

## SENDING & RECEIVING FAXES THROUGH LINKSYS VOIP ADAPTORS

Reliably transmitting faxes using Voice-over-IP is difficult to achieve. The problem lies in the fact that both the sending & receiving fax machines need to run pretty much perfectly in time with each other, also the data sent to the receiving fax must arrive in the same order as it left the sending fax. Over an analogue (PSTN) telephone line this is fine as variations in timing between sections of data (known as jitter) is pretty much zero, it is also trivial over an ISDN line as there is very strict timing & loss control. In both these examples data (including voice) is transmitted in an orderly fashion & arrives at the destination with the same order & timing as it was sent with.

However, IP (Internet Protocol) was designed to carry non-time critical data such as web pages where it doesn't really matter what order the sections of data (called packets) arrive & if a packet is dropped along the way, it can be re-requested without causing any problems. IP communications are also subject to high jitter caused by network congestion, timing drift or route changes. As soon as you try to send an analogue fax (or any type of modem communication such as a credit card payment machine) over IP these effects are disastrous. Additionally to improve voice quality over IP, methods such as echo cancellation, variable jitter buffers & silence suppression can be employed. Any one of these will cause fax to fail.

## SENDING FAX USING A VOICE CODEC

One way of sending faxes using VoIP with Linksys adaptors is to use the common g.711a codec (A-LAW) which is normally used to transmit voice. This codec (including IP overheads) requires roughly 100kbps in either direction to work. In order to have a better chance of success the fax machine should be set to 14,400bps as any higher is unlikely to work over any VoIP connection.

The entire range of Linksys adaptors support fax pass-through using the g.711a codec. It is necessary to alter a few settings in the line tab of the web interface of the Linksys adaptor. You only need to alter the line the fax will be plugged into. The following settings will give the best results:

- Network jitter buffer: very high
- Jitter buffer adjustment: disable
- Call Waiting: no
- 3 Way Calling: no
- Echo Canceller: no
- Silence suppression: no
- Preferred Codec: G711a
- Use pref. codec only: yes

There is no real way to guarantee this method of faxing is going to work all the time. A lot will depend on the quality of your Internet service from your ISP. As always with Voice-over-IP you will see more reliable results when using a router with Quality-of-Service functionality to prioritise voice traffic over data traffic on your Internet link.

## SENDING FAX USING THE T.38 PROTOCOL

T.38 is the real-time Fax-over-IP protocol. Rather than just trying to use a voice codec to transmit an analogue fax signal, t.38 has been developed purely to allow fax or modem transmission over an IP network (such as the Internet). A gateway (such as a Linksys adaptor) that supports t.38 deals with all the delays, timing jitter, packet loss and isolates the analogue fax machine from these as far as possible. Also since t.38 sends faxes as image data rather than audio, the bandwidth requirements are half that of using g.711a (so roughly 50kbps in either direction).

The t.38 protocol is still a new technology & the range of devices supporting it well is very limited. Currently only the Linksys SPA-2100 adaptor has t.38 support & you must be using firmware version 3.1.5 onwards. At the time of writing the SPA-2002 has sufficient memory capacity & processing power for t.38, the support is planned for a future firmware release from Linksys.

Sending or receiving a fax using t.38 is automatic when using the SPA-2100. It is necessary to set the "Fax Passthru Method" to "ReINVITE" for the line the fax is connected to.

The reliability of t.38 faxes should be much greater than using a voice codec but it is worth considering that the device you are sending a fax to or receiving a fax from, must also be a working t.38 device. If you are registered with a VoIP service provider who provide you with a PSTN phone number you want people to be able to fax to, you must check that your provider supports t.38.