ALCATEL-LUCENT TELEPHONY OVER IP SURVIVAL FOR REMOTE OFFICES

TECHNICAL INFORMATION GUIDE

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INTRODUCTION

Communications play an increasingly important role in modern companies and can significantly contribute to their success. Efficient communications, which enable people to quickly receive the information they require, contribute to the success of a business and also lead to employee and customer satisfaction. Information and Communications Technologies (ICTs) play a key role, and in most cases have become absolutely essential.

A company's telephone system is one of its mainstays in communications, both internal and external. The evolution generated by Telephony over IP (ToIP) has improved communications efficiency both from a user perspective and an administrative perspective.

ToIP provides a solution for all enterprises and unifies management into a single system, regardless of the size of the company or the number of branches. It is precisely in the remote branches where ToIP has produced the greatest revolution by providing features that were previously available only to head office users. However, in this new scenario there is a weak point because telephony in the remote offices completely depends on connectivity with the central server for even the most basic functions. This drawback needs to be dealt with through local systems that permit branch telephony rescue or survival when disconnections from the main server occur. Otherwise, communications with the head office and the other branches will be adversely affected.

TELEPHONY RESILIENCY FOR REMOTE OFFICES

Standard survival solutions

Standard survival solutions are usually based on the interoperable Session Initiation Protocol (SIP) supported by an extensive base of telephony servers and terminals. Usually, these solutions consist of a small local server that is installed at a remote office (see Figure 1).

Figure 1. Standard survival scenario
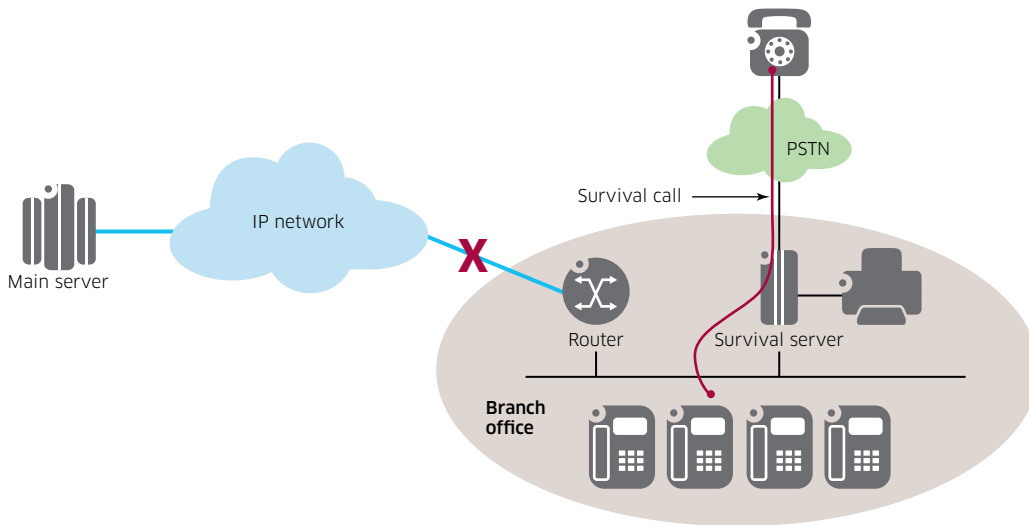
Under normal connectivity conditions, the remote office terminals connect directly to the central server, which manages the remote telephony (registers and calls). However, if the remote office communications are cut off from the central server, the terminals detect the loss of connectivity when they attempt to make a call or when they do not receive any response to the registers being sent periodically to the central server.

The time between registers is usually around one minute. When this time passes, the remote office enters survival mode and the remote office terminals connect to the local server, which manages registers and calls.

While the office is in survival mode, the terminals constantly poll for connectivity with the central server. When they detect that communication has been reestablished, they resume normal operation.

The local server usually has connectivity to the telephone network for external calls under normal circumstances and also while in survival mode. In this case, the local server behaves as a simple media-gateway of the central server. Sometimes the local server also performs router functions, thereby reducing both the number of devices and the management costs.

The standard solutions usually provide a reduced set of features for the office while it is in survival mode, such as calls between branches, external calls, forwarding, and capture or hunt groups. However, it is not possible to offer features that require services from the central server, such as voicemail, presence or call center functionality.

One advanced feature that can be offered is dialing to a corporate number in other corporate branches. In a two-step process, the survival server translates the corporate number to a public number, then uses the public telephone network to transmit between branches (see Figure 2).

Figure 2. Dialing from an office in survival mode to a corporate extension
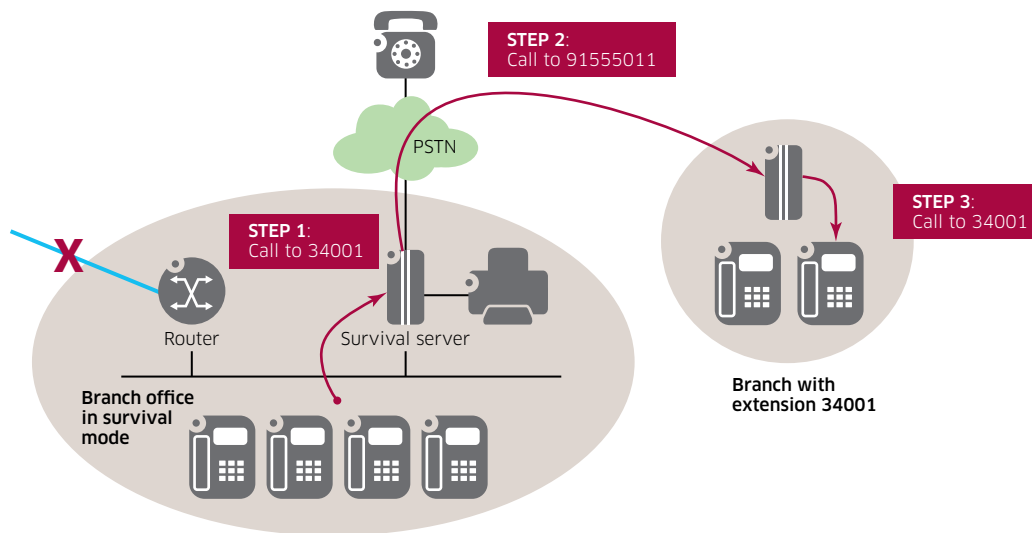
Proprietary solutions

It is common for large ToIP solution manufacturers to use proprietary protocols to increase the features available to users past the features available using standard SIP. However, the local survival solutions must be compatible with the proprietary protocols; that is, the solutions must be from the same manufacturer or associated manufacturers. The principle of operation is very similar to the standard survival solutions.

The range of proprietary ToIP survival solutions is extensive, from simple devices that provide basic telephony connectivity in small offices to redundant servers locally installed in large offices where a loss of features is not acceptable in survival mode.

ALCATEL-LUCENT RESILIENT TELEPHONY SOLUTIONS

Alcatel-Lucent ToIP Survival for Remote Offices provides a cost-effective solution for supporting redundant call control in the remote branch office. The Alcatel-Lucent solution architecture provides several rescue options depending on the size and needs of the office that needs to be rescued.

Distributed call server model

The distributed call server model (also called a homogeneous network) involves installing Alcatel-Lucent OmniPCX™ Enterprise Communication Servers (OmniPCX ECSs) in different offices but operating as a single system (see Figure 3). All these OmniPCX ECSs, hereafter referred to as call servers (CSs), are synchronized in real time, and any of them can provide local services when disconnected from the rest while maintaining all the features.

This is a complex configuration where each branch has a CS to provide complete continuity for all the services. Users do not notice the loss of connectivity to the central office of the company.

This is technically not a survival solution but a replication of fully functional CSs in various offices. This solution is typically used only for main corporate offices, where any loss of any function is not acceptable under any circumstances.

Figure 3. Different call servers operating in a homogeneous network
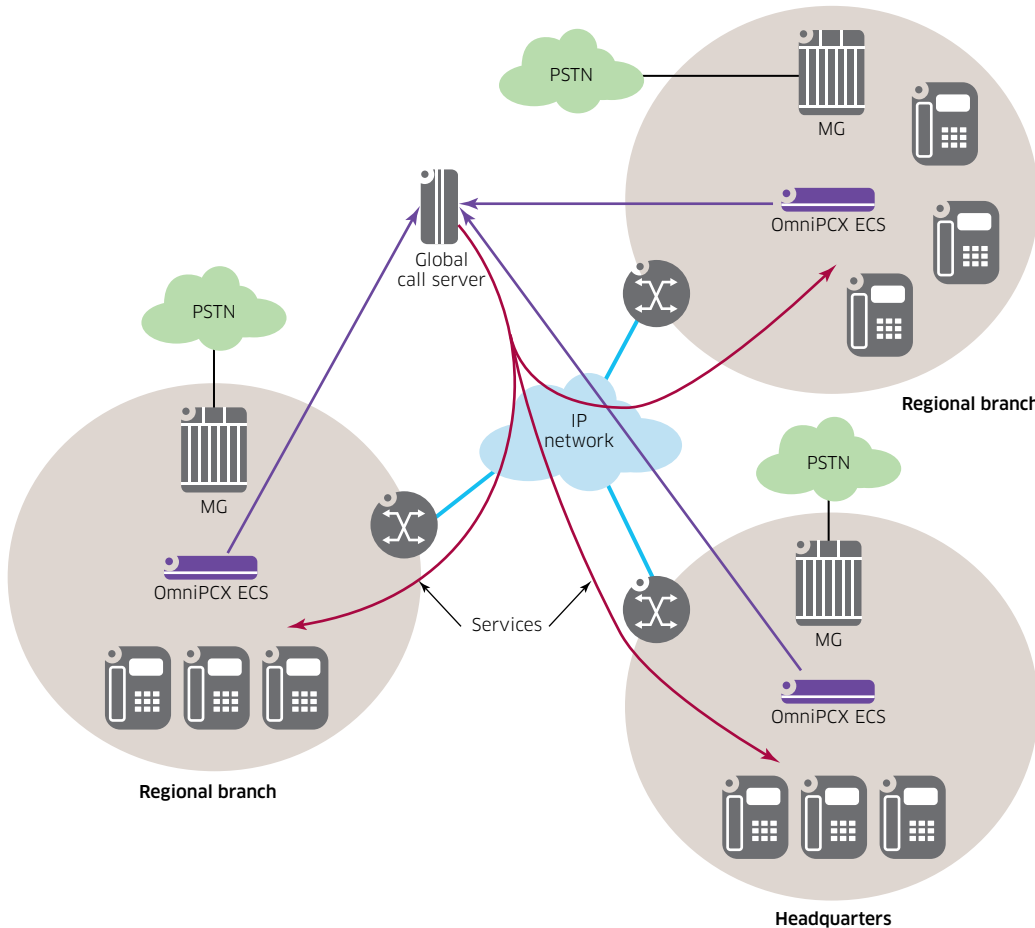
Passive communication server

A passive communication server (PCS) is a local server capable of providing similar features for the office as those offered by a CS. The PCS is not synchronized with the CS in real time; instead, it synchronizes every 24 hours. As a result, some of the features may have outdated information and not behave as expected.

The survival and recovery process for terminals and media gateways (MGs) through a local PCS is as follows (see Figure 4).

1. In a normal situation, the head office terminals and MGs are controlled by the CS, and the PCS is in standby mode.
2. The link between the office and the CS fails.
3. After 7 seconds the terminals and the MG detect the link failure. They wait for an additional 7 seconds to ensure that the connection is still down.
4. The terminals and MG restart and connect to the PCS, thereby switching to a survival situation.
5. While the office is in survival mode, the PCS regularly polls connectivity with the CS. When the CS detects that connectivity has been re-established, it instructs the terminals and the MG to reboot and connect to the CS to return to a normal situation.

Figure 4. Remote branch in survival mode with PCS
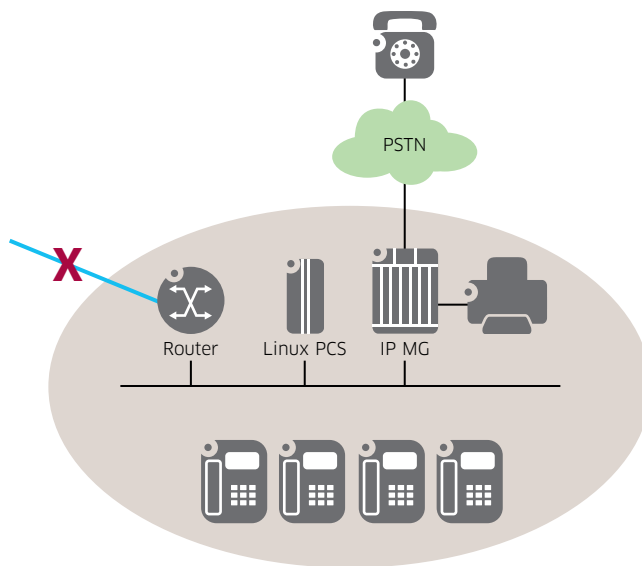
The PCS offers almost the same features as the CS but there are some limitations. For example, the synchronization of the databases is not done in real time, and any modifications executed in the database while it is in rescue mode are lost when normal operation is re-established.

There is usually an IP Media Gateway (IP MG) together with the PCS for connectivity with the telephony network, both in normal mode (controlled by the CS) as well as in survival mode (controlled by the PCS). Depending on the number of terminals in the office, the PCS can be dedicated hardware or a card integrated in the MG.

Because the PCS is an autonomous system, the local terminals remain operational in any contingency situation, whether the situation is the result of a failure in the office's local WAN line, a failure in the main office WAN or a failure in the CS. In cases where the CS or the main branch office connectivity fails, all the branches with a PCS go into survival mode.

A PCS can provide survival mode service for up to a maximum of 30 consecutive days.

One CS can support up to 240 PCs in a local or distributed network.

The PCS provides a resiliency solution for large and very large offices where even in survival mode advanced functionality must be available: connection to call center agents, multiple conferences, personal call assistant, unique number, and so on.

IP MG and signaling channel through PSTN

In many offices, it is difficult to justify installing and maintaining a PCS in addition to an IP MG. This is the case in small offices or when advanced services in survival situations are not essential. A more economical option is to provide resiliency to terminals through the IP MG. This solution employs a signaling channel from the IP MG to the CS (see Figure 5).

In this scenario, if the office connectivity with the CS fails, the terminals reboot and use the IP MG as a server. This process establishes a signaling session through a PSTN connection (Integrated Services Digital Network B channel [ISDN B], Primary Rate Interface [PRI] channel or modem) with another IP MG (a rescuer) that has connectivity with the CS, usually in its local network. The signaling reaches the CS, which can then control the rescued terminals.

Figure 5. Remote office in survival mode with an IP MG

Branch office in survival mode
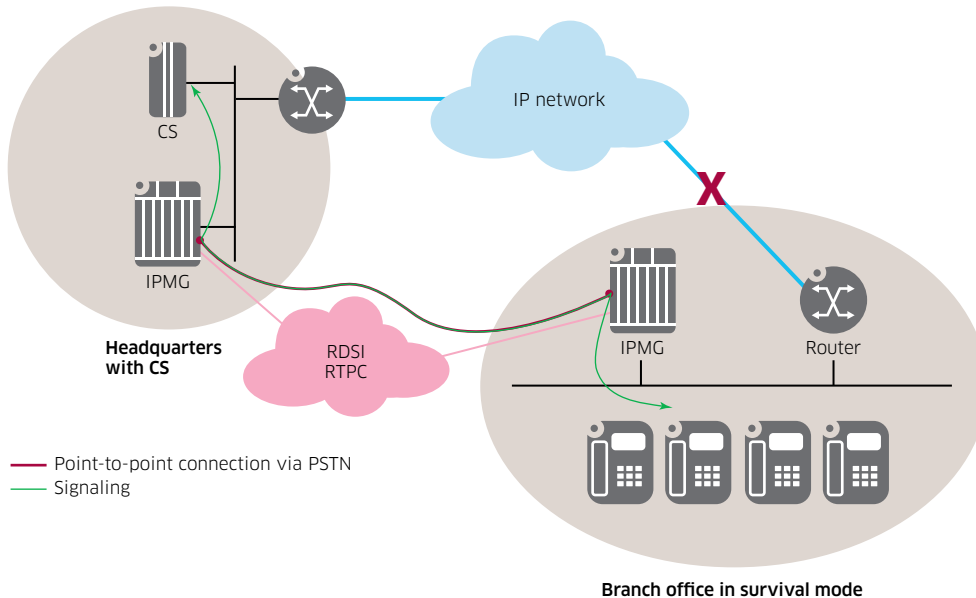
This method has its drawbacks because a rescuer IP MG can rescue only one office; therefore, scalability is very limited. This method is only recommended for a company with few offices because the greater the number of offices, the greater the risk of not being able to simultaneously rescue them unless there are multiple rescuer IP MGs

One CS can support up to 240 IP MGs in a local or distributed network.

Another drawback of this approach is the need for additional elements to rescue an office (rescuer IP MG and CS). It is therefore not useful in the case of a communications failure at a central office.

Additionally, in rescue situations one of the output lines from the IP MG to the PSTN (ISDN B channel or analog connection) is lost because it is used so that the rescued office can signal to the CS.

Due to the preceding reasons, the solution provided by an IP MG only applies to very specific cases, such as when the number of offices that need to be rescued is very low, where there is an IP MG available in the offices to be rescued with sufficient channels with the PSTN, and where these offices can cope with not being rescued under certain circumstances.

Alcatel-Lucent OmniAccess Enterprise Services Router 5800 Series

The Alcatel-Lucent OmniAccess™-Enterprise Services Router 5800 (ESR 5800) series are multiservice platforms that encompass the following features:
- Access router for branch offices with WAN Ethernet, xDSL, fiber, serial and E1/T1 connectivity options, among others
- Integrated 8-port Fast Ethernet switch prepared for Power over Ethernet (PoE)
- Telephony survival features that support the following protocols:
  ¬ Universal Alcatel – New Office Environment (UA-NOE) for Alcatel-Lucent IP Touch™ terminals: all Alcatel-Lucent IP Touch™ 8 Series Extended Edition terminals and all Alcatel-Lucent IP Touch™ 9 Series terminals)
  ¬ Standard SIP (registrar and server)
  ¬ Standard H.323 (with H.323 gatekeeper feature)
  ¬ Skinny Call Control Protocol (SCCP)
  ¬ Survivable Remote Site Telephony (SRST) for Cisco terminals
  ¬ Foreign exchange service/foreign exchange office (FXS/FXO) for analog terminals
- MG for local break-in/out through internal cards:
  ¬ Analog cards to connect to PSTN or PBX (FXS/FXO/E&M) lines
  ¬ Digital ISDN-BRI (Basic Rate Interface) (S/T) cards
  ¬ Digital E1 cards with Channel Associated Signaling (CAS) (R2 and E&M) or ISDN-PRI (Primary Rate Interface)
- IP protocols towards the CSs (as part of MG):
  ¬ SIP (trunk)
  ¬ H.323
  ¬ Media Gateway Control Protocol (MGCP) (allows ISDN-BRI/PRI integration with the Cisco® Unified Communications Manager)
- TDM-to-IP (SIP) conversion gateway for analog terminals (telephones or faxes)
- SIP trunk terminator
- Open Cloud services platform with applications provided and a GNU/Linux environment for third-party applications (optional in OA ESR 5850)

Survival with the OmniAccess ESR 5800 Series: Characteristics

For UA-NOE terminal survival, the OA ESR 5800s operate independently of the CS. This is different from the previous survival methods, which in one way or another depend on the CS. This independence has the following advantages:

- Unlike PCS and IP MG survival, which are limited to 240 offices, there are no limits to the number of offices that can be rescued.
- It is not essential to configure the OA ESR 5800 in the CS.
- The OA ESR 5800 does not require an IP MG for connectivity to the PSTN. The OA ESR 5800 acts as an MG for connectivity to the PSTN or analog terminals. In cases where additional ports are required, local MGs (for example, a second OA ESR 5800) can be added using standard SIP or H.323.
- The OA ESR 5800 does not require a signaling channel between itself and the CS, so fewer IP MGs and communication lines are required.
- The OA ESR 5800 provides survival if the local WAN, the WAN in the CS or the CS itself drops. Because this is a fully autonomous system, in cases where the central system drops, all the offices with OAESR 5800s enter survival mode.
- There is no limit to the number of consecutive days that survival can be provided.
- The OA ESR 5800 can operate as an autonomous CS in small offices without requiring an OmniPCX ECS.

Because there is no communication between the CS and OA ESR 5800, it is not possible to provide features in survival mode that depend on information stored in the CS (for example, voicemail, interactive voice response [IVR] and forwarding). However, the most common features are provided; these cover most of the normal user functionality and almost all use cases. (The full list of features in survival mode is provided later in this document.)

Switching to survival mode with the OmniAccess ESR 5800

The OA ESR 5800 supports three different modes to provide office terminals with survival, depending on the required office communications architecture and functionalities:

- Monitor mode
- Server mode
- Server + Monitor mode

Monitor mode

In Monitor mode the IP traffic between the office telephones and the CS (OmniPCX ECS) in normal mode must go through the OA ESR 5800 (see Figure 6). This occurs when the OA ESR 5800 is the office WAN router and the traffic is not encrypted. (If the OA ESR 5800 is not the office router it is also possible to ensure that the traffic between the telephones and the CS is routed through the OA ESR 5800 by appropriately configuring the IP network in the telephones and the router.)

In this mode, the OA ESR 5800 monitors the UA-NOE signaling between terminals and the CS, obtaining and memorizing the information that the CS communicates to each telephone: extension number and user, previously configured in the CS. Simultaneously, the OA ESR 5800 polls the connectivity with the CS and in case of disconnection, supplants the CS using its IP address and maintaining the signaling and registry information of the telephones, which think they are still connected to the CS and continue to operate normally.

The Monitor mode only works with UA-NOE signaling and is not an option for SIP-based communications.

While the OA ESR 5800 provides survival features, connectivity with the OmniPCX ECS is polled by the OA ESR 5800. When the connection is re-established the telephones are instructed to restart when possible so that they can establish a new connection with the CS.

Figure 6. Survival with OmniAccess ESR 5800 in Monitor mode
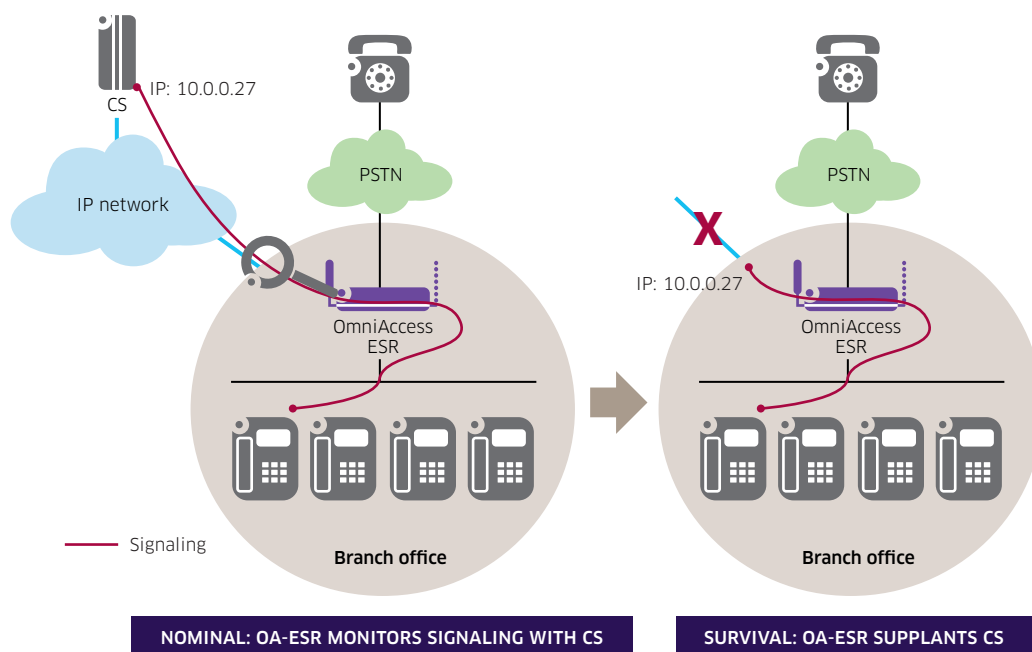
Advantages of this mode
- Unlike survival with the PCS or IP MG, the telephones do not restart when switching to survival mode.
- The OA ESR 5800 dynamically learns the telephone extension information, thereby lowering management costs.
- Switching to survival mode is very fast — it is determined through configuration in the OA ESR 5800, and can be as short as a few seconds — and is simultaneous for all the telephones.
- A switch to survival mode is also possible not only when connectivity with the CS is lost but also when the link conditions are defective (when delay, jitter and/or packet loss go over a configurable threshold).

Drawbacks of this mode
- If a telephone restarts while it is in survival mode, the service is lost.

Usage scenarios
- Low management is required because the OA ESR 5800 configuration is very basic, is identical in all of the offices and does not require configuration in the CS.
- The OA ESR 5800 is the office router (or telephony traffic passes through it in some other way).
- The telephone signaling traffic with the CS is not encrypted.
- The loss of service in a telephone can be assumed because a telephone that is restarted during survival mode will lose connectivity.

Server mode

The main drawback of the Monitor mode is that if the telephone restarts while the office is in survival mode, it loses service. This happens because in Monitor mode the OA ESR 5800 can only supplant the CS to maintain the sessions previously initiated by CS but cannot initiate sessions.

To avoid this situation, a survival method completely different from the previous mode is supported. In Server mode, as when using a PCS, the telephones have the CS IP address configured and an alternative IP address for a backup CS; this address is the OA ESR 5800 IP address (see Figure 7). The telephones detect the loss of connectivity with the CS and register with the OA-ESR 5800.

Unlike in Monitor mode, the OA ESR 5800 has not dynamically obtained the register information of the telephones; it needs to obtain the information through other means. There are two alternatives (and neither is exclusive to working with OmniPCX):

- Configure a table in the OA ESR 5800 with user/extension number for each telephone
- Have the OA ESR 5800 ask the user through the display on his/her telephone to enter their own extension on the keypad

Figure 7. Survival with OmniAccess 5800-ESR in Server mode
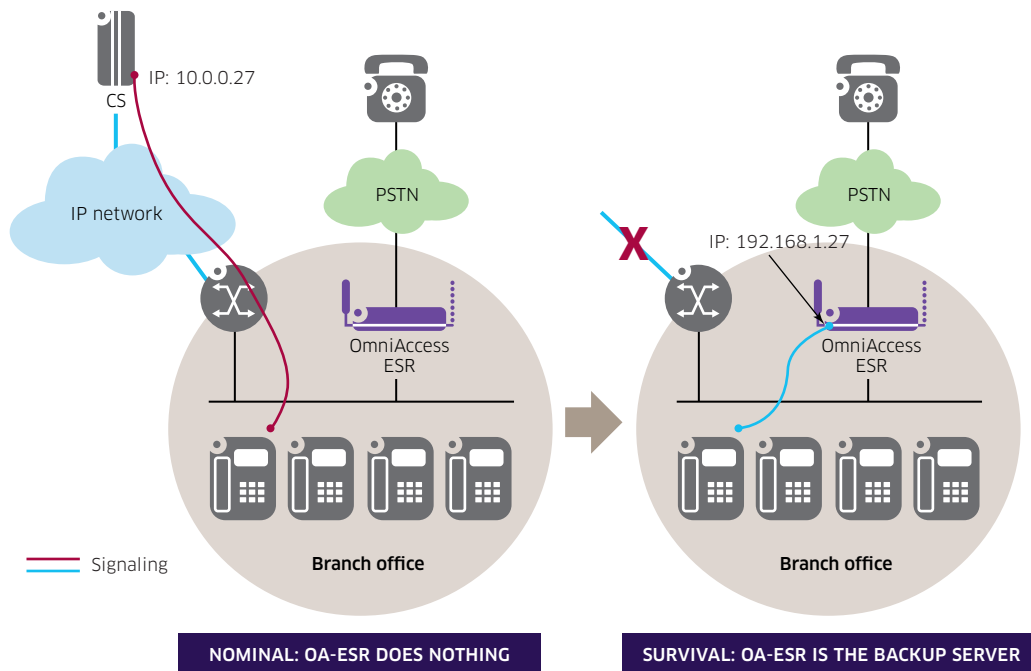
Advantages of this mode

- If the telephone restarts while in survival mode, it continues to function.
- The signaling traffic between the telephones and the CS does not need to go through the OA ESR 5800.
- The signaling traffic between the telephones and the CS can be encrypted.

Drawbacks of this mode
- The telephones restart when switching to survival mode (in the same way as survival with a PCS or IP MG).
- The OA ESR 5800 does not dynamically learn the extension number and user for each terminal. This information must be maintained in the OA ESR 5800 configuration or the user must provide it when switching to survival mode.

Usage scenarios
- Service for a telephone that may be restarted while it is in survival mode must be maintained.
- The OA ESR 5800 is not the office router.
- The telephone signaling traffic may be encrypted.
- The extension number and user for each telephone are managed in the OA ESR 5800 or this information can be obtained from the user through the telephone display/ keypad when switching to survival mode.

Server + Monitor mode
The Server mode has the advantage over Monitor mode of maintaining the service for a telephone that is restarted while in survival mode. However, Server mode cannot dynamically discover the extension number and user data for the telephones and therefore requires maintenance of the tables in all OA ESR 5800s (or requires users to provide this information when switching to survival mode).

To benefit from the advantages of both modes, there is a combined mode, Server + Monitor, which uses the Server mode strategy but with the dynamic learning of the extension number for each telephone while the office is in normal mode. The signaling traffic of the telephones to the CS must pass through the OA ESR 5800 and cannot be encrypted.

Advantages of this mode
- If a telephone restarts while it is in survival mode, it continues to function.
- The OA ESR 5800 dynamically learns the telephone information, which does not need to be maintained or input by the user.

Drawbacks of this mode
- The telephones restart when switching to survival mode (in the same way as survival with a PCS or IP MG).

Usage scenarios
- Service for a telephone that may be restarted while it is in survival mode must be maintained.
- Little management is required. The OA ESR 5800 configuration is very basic, identical in all of the offices and does not require configuration in the CS.
- The OA ESR 5800 is the office router (or telephony traffic passes through the OA ESR 5800 in some other way).
- The telephone signaling traffic with the CS is not encrypted.

Questions about survival mode with the OmniAccess ESR 5800

When do extension numbers need to be maintained in the OA ESR 5800 (or information requested from the user)?

- Monitor and Server + Monitor modes: It is unnecessary to configure this or ask the user. The OA ESR 5800 learns this information dynamically.
- Server mode: This information needs to be configured in the router.

What is the recommended method?

All three methods are valid and depend on the required features and the existing network setup. When possible the Server + Monitor method is recommended because it provides the most advantages.

Supported terminals

The OA ESR supports the following terminals, which have been tested with the Alcatel-Lucent OmniPCX ECS, Release 10.1:

- Alcatel-Lucent IP Touch™ 4008 Extended Edition
- Alcatel-Lucent IP Touch™ 4018 Extended Edition
- Alcatel-Lucent IP Touch™ 4028 Extended Edition
- Alcatel-Lucent IP Touch™ 4038 Extended Edition
- Alcatel-Lucent IP Touch™ 4068 Extended Edition

Features supported in survival mode

- Unlimited number of telephones, although 300 is the recommended limit per OA ESR 5800
- Automatic detection of the terminal extensions and the types of terminals
- Option where the user can configure his/her own extension number from the telephone
- A text message on the terminal display indicating that it is in survival mode
- Calls between UA-NOE Alcatel telephones
- Incoming and outgoing calls as UA-NOE MG
  - ¬ MG connectivity with ISDN basic access lines (up to 4 lines)
  - ¬ MG connectivity with ISDN primary access lines (up to 2 lines)
  - ¬ MG connectivity with PSTN analog lines (up to 8 lines)
- Calls between UA-NOE telephones and SIP devices
- Call routing according to local table (least-cost routing)
- Number translation to redirect calls to an IP extension over PSTN (for example, a user in survival mode dials extension 40203 and the OA ESR-5800 translates it to the PSTN number, such as 34935550222, which corresponds to the direct external number for extension 40203)
- Number and name identification for caller/callee
- Call Detail Record (CDR) storage
- Maintenance of date
- Volume and mute keys
- Automatic redial
- Headphone and hands-free options
- Mute button to activate auto answer
- Call holding, generating music on hold in PSTN/ISDN

- Ring groups (simultaneous ringing on various mixed telephones and protocols: NOE, SIP, FXS)
- Forwarding groups if busy
- Pickup and directed pickup groups
- Management of calls
- Transfer of attended and semi-attended calls

Features that are not supported compared to PCS include conference rooms, call centers, programmed messaging and forwarding.

Scalability with the OmniAccess ESR 5800

An OmniAccess ESR 5800 is recommended for up to 300 telephones and therefore fits most offices.

For TDM connectivity, the OA ESR-5800 has two slots where any combination of the following voice cards can be inserted:
- 2 x ISDN BRI card
- 1 x ISDN PRI card
- 4 x FXS/FXO card
- 2 x E&M card

FXS/FXO Card   ISDN PRI Card

Additional OA ESR-5800 devices (unlimited) may be used as slaves to increase TDM connectivity possibilities.

Survival with OmniAccess ESR-5800: Normal user scenario

The OmniAccess ESR 5800 is a survival solution that is ideal for most offices because of its unlimited scalability in the number of offices it can rescue and its cost effectiveness compared to alternative survival solutions.

The device is especially cost-effective when used as the office router and/or MG and especially when using the Cloud appliance possibilities (Linux applications embedded in the same device), such as applications to record calls on the device's hard disk.

The OA ESR 5800 is usually the most appropriate option for 90 percent of the offices in a corporation. The remaining 10 percent would need distributed call servers, a PCS or an IP MG.

Alcatel-Lucent OmniAccess Enterprise Services Router 5700 Series

The Alcatel-Lucent OmniAccess™ Enterprise Services Router 5700 (ESR 5700) series are compact routers with the same software features as the OmniAccess ESR 5800 and a hardware architecture that includes data interfaces (switch + router) but no voice interfaces; therefore, it does not have MG capabilities.

The OA ESR 5700 series supports the UA-NOE protocol and can provide survival service to all IP Touch terminals but no connectivity with the PSTN. When an office is in survival mode, the telephones can have calls between them but not to/from the PSTN (unless a standard SIP MG has been added in the office).

The OA ESR 5700 could be an option for very small offices that have decided not to maintain local telephone lines. By using the OA ESR 5700 instead of other routers, if the office WAN connection drops, service to the IP Touch terminals for intra-office calls is maintained.

CONCLUSION

Telephony over IP allows remote office users to take advantage of a wealth of features which they would otherwise find available only at head offices. It requires the implementation of resiliency solutions that minimize the dependence on central servers when a communications failure leaves a remote office cut off from the central telephony services. The solution for resiliency lies in using intelligent local devices that manage the office's telephony survival mode and subsequent restoration of services.

Alcatel-Lucent offers three resilient ToIP solutions: a PCS, an IP MG and the OmniAccess ESRs. A PCS offers the most features and fits well in larger offices. An IP MG solution fits only very specific cases and has little scalability. The OmniAccess ESRs are the most efficient and cost-effective solution for most offices. The OA ESRs also reduce the number of devices to install and maintain in the office, owing to their combined functionality as a router, switch, MG and Cloud appliance.

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