAN before continuing with the circular search through the list.

Once the Avaya Media Gateway is able to reach a gatekeeper, the MGP will reset and begin the search at the top of the list once again.

If the Avaya Media Gateway is unable to reach the LSP, the Media Gateway will start its search at the top of the list. If the Gateway continues in this fashion and is unable to reach a gatekeeper for duration of the total search time, the MGP will reset and start at the top of the list.

Example 2:

Primary search time: 1 minute
Transition point: 2
Total search time: 30 minutes
1. CLAN1
2. CLAN2
Transition point
3. LSP

Example 2 puts the emphasis on maintaining a fully-connected network by having two CLANs above the transition point and the LSP after. If the Avaya Media Gateway is registered to CLAN1 when there is a network outage between the Media Gateway and the primary gatekeeper, the Gateway will attempt to re-register with CLAN1, then continue down the list trying to register with CLAN 2, then the LSP.

If the Avaya Media Gateway is able to reach the LSP, the MGP will reset and begin the search at the top of the list once again, attempting one registration with each address in the list.

If the Avaya Media Gateway is unable to reach the LSP, the Media Gateway will start its search at the top of the list. If the Gateway continues in this fashion and is unable to reach a gatekeeper for duration of the total search time, the MGP will reset and start at the top of the list.

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7. Failover to the LSP

7.1 Avaya Media Gateway

The transition to the LSP is an automatic process. When an endpoint determines that it can no longer communicate with the primary gatekeeper, it searches its list of gatekeeper candidates until it finds one that responds to the registration request and allows the Gateway to register.

The Avaya Media Gateway will determine that it does not have connectivity with the primary gatekeeper and then search for the next available gatekeeper. Once contact can be made with a new gatekeeper, the MGP reboots in order to synchronize the call states on the Media Gateway with the call states on the new gatekeeper. Any calls that are up at the time of the failure will remain up until the Gateway finds a new gatekeeper and resets the call state, in CM2.2 and earlier. As of CM 3.0, the bearer connection of pre-existing stable calls will remain up during the failover. When the Gateway is in this state, no features can be used, nor can new calls be made until the Gateway is re-registered with a gatekeeper.

The amount of time an Avaya Media Gateway takes to transition over to the LSP will vary based on the nature of failure,, the transition point, timer settings, and number of alternate gatekeepers attempted.

Avaya Media Gateways send a keep alive message once every 20 seconds. If the failure occurs in the network, and the Media Gateway does not receive a response to three keep-alive messages in a row, it will then enter into recovery mode and begin the search for a new gatekeeper. This takes a maximum of 60 seconds. If the failure occurs at the CLAN or the primary gatekeeper, the communication link is closed and the Gateway is alerted to this closure immediately.

The next stage of a failover is the search time to find a new gatekeeper. The Avaya Media Gateway will try to re-register with the same IP address first. If that address is unreachable, the Media Gateway will continue through the list until it is able to register with one of the addresses.

Once the Avaya Media Gateway makes contact with a gatekeeper, the MGP then is restarted. Following this, the search starts again at the beginning of the list. This allows the Gateway the best chance to be registered with the primary gatekeeper, especially after a short network outage when the primary gatekeeper is still able to provide service and the link between the Gateway and the primary gatekeeper has been restored.

Using the defaults of one-minute primary search time, a transition point of one, a total search time of 30 minutes, and one CLAN and one LSP with a network failure, here are the times involved in the Avaya Media Gateway failover to an LSP:

Keep-alive failure : 41-60 seconds
(first) Search time attempt to the CLAN : 10 seconds

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Connect to LSP : ~1 second (can be up to 10 seconds)
MGP restart : 5 - 10 seconds
(second) Search time attempt to the CLAN: 10 seconds
Reconnect to LSP : ~1 second (can be up to 10 seconds)

Until the Avaya Media Gateway reaches a second gatekeeper, all calls in progress will remain up, but without access to features. Any call that is attempted when the Gateway is in its recovery stage will receive no dial tone until the Gateway re-registers with a gatekeeper and is receiving call processing again. After the Gateway successfully registers with an alternate gatekeeper, the MGP resets and any DCP, analog, or trunked calls in progress at this time are torn down in CM3.0 and earlier. As of CM3.1 the bearer connection of stable calls, including analog stations and trunks, DCP stations, IP stations, and DS1 trunks will remain up during the failover. However, new features and new calls are not accessible until re-registration is complete.

7.2 IP Telephone

Any IP-direct calls (In network - IP endpoint to IP endpoint) will stay up during failover until both parties hang up, but will have no access to any features. The telephone will enter into recovery mode when the users hang up. The LSP will deny IP phone registrations until at least one Media Gateway has registered with the LSP. Until the Gateway has registered, the LSP has no access to IP resources to serve the telephones, so this is a precautionary measure to ensure the highest quality of service once the transition to the LSP has occurred.

Once the primary call controller is ready to serve the endpoints being served by the LSP, the LSP must undergo a scheduled or manual reset, and the endpoints will re-register with the primary call controller once again. A discussion about returning control to the main gatekeeper and recommendations is included later in this paper.

8. Networking

Any LSP that controls an Avaya Media Gateway with a trunk, either to the PSTN or to other call controllers, will have access to that trunk. This is important because once LSPs are giving service to Media Gateways and IP telephones, each LSP is its own switch and has no internal communication paths to other LSPs. Instead, a DCP phone on LSP1 can call a DCP phone on LSP2 through PSTN trunks maintained in each LSP. The same rule applies for IP telephones registered to different LSPs; no direct calls between LSPs can be placed.

9. Failback from LSP

Once the network problem has been resolved, the failback to normal operation from LSP can be handled in several different ways, to suit the needs of the customer:

- Automatic fail-back (as of CM3.0).
  - Based on customer selected recovery rules, with options:
    - Immediate (note: calls in progress will be held up until they complete).
    - When there are zero active calls

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    - Time and Day window (migration occurs during specified hours and days of the week; eg after business hours).
    - Time and Day window + zero active calls (adds condition of no active calls to above).
- Manual Fail-back. (where customer desires case by case control of fail-back,)

As part of the failback process, the LSP must undergo a reset system 4, which will close all communication links with the LSP, forcing all endpoints to register with the primary call controller. This time to transition is again dependent upon the settings, and ordering and administration of alternate controller lists,.

The return to the primary call controller is connection preserving (as of CM3.1), just as for the failover process, so calls in progress are held up until their completion. Note that call-control features, such as call transfer, conference and call forward are not available during the transition.

10. Alarming

The LSP will raise several alarms to alert services that the LSP is in service and that there is a problem either in the network or with the primary call controller. These alarms will be sent out through a modem and/or through SNMP over the Internet, depending on how the LSP has been administered during installation. While the LSP is running as either a non-active call controller or as an active call controller, any problems discovered through normal maintenance checks will also initiate alarms.

Each inactive LSP sends keep alive messages to the primary call controller, continuing communications with the primary call controller as part of the translation transfer mechanism. If the LSP sends three keep-alive messages and receives no response, it will raise an alarm to indicate that it is unable to reach its primary call controller. This alarm appears in “display alarms” as an ICC alarm and shows the time the alarm was raised. The host Media Gateway must be administered with an S8300 Server in the ‘add media gateway’ form before this alarm will be displayed.

When the Media Gateway registers with the LSP, the LSP will raise an alarm that the H248 link is up. At the same time, the primary call controller will raise the converse alarm that the H.248 link is down to that Gateway. This alarm should aid in finding the location of a network failure, as well as determining where endpoints are registered.

Each IP telephone registration will generate a warning on the LSP. Since warnings are not called out, this warning will only be seen when it is actively looked for and is only intended to assist in finding where each endpoint has registered. In addition to following the warnings to find which IP telephones are registered to the LSP, the command ‘list registered’ will display a list of extensions that are currently registered.

10. Software Versions, Upgrades and License Files

The same, or higher, Avaya Communication Manager Software version must be running on the LSPs than is running on the primary call controller to ensure that the system translations will work on the LSP after the translations are transferred to the LSP. This requirement is enforced through the transfer mechanism, which will not run between a primary call controller and an LSP when the Avaya Communication Manager Software version on the LSP is not as high as on the primary controller. LSPs should be upgraded

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first, and the LSPs should be left out of service while the software upgrade is being completed on the primary call controller. The LSP Avaya Communication Manager Software upgrade is a manual process and requires that each LSP be upgraded individually.

The license file turns on the LSP feature bit and activates the LSP. The license file for the Avaya S8300 Gateway, as a survivable processor or as a standalone, keys off of the serial number of the hosting Avaya Media Gateway. Therefore, each LSP requires its own license file to be loaded. This license must match or exceed the primary call controller's in capacity limits in order to allow the primary controller's translations to load on the LSP without exceeding the limits set by the license file.

13. Conclusion:

Traditionally, duplication of data has been done by a call processor, which protects against server difficulties and provides this protection invisibly. When increasing the distances between headquarters and remote branch offices however, it becomes more likely that a network outage causes a loss of communications. Setting up Local Survivable Processors on corporate networks provides coverage with full feature functionality in the event of a network outage. With the Avaya Communication Manager Software based solutions, the system administrator is empowered to select which strategy for recovery is priority: reconnecting the location to the network for interoffice communications, or reestablishing local call traffic.

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