Fax over IP

Understanding the realities of T.38 compliance

Introduction

In recent year, small and medium-sized businesses have seen a tremendous surge in communications conducted using voice over Internet Protocol (VoIP). While VoIP provides some highly appealing benefits, it occasionally causes confusion with legacy technologies on which your customers rely in their day-to-day work.

One of the most common issues to crop up is with fax machines. VoIP lines can often cause faxes to become distorted or lost. Fortunately, phone system makers have worked hard to correct fax issues through a protocol called **T.38**. ESI's **IP Server 900** business communications system supports the industry-standard T.38 protocol to ensure that faxes into and out of the system can be processed as reliably over IP as they were over conventional telephony.

This *Fax over IP Feature Overview* is to help you understand not only what the T.38 protocol is and how the IP Server 900 supports it, but also how to identify where and when T.38 applies. This document will examine several real-world configurations that require T.38, as well as some that don't, and also will take a close look at T.38 technology and how it works.

Fax over IP: An historical overview

Late in the 1990s, when businesses first began experimenting with VoIP communications, it quickly became clear that fax machines were incompatible with this new technology. The problem occurred because, in order to keep bandwidth requirements low and attempt to circumvent network errors, VoIP uses rather aggressive compression techniques that can easily lead to lowered voice quality. At the remote end of a call, a VoIP system employs powerful error correction techniques to account for any data lost or mangled by the network, and research in this area has led to the greatly increased voice quality which VoIP system users enjoy today. However, voice information is much more tolerant of such correction than is data. While you may not notice a clipped or regenerated syllable in your conversation, a transmission involving a data modem or fax machine is critically affected because such devices require absolute, real-time communications.

In 1998, members of the International Telecommunication Union (ITU), the United Nations agency responsible for international communication standards, met to rectify the problems of fax over IP. As a result, the ITU published the T.38 protocol recommendation. T.38 specifies a way for VoIP systems to communicate with fax machines by making the data network appear to be identical to traditional CO lines. On the fax machine's side, a **T.38 gateway** monitors the data transmission on the network and, as necessary, generates dummy signals to the fax machine to prevent the transmission from failing. On the network side, a T.38 gateway encapsulates the fax data in a specific way that tells the network to try to keep the data packets in order and moving as close to real-time as possible. Together, these two T.38 functions allow fax transmissions to proceed across a VoIP network as reliably as possible.

The IP Server 900's **built-in T.38 gateway** is used whenever a fax is sent or received on a T.38-enabled SIP trunk or Esi-Link channel. For sites that **don't** use SIP trunks or Esi-Link channels, **T.38 has no effect**; instead, faxes are transmitted using the traditional T.30 protocol used by the public switched telephone network (PSTN) since 1980. However, for sites that **do** use SIP trunks or Esi-Link, the IP Server 900 transmits faxes using T.38, greatly increasing the reliability of fax transmissions.

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Configuration

Standard faxing

The first scenario we will examine is a standad fax configuration that uses neither SIP trunks nor Esi-Link. This is the standard fax configuration that's been in place since the 1980s; it establishes a baseline for comparison in later scenarios.
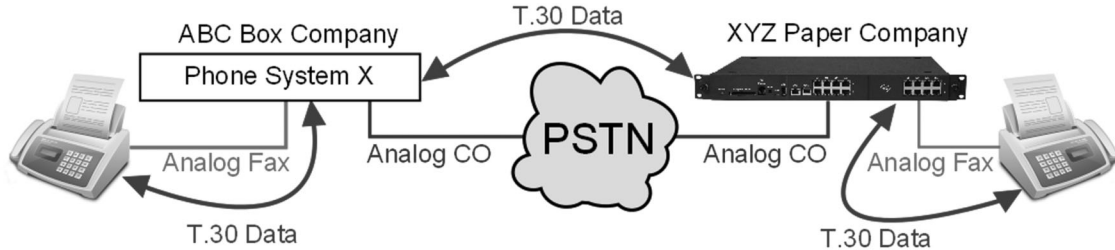
In this standard business configuration, the fax machine connects to the phone system that ABC Box Company has been using for years; the phone system, in turn, is connected back to the PSTN through analog loop lines. At the far end, XYZ Paper Company also has analog loop lines connected to its phone system and an analog fax machine connected. Note that the protocol used to communicate is T.30, the standard fax format. The two machines communicate over standard phone lines and transmit fax with a high degree of reliability.

SIP faxing gone wrong

Now, consider the result if ABC Box Company were to move its existing analog loop lines to SIP trunks in a system that **doesn't** support T.38:
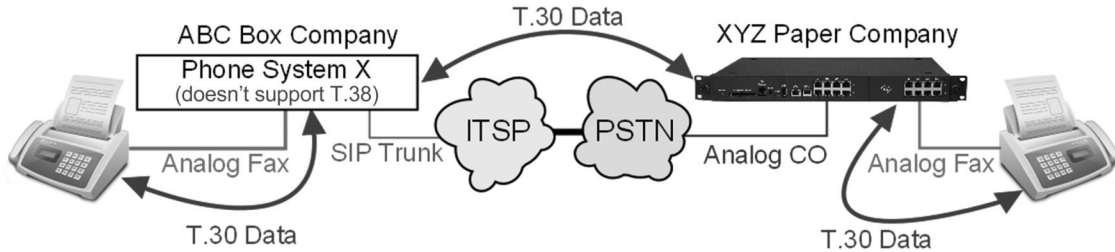
In this configuration, the analog fax machine still connects to the phone system, but now the phone system connects to a SIP service provider — an **Internet telephony service provider (ITSP)** — which, in turn, connects to the PSTN. At the far end, XYZ Paper Company still has analog loop lines, so its configuration is unchanged. In this scenario, the fax communications will be **extremely** unreliable: the Internet's normal jitter and network latency will typically cause garbled data and incoherent faxes in both directions. The SIP standard simply wasn't written to pass normal T.30 data, so ABC Box Company will experience a good deal of frustration.

SIP faxing the right way

This is where you and ESI's IP Server 900 come in to save the day, because you **can** offer T.38 support. Let's re-examine this scenario but, this time, with the IP Server 900 . . .
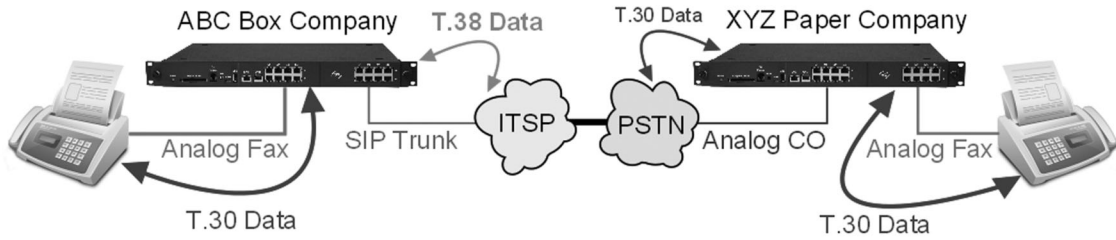

You've upgraded ABC Box Company's system to an IP Server 900. Notice that, now, the data from the phone system to the ITSP **does** use T.38, but all other points still use T.30. This is because T.38 simply "wraps around" T.30 data to protect it as it moves across a data network. When the data moves back to the PSTN, the T.38 container is discarded and the T.30 data travels along as is usual. While this configuration is still subject to problems if ABC Box Company's Internet connection is lost, this still returns fax reliability to almost as high a level as with traditional all-PSTN faxing.

Think local, fax global

Armed with this knowledge, let's look at another case where T.38 is extremely useful.

ABC Box Company has had so much success with its recent fax campaigns that the company has opened a second location across the country. ABC is looking for the ability to use fax machines in Dallas to fax out to customers in New York, using a New York local phone number. Esi-Link makes this a snap.
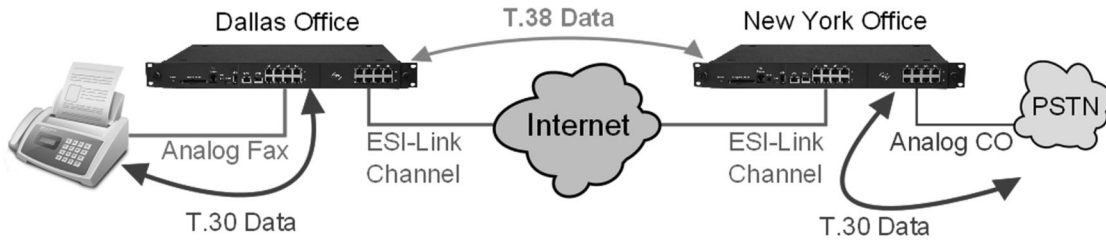
In this configuration, the New York and Dallas offices' IP Server 900 systems have been connected with Esi-Link to enable not only inter-office dialing but also cross-country trunk access. Notice that, again, T.38 is used only where the fax crosses the data network — in this case, when it's traveling down an Esi-Link channel.
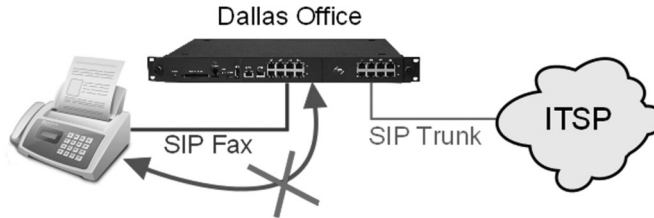
T.38 fax server

Another scenario in which T.38 is very useful is when faxing **to** a T.38 **fax server** or receiving a fax **from** a T.38 fax server. Notice the configuration illustrated below; once the fax is put on the network and wrapped by T.38, it doesn't get converted again until reaching its destination. This lets the fax traverse the network with fewer conversion delays, and allows for significantly higher-quality faxes.
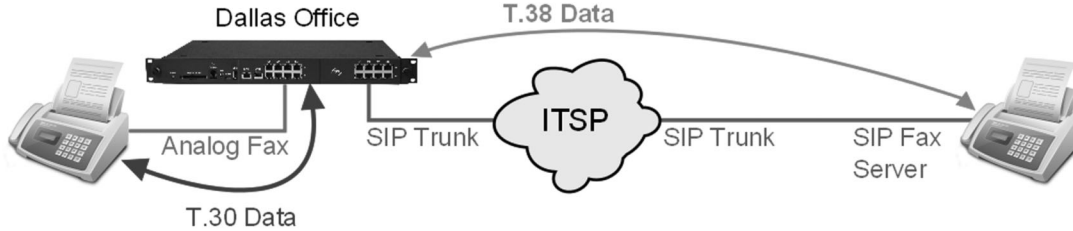
However, there's a version of this scenario that can cause problems . . .

T.38 fax server as a SIP station

ABC Box Company is now faxing so much that it requires a fax server. The company has purchased a brand-new T.38 fax server, and wants to use it to fax out over ABC's SIP trunks.

Unfortunately, IP-enabled fax servers use radically different standards from model to model, so it's difficult to properly implement T.38 support to a SIP station port. For this reason, the IP Server 900 won't accept T.38 data from a SIP station. However, there is a way around this limitation if the ITSP allows it:
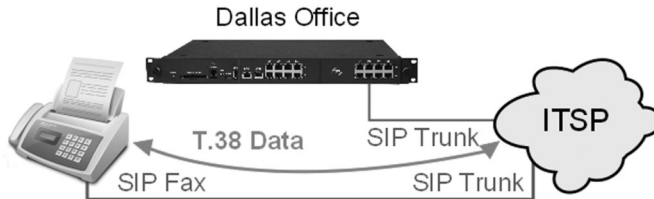
Some IP-enabled fax servers will allow you to connect directly to a SIP ITSP; so, if the ITSP allows it, you can connect directly, much as some companies connect dedicated CO lines to their existing fax servers.

Frequently asked questions

Here are some questions your customers and prospects may have about fax over VoIP using the T.38 protocol, and the answers that ESI solutions make possible.

What do I have to do to turn on T.38?

Nothing special; simply configure your SIP trunks and/or Esi-Link, and connect a fax machine to the IP Server 900. The system will take care of the rest. There are no programming options or configuration steps required to enable or use the T.38 protocol.

Does T.38 let me get faxes in my e-mail?

No. T.38 is simply a communications protocol. The IP Server 900 **does** allow you to receive faxes to your e-mail, but this is a system feature rather than a T.38 capability. (For more information about the fax-over-e-mail feature, see the *IP Server 900 Fax-over-e-mail Feature Overview*, ESI # 0450-1354.)

Can I use a T.38 or SIP fax machine or fax server with the IP Server 900?

Not at this time. Currently, the IP Server 900 supports T.38 on **only** SIP trunks and Esi-Link channels, not SIP stations. SIP and T.38 fax machines can't pass the necessary signaling through IP Server 900 SIP stations because these types of devices transmit using further specialized protocols that haven't yet been fully standardized. ESI is monitoring these device types' development; when the technology is fully mature, ESI will provide the best solution possible.

Does the IP Server 900 support T.38 redundancy?

Yes. Redundancy is a major T.38 capability that tries to mitigate the effects of an unreliable network. In basic terms: when redundancy is enabled, the T.38 gateway will send multiple copies of every packet it sends so that the far end is more likely to receive at least one copy of each packet and, therefore, have a greater chance of receiving the entire fax without errors.

This seems too simple; why is there so much discussion about T.38?

IP technology can seem rather intimidating. In truth, it's simply a difference of naming and behavior. For instance: faxing over the PSTN is done through the T.30 standard; the difference between "normal" faxing and fax-over-IP is only that people tend to refer to fax-over-IP by the protocol (T.38) rather than the common name, which complicates the discussion — much the way you could confuse someone by referring to "E.164 data" rather than the more common "Caller ID"! The term *T.38* simply refers to a way of transmitting the normal T.30 fax data over a VoIP trunk.