Trunking between two **Elastix** PBX Systems Via Internet Title Trunking

Elastix Application Note #201110032:

Trunking between two Elastix PBX Systems Via Internet

Title	Trunking between two Elastix PBX Systems Via Internet
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Foreword

These application notes are intended to be a guide to implement features or extend the features of the Elastix IP PBX system.

Finding information on the Internet can be haphazard due to the lack of document version control, lack of attention to software versions, and in some cases they are wrong. Then you have the cross pollination issues, where a guide has been done for another distribution, which may or may not be applicable to your Elastix system.

You will table on the front page of every Application Note written released in this way, will be an easy to read summary, regarding the Elastix system it was tested on, when the document was written, whether it is backward compatible, and the level of expertise needed to accomplish the implementation.

These application notes are written up and tested in a lab that has been specially setup to write these notes. This includes

- 5 x Elastix IP PBX Hardware with a mixture of SIP only, Digium, Sangoma, OpenVox Cards
- 1 x WAN Simulator (including latency, jitter, random disconnects, random packet drop)
- 8 x Consumer / Business routers, including Draytek, Cisco 1842, Cisco 877, Linksys WRT54GL
- 2 x IBM XSeries servers running VMware with 8 images of various versions of Elastix IP PBX
- 1 x Standard Microsoft SBS Network providing DHCP and DNS and Mail system
- 2 x Linux Servers

The Elastix IP PBX systems, both hardware and Virtual based have image systems to refresh the systems to limit infection from other testing. Combined with a range of Phones, which include Aastra, Linksys, Cisco, Yealink, it provides a reasonable cross section of typical systems currently in the field.

These application notes are not just done in isolation either. Behind them is over 6-7 years of commercial implementation of IP PBX systems, utilising these methods and concepts. The Lab is just used to reconfirm the implementation in a less production like environment.

How you use these application notes is entirely up to you. However, it is highly recommended that in the first instance, that you follow the notes and configurations in their entirety (except for IP addresses) of course. If you follow it exactly, then it will be easier for others to assist you when you do have an issue.

So why do I write these guides?? Basically it's my way of giving back to the Open Source Community which I have done since 1998 (or earlier). Similarly, the Elastix product is a great product with a great crew behind it, and fantastic community supporting it as well, and these guides are away of imparting knowledge, to make someone's life a little easier.

Introduction

As a business changes, usually through growth, acquisition, diversification or even geographical diversification, there are requirements to setup multiple Elastix PBX systems.

Like most businesses there is large requirement to call between the offices, especially in the case of one of them being a head office. Naturally, these calls can add up if routed via the normal carrier service, so it is normal, in the effort to reduce costs, that the business wants to utilise the ability to transfer calls via IP to the other branch(es). Furthermore, especially in the case of large geographical distances between the offices, such as interstate or international, they would rather that calls to another country be routed via the office closest to that call termination location or at least the location that has the lowest call cost.

So the purpose of this guide is to provide you with the step by step guide on how to connect two offices together utilising an Elastix system in both offices.

Planning

Connecting two offices or sites with Elastix is relatively simple, but like all good implementations a bit of planning ahead of implementation is always a good investment. I have seen many mistakes made, not just from misunderstanding the basic concepts, but actually becoming confused with setup details and not putting the basic building blocks in place first. Some do start with the basic building blocks, but part way through they make a leap feeling confident, making changes on the fly, and then it ends up not working.

So it is important to write out what you are trying to do, it will make it easier in the long run. Even printing the configurations from this tutorial, making changes to the names and IP addresses to suit your setup, will keep you on the right track.

This planning also extends to making sure that each site is using a separate set of Extension numbers e.g. 200 range in Sydney and the 500 range in Melbourne. This simplifies your routing rules. If you are setting up the two Elastix systems for the first time, then this is worth considering the particular numbering separation to make it easy for both yourself and the business.

One of the most common issues that you come across with many in experienced implementers is that they refuse to take the hard decisions at the start. A typical mess that I have seen many implementations, where they want to keep the same range of phone extension numbers on both systems. Whilst not impossible, it is not the sort of project that you want to become involved in, especially if you don't work with Elastix systems every day. Whilst adding a prefix to call another office extension is easy, it's when the next stage that the business requests like ring groups that bridge both PBX systems, that things start getting a little complex. So make life easy on yourself, take the hard yards at the start, and negotiate the changes necessary.

The Scenario

This is scenario and configurations are taken from a production system, so you know that they work.

The company has two offices one in Sydney and one in Melbourne. The office in Sydney has 60 staff and the one Melbourne has 20 staff

The two offices have a Virtual Private Network (VPN) between them which will generally be the case with most businesses that need to share or access data between their offices.

Elastix IP Address & IP Ranges used by each office

The Sydney office (Head Office) has a **172.22.22.0/255.255.255.0** IP address range
The Sydney Elastix system has an IP address of **172.22.22.15**
It has a Static Public IP Address of **202.22.44.254**

The Melbourne office (Remote Office) as a **10.0.0.0/255.255.255.0** IP address range
The Melbourne Elastix system has an IP address of **10.0.0.15**
It has a Static Public IP address of **202.33.44.1**

Extensions setup on Elastix at each Office

Sydney : Extensions 201 - 260
Melbourne : Extensions 501 - 521

Diagram 1 – Connecting Two Elastix Systems via the Internet (no VPN)
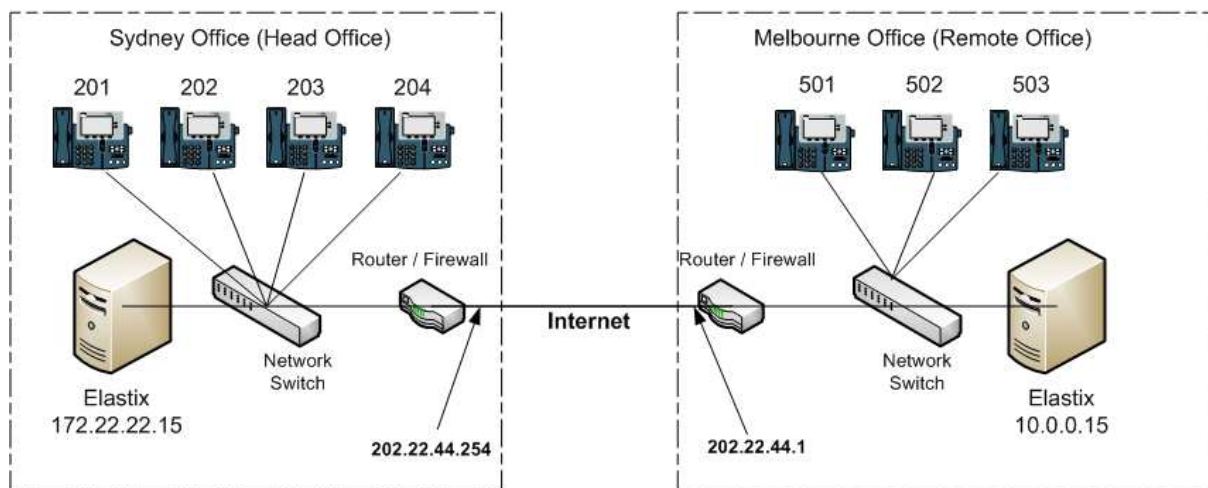
Note 1: The Internet addresses here are only examples and reflect what has been used in the configurations for this tutorial. Yours will be different.

Note 2: As we are not using a VPN in this example, you will need to Port Forward (NAT) the IAX port (4569) on the router to the Elastix Internal IP address at both ends. So at the Sydney Office, we will need to set a port forward on the router for port 4569 to 172.22.22.15. Likewise on the Melbourne end we will need to set a port forward on the router for port 4569 to 10.0.0.15.

IAX Trunk Setup

On the Sydney Elastix system

Add an IAX Trunk

Leave all other options until you reach Trunk Name as default. I know it hurts to leave fields blank, resist the temptation until you have a working trunk, then come back and tweak these options. Enter all the details below listed under the Sydney Elastix System.

On the Melbourne Elastix System, Add an IAX Trunk, and enter the information listed under the Melbourne Elastix System

Sydney Elastix System	Melbourne Elastix System
Trunk Name : melbourne **PEER DETAILS** username=melbourne type=peer secret=yellow47 qualify=yes host=202.22.44.1 context=from-internal trunk=yes disallow=all allow=gsm **User Context :** sydney **USER DETAILS** type=user secret=yellow47 host=202.22.44.1 context=from-internal disallow=all allow=gsm **Registration** {Blank}	**Trunk name :** sydney **PEER DETAILS** username=sydney type=peer secret=yellow47 qualify=yes host=202.22.44.254 context=from-internal trunk=yes disallow=all allow=gsm **User Context :** melbourne **USER DETAILS** type=user secret=yellow47 host=202.22.44.254 context=from-internal disallow=all allow=gsm **Registration** {Blank}

You should now be able to access the Asterisk CLI and type the command **iax2 show peers** on the Sydney Elastix system and see the following:

```
ElastixSydney22rc3*CLI> iax2 show peers
Name/Username    Host                 Mask            Port      Status
melbourne/melbo  202.22.44.1     (S)  255.255.255.255 4569 (T)  OK (2 ms)
1 iax2 peers [1 online, 0 offline, 0 unmonitored]
```

And similarly on the Melbourne system

```
ElastixMelbourne22RC3*CLI> iax2 show peers
Name/Username    Host                 Mask            Port      Status
sydney/sydney    202.22.44.254   (S)  255.255.255.255 4569 (T)  OK (61 ms)
1 iax2 peers [1 online, 0 offline, 0 unmonitored]
```

So what have done in the configurations that we have completed so far.

The Peer Details on the Sydney Elastix system, we have setup under Trunk Name Melbourne the details which include how to contact the Melbourne System, what password to use, the context to use, the codec to use, and we have also told it to trunk the calls. You can omit the Trunk=yes if you want, but it needs to be removed from both sides. Trunk=yes reduces the overhead a little especially if you have a number of calls being handled by that trunk.

The User Details on the Sydney Elastix system, are basically the authentication information for the Melbourne system when it tries to make contact with the Sydney system. The Sydney system will match the authentication being provided by the Melbourne system with the information here. If it matches then it will let the call come through.

The reverse is the same on the Melbourne Elastix System

It is as simple as that, you have setup a trunk between two offices. Now we need to get the Elastix systems on both ends to use this trunk because as it stands now, other than a bit of authentication traffic, it doesn't do much else. That's where the next part of this application note comes into play.

Router Port Forwarding

As you are routing via the Internet (as opposed to using a VPN), you will need to implement Port Forwards on your router for Port 4569 (UDP) and point to your local Elastix system. If you don't understand Port Forwarding or Network Address Translation (NAT), then I recommend that you look into how to accomplish this with your router. Every router is different, so trying to cover it in this Application Note is impossible and outside the scope. Likewise, your router may also you to manually implement firewall rules as well to allow Port 4569 UDP through, again check your router.

Outbound Route Setup

On both systems, we need to setup an outbound route to tell it what to do when a caller in Sydney wants to call an extension in Melbourne.

On the Sydney Elastix system, we setup an outbound route called MelbourneExts

So, what we have completed here is an outbound route that tells the Sydney Elastix system, when a user calls any three digit extension that starts with a five(5) that it is to be directed to the IAX2/melbourne Trunk.

We have also ticked the Intra Company Route option which tells the system to preserve the CID information when transferring the call to the Melbourne system.

Note : *you will also note that the route has been moved up to the top of the routes. The reason for this is that on many systems, especially in an effort to get something going quickly, they setup a default route with a "full stop", which matches any phone number dialled. Naturally if your Melbourne outbound route is sitting under this default route, when a user calls a 501 extension number, the default route thinks it owns it, tries dialling 501, which will naturally fail.*

On the Melbourne System, setup basically a mirror image of the Sydney outbound route.

As you will note, the route name is called SydneyExts, again Intra Company Route is ticked, and the other main difference is that we are telling the Melbourne Elastix system to handle any Melbourne users that dial 2xx and redirect the call to the IAX2/sydney Trunk.

Conclusion

That is it. The best way to test it is to dial a Melbourne extension from the Sydney office. There is no other science needed, no magic potions.

The main reason for failure for many is usually the failure of the IAX trunk. There are many configurations on websites, some that contain lines using the G729 codec only (which is common), but on freshly installed Elastix systems, you are generally not going to have the G729 codec loaded. My recommendation is leave the codec setting as GSM until you have completed basic testing.

Following this is an FAQ answering some common questions.

Frequently Asked Questions

Why have you used IAX2 trunks instead of SIP?

Simple answer, IAX stands for Inter-Asterisk Exchange, which is exactly what we are performing here. There are other reasons, such as the fact that IAX uses a single port (4569), which stops us getting caught up in SIP issues with firewalls/routers.

My Trunks are not connecting – What could be wrong?

To be honest, there is very little that can go wrong with connecting two Elastix systems together. As we are using the Internet, the standard rules apply. Have the Elastix systems got the correct gateway set (which should generally be pointing to their local router).

Have you setup Port Forwarding (NAT) on the router to point the local Elastix system with port 4569 (UDP). This needs to be done both ends.

Does your router require separate changes to the Firewall, to allow Port 4569 UDP through?

Does this application note apply to earlier Asterisk systems such as Elastix 1.5 and Elastix 1.6?

Yes it does. The only thing that may look different is in the outbound routes, in particular the dialplan pattern, you enter it in freeform in a box, not in the structured form the later versions of Freepbx require.

I have implemented this on a Elastix 1.5 connecting to and Elastix 2.2 system, but the calls are failing?

Time to upgrade your Elastix 1.5. Asterisk beefed up the security on IAX, compiling in CallToken Validation to resolve a serious IAX security flaw. More info at
http://downloads.asterisk.org/pub/security/IAX2-security.pdf

You can get round this issue by adding the following command
requirecalltoken=no
which needs to be added to the trunk of the Elastix 2.2 system.

In effect you are "removing" the security enhancement Asterisk has implemented. So be very careful and make sure everything is secure

Note: it should be noted that I do not have records of what Elastix versions have it and what don't, but basically it comes down to the Asterisk version and whether it was patched to include Call Token Validation.

My Routers have VPN Capability, so how do I do trunking with a VPN?

Have a look for Application Note #201110031 - Trunking between two Elastix PBX Systems Via VPN. Ideally for Security it is best to implement via a secure VPN

Do I need Public static IP addresses for connection via the Internet?

Yes if you want this to be a production system between two offices, then it is highly recommended that you apply to the ISP and get a static IP address. Yes, it may cost an extra few dollars a month, but using Open Source software does not imply everything else has to be done at a low cost.

How do I get external calls to Melbourne from Sydney to route out via the Melbourne Elastix system?

Quite simple again. Add an outbound route called MelbourneExternal on the Sydney system, and tell it to use the Melbourne Trunk like the following example. For those that are not aware of Australia's phone number system all Melbourne numbers start with area code 03 and have eight digits
e.g. 03 xxxxxxxx

Naturally if you want the same for Melbourne calling Sydney numbers the reverse applies

What to do if the same extension numbers exist at both branches?

As mentioned previously for staff sanity, it is better to plan for a change on one of the branches so that the extensions are unique to each branch. However, if this is not possible, then you can implement a slightly different way of calling extensions in each office.

The IAX Trunk setup remains exactly the same, however the difference is in the outbound routing for each system.

Since the company wants to maintain their extensions as they are, this means as an example, Sydney has extensions 201 - 260 and Melbourne has extensions 201-220, after discussions with the business, we decided that to call an Melbourne extension from Sydney, they will place a 3 in front of an extension number. Likewise Melbourne to call Sydney extensions they would place a 2 in front of the three digit extension they wanted to call.

So if Melbourne wanted to call Sydney Ext 201 they would call 2201
If Sydney wanted to call Melbourne Ext 203 they would call 3203

So the only change to implement this is in the outbound route in the examples shown previously of the outbound routes. In the Sydney Elastix system, I change the outbound route Dial Pattern from 5xx to 3|2xx and on the Melbourne Elastix system, I change the outbound route Dial Pattern from 2xx to 2|2xx

And the following diagram is the changes to the Melbourne system

Edit Route

⊖ Delete Route SydneyExts

Route Settings

Route Name: SydneyExts
Route CID: [   ] ☐ Override Extension
Route Password: [   ]
Route Type: ☐ Emergency ☑ Intra-Company
Music On Hold? default ▾
Time Group: ---Permanent Route--- ▾
Route Position ---No Change--- ▾

Additional Settings

PIN Set: None ▾

Dial Patterns that will use this Route

([   ]) + [2] | [[2XX   ] / [   ]] 🗑
([   ]) + [   ] | [[   ] / [   ]] 🗑

[+ Add More Dial Pattern Fields]
Dial patterns wizards: (pick one) ▾

Trunk Sequence for Matched Routes

0 sydney ▾ 🗑
1 [   ] ▾
[Add Trunk]

[Submit Changes]

In a nutshell, from the Sydney Elastix System, if we just dialled 201 hoping to reach Melbourne it will never happen. it will always ring the Sydney 201 extension. By adding the digit, e.g. 3201, Elastix will not see it as a local extension number and will look at the outbound routes for a match. Now as soon as it makes a match, which is the 3|2xx, it will strip off the 3 digit, and pass 201 down the IAX Trunk to Melbourne. The Elastix System in Melbourne will recognise that it has an extension 201 and will connect the call.