

White Paper

How Does Fax over IP Work?

A Discussion of the T.30 and T.38
Protocols and the Dialogic[®] Brooktrout[®]
Fax Products

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Brooktrout® Fax Products

Executive Summary

This white paper briefly describes the T.30 and T.38 protocols, which enable fax to be sent over an IP network. The T.30 fax protocol was designed to be implemented over a network that provides relatively smooth and uninterrupted data flows, and the T.38 was created to describe the process for sending and receiving faxes in real-time over a VoIP network — an environment that can cause the T.30 to fail.

This background paves the way for a discussion of how the protocols work in a Fax over IP (FoIP) implementation by comparing traditional fax technology — that is, plain old fax, which is a fax device that is not connected to an all-IP enabled fax server — with the more advanced fax option of sending faxes over an IP infrastructure, which also has more security features.

This white paper also provides examples of the Dialogic® Brooktrout® T.30 and T.38 Stacks used in Dialogic® Brooktrout® fax products, followed by notable benefits of these enhanced protocols in Brooktrout fax products.

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Introduction

Two separate protocols enable faxes to be sent effectively over an IP Network — the T.30 and T.38 protocols.

The T.30 fax protocol was designed to be implemented over a network that provides relatively smooth and uninterrupted data flows. The Dialogic® Brooktrout® T.30 Stack is one of the most robust in the industry, with over 20 years of deployment history. It has also been regularly updated to deal with interoperability issues that arise as new fax machines and equipment have been introduced into the market.

Unfortunately, even having a first rate T.30 fax protocol does not guarantee success when attempting to send facsimile traffic over a VoIP network. As stated previously, the T.30 fax protocol was designed to be implemented over a network that provides relatively smooth and uninterrupted data flows. This is the antithesis of the design of an IP network. The T.30 fax protocol does not tolerate the latency, jitter, and packet-loss that are inherent in an IP network.

In addition, the compression implemented by many VoIP networks works well for speech (based on the limited frequency response of the human ear and our ability to “fill in the gaps” when certain sounds are missing from spoken words); however, the distortion caused by compression and packetization can be enough to cause a T.30 transmission to fail.

Therefore, the T.38 fax protocol was created to describe the process for sending and receiving faxes in real-time over a packet network. T.38 is designed to preserve the traditional fax experience and to allow faxes to be successfully sent and received by making adjustments for jitter, latency, and packet loss, which are inherent in all IP networks. Without T.38, fax devices, which are sensitive to timing, cannot reliably send and receive faxes over an IP network.

This white paper briefly describes the T.30 and T.38 protocols, and has examples of the Dialogic® Brooktrout® T.30 and T.38 Stacks used in Dialogic® Brooktrout® fax products, followed by notable benefits of these enhanced protocols in Brooktrout fax products.

Traditional and Advanced Fax Technologies

Traditional Fax Technology

Figure 1 shows a simple real-time Fax over IP (FoIP) example implementation with a TDM fax server working with T.38 gateways (in this example, the Dialogic® IMG 1010 Integrated Media Gateways) to deliver a fax to a “plain old fax” machine that is connected to the PSTN. In this case, the fax transmission originates from the TDM-based fax server as a “plain old fax.” The T.38 gateway then demodulates the fax transmission and sends it over the IP “cloud” to another T.38 gateway, again shown as an IMG 1010. This second gateway remodulates the transmission and sends it over the PSTN to the receiving plain old fax machine. Note the two end point devices (the originating TDM fax server and the receiving fax machine) know nothing of the T.38 protocol. From the viewpoint of these devices, the entire transaction is just a T.30 session. The faxing intelligence required to negotiate, synchronize, and send the fax (defined by the T.30 protocol) still resides in the end-point devices. The T.38 protocol completely hides the IP portion of the transmission from the endpoints.

Advanced Fax Technology

Figure 2 shows a slightly more sophisticated example of sending faxes over an IP infrastructure via an IP fax server using Dialogic® Brooktrout® fax technology. Because the fax server is IP-enabled, it eliminates the needs for a T.38 gateway on the originating side of the transaction. Note that even though there is no T.30-specific equipment on the originating side, the fax server still uses that same T.30 protocol to create the fax transmission. It then demodulates the fax transmission and transmits it using the T.38 protocol. This is done so that the terminating fax machine can still receive the fax using T.30.

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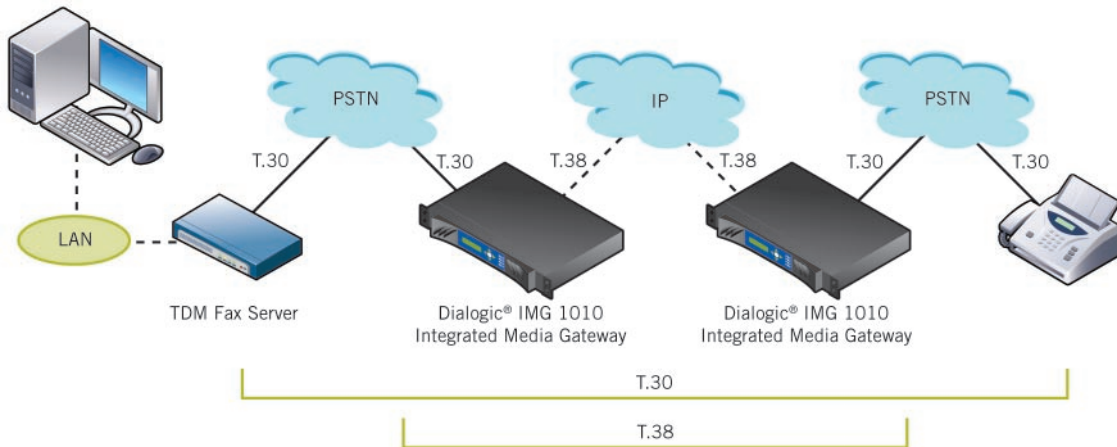


Figure 1. Traditional Fax Technology

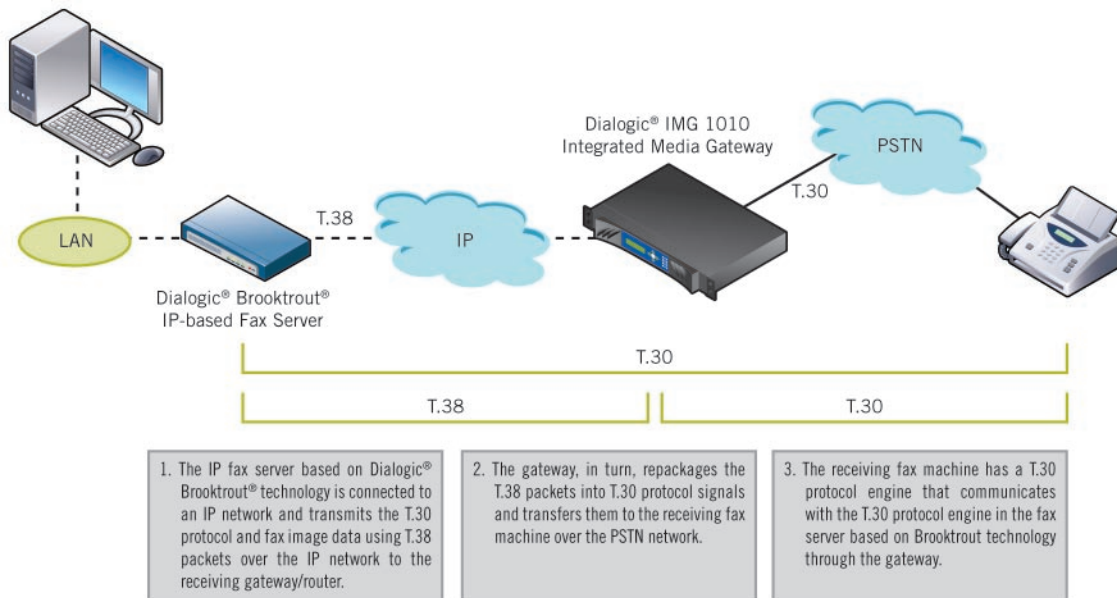


Figure 2. Using Dialogic® Brooktrout® IP-Enabled Fax Server Eliminates the Second Gateway

Security and T.38 Real-Time Fax over IP

The Dialogic® Brooktrout® TR1034 Fax Boards have unparalleled security, as do the Dialogic® Brooktrout® FoIP products. With a properly configured IP network, there are no additional security concerns with real-time FoIP on the Brooktrout TR1034 or Dialogic® Brooktrout® SR140 Fax Software. If a malicious packet penetrates the firewall, it will be dropped by the Brooktrout TR1034 or Brooktrout SR140. The T.38 protocol and Brooktrout T.30 protocol allow only for the transfer of T.4 and T.6 fax images.

To protect against internal attacks, the IP network can be configured to use Virtual Private Networks (VPNs) between the T.38 endpoint and gateway.

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Dialogic® Brooktrout® Fax Products

Dialogic® Brooktrout® intelligent fax technology supports corporate networks in the various stages of transition ranging from purely TDM, to hybrid, to pure VoIP networks.

Both the SR140 and TR1034 fax platforms support real-time FoIP, providing companies with the ability to integrate fax servers and fax document management solutions with their VoIP network. With Dialogic's industry-leading fax technology, enterprises can achieve the high levels of performance, reliability, and scalability that they have come to expect over the past 20 years from their Brooktrout® products, while being able to capture the benefits of FoIP.

The Brooktrout TR1034 supports both TDM and VoIP networks, providing companies with a smooth migration path from TDM fax to IP fax. The TR1034 can save time by providing a single platform to support and maintain company wide, which can eliminate the hidden costs of maintaining multiple vendor platforms.

For companies looking for a pure software-based IP fax solution, Dialogic offers the Brooktrout SR140, a host-based FoIP platform for companies that have transitioned their networks to VoIP. The SR140 has the same renowned functionality — which includes the Dialogic industry-leading Brooktrout T.30 Stack, Error Correction Mode, and MMR fax compression — that has made Dialogic a leading provider of intelligent fax boards. The SR140 is available in a variety of densities from 2 to 60 channels. To add channels as their needs grow, customers can simply purchase and install a new software license key to instantly upgrade their solution. There is no hardware to buy, maintain, or upgrade.

With nearly 20 years experience since pioneering the intelligent fax technology category, Dialogic has built a solid reputation for delivering value in the industry. Dialogic is poised to build on this legacy and to continue to deliver unparalleled value as the world moves to an all-IP network.

- **Trusted Market Segment Leader** — Dialogic is the intelligent fax board market segment leader with over 90% market share [Davidson]. Companies trust the Dialogic Brooktrout intelligent fax technology for their critical fax documents.
- **Outstanding Value** — Although other fax options, including some lower priced ones, have sought to position themselves alongside the Dialogic Brooktrout fax products, the Brooktrout fax products have long proven their worth by providing first rate quality, reliability, security, and customer service. Having Dialogic Brooktrout fax technology in place to help avoid the loss of a single critical fax document, for example, a purchase order, contract, invoice, sales quote, and so on, more than pays for the fax platform with peace of mind.
- **Reliability** — The Brooktrout T.30 Stack remains at the heart of every fax connection using the Brooktrout T.38 Stack, including IP fax connections. The Brooktrout T.30 Stack has been thoroughly field tested. With such a large installed base, Dialogic has adjusted the Brooktrout T.30 Stack to interoperate with virtually every T.30 variant, which provides that faxes are sent and received with confidence and reliability, thus saving you money on telephone tolls associated with less reliable options.
- **Security** — The Brooktrout T.30 Stack and T.38 Stack allow only for the transfer of T.4 and T.6 fax images.
- **Broad Range of Products** — Brooktrout fax products span the range of fax platforms from low density to high density, from analog to T1/E1/ISDN to IP. Companies with diverse and complex hybrid telecommunications environments can standardize on a single vendor platform to address all their needs.
- **One API for TDM and IP Fax Platforms** — Supporting varying platforms and applications costs money, but the Brooktrout fax products can enable companies to cut costs by consolidating and standardizing on a single vendor platform.

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- **Built and Supported by Dialogic** — Business critical document management systems demand reliability and responsive customer service, which are achieved by maintaining full control over the core technologies that comprise the intelligent fax solution. The Brooktrout T.30 Stack and T.38 Stack — the heart of faxing over IP and TDM networks — are developed, tested, maintained, and supported by Dialogic.
- **Patented Inbound Fax Routing** — Regardless of whether faxes are being sent over IP or over the PSTN, patented Dialogic® inbound fax routing technology enables companies to fully automate document delivery directly to the desktop.
- **Supported by More Applications** — More than 50 Application Partners (as of 2008).
- **Business Critical Fax Technology** — With the daunting risk of non-compliance posed by new regulations such as Sarbanes-Oxley, HIPAA, Basel II, SEC-17a4, the role of the fax server has expanded from that of a business automation tool to include compliance enforcement. Brooktrout intelligent fax technology offers the level of security and reliability demanded by compliance solutions.
- **Industry Leading T.38 Expertise** — Dialogic has a long history in both real-time PSTN and packet-based fax. Dialogic was the primary editor and contributing author of the T.38 real-time FoIP protocol specification, which Dialogic began to develop in the mid 1990s.

References

[Davidson] Davidson Consulting, *Computer-Based Fax Markets, 2006-2011*, December 2007.

For More Information

Dialogic® IMG 1010 Integrated Media Gateway —
http://www.dialogic.com/products/gateways/img_gateways/default.htm

Dialogic® Brooktrout® TR1034 Fax Board —
http://www.dialogic.com/products/tdm_boards/fax_boards/TR1034.htm

Dialogic® Brooktrout® SR140 Fax Software —
http://www.dialogic.com/products/ip_enabled/FoIP/SR_140.htm

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