Release Notes

Dialogic® Brooktrout® Product Series

SDK Version 6.11.0

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Technical Support

For Technical Support, see www.dialogic.com/support

Product Documentation

For the latest product documentation, see http://www.dialogic.com/en/manuals/brooktrout/brooktrout.aspx.

Table of Contents

Dialogic® Brooktrout® Product Series

The Dialogic® Brooktrout® Product Series is a set of sophisticated and feature rich products. These release notes capture the state of the product family at the time of its release(s). Generally, these release notes cover information that is either not in the user documentation or deemed to be of sufficient importance that it is highlighted in the release notes.

The Dialogic® Brooktrout® Product Series includes the following product lines:

- Dialogic® Brooktrout® TR1034-branded board-based T.38 IP, T1/E1, analog loopstart, DID, and BRI fax models
  (note – these products are often referred to herein as "TR1034" products)
- Dialogic® Brooktrout® TruFax®-branded analog and BRI fax models
  (note – these products are often referred to herein as "TruFax®" products)
- Dialogic® Brooktrout® SR140-branded IP Host-based Fax models
  (note – these products are often referred to herein as "SR140" products)

New Features in the Dialogic® Brooktrout® SDK 6.11.0

Support for Windows 2019 Server

Added support for Windows 2019 Server.

Ability to set ISDN numbering type and numbering plan parameters on a per call basis

Ability to set ISDN numbering type and numbering plan parameters on a per call basis.

Changes in SDK 6.11.0 (From SDK 6.10.1)

The following section describes the customer-visible issues that have been resolved in this SDK release. The notation "*BRKT-nnnn*" is used to reference a specific issue in Dialogic's change request tracking database.

- **Fixed BRKT-926** - (SR140) SR140 channels will fail to reset after 24.8 days. This is due to a Windows clocking function used in the Boston Host Service that will reach a maximum value at that time rather than rolling over. A change was made to use a different clocking function to correct this issue.
- **Fixed BRKT-941 -** (SR140) Under certain conditions the SR140 may send a SIP 200 OK message (in response to an incoming INVITE) without correct record-route tags. This can cause the SIP call to fail during establishment. This has been corrected.
- **Fixed BRKT-880 -** (SR140) Under rare conditions, the Boston Host Service could crash due to an improper linked list. This has been corrected.
- **Fixed BRKT-942 -** (Brooktrout Fax Boards and SR140) The Brooktrout Linux driver could not be compiled under Red Hat or CentOS Linux 7.6. Dialogic has changed its Brooktrout driver rebuild package to be GPL compliant so that the driver can be now be compiled. There was no issue with Red Hat/CentOS 7.5 and earlier versions.
- **Fixed BRKT-930 -** (Brooktrout Fax Boards and SR140) The brooktrout_x64.msi file (64-bit library installation package) from 6.10.1 was not able to be installed. There was no issue with the brooktrout_x64.msi from 6.10. This has been corrected.
- **Fixed BRKT-893 -** (Brooktrout Fax Boards and SR140) When using SDK 6.10 under Linux, the btver utility would report the driver version as 7.0.00 instead of 6.10.00. The btver utility under Windows reported the correct driver version. This has been corrected.

Release Contents

The Dialogic® Brooktrout® Product Series SDK contains the following components:

Component	Version	Build
Boston Driver – Windows (Microsoft-certified WHQL PnP driver)	6.11.0	1
Boston Driver – Linux	6.11.0	2
Boston BFV API	6.11.0	2
Configuration Tool	6.11.0	2
TECUpdate Tool	6.11.0	2
Call Tracer	6.11.0	2
VTTY_Tracer	6.11.0	2
BSMI	6.11.0	2
Host Based Fax SR140 Virtual Module	6.11.0	2
TR1034 Series Control Processor	6.11.0	1
TR1034 Series low density DSP firmware	6.11.0	1
TR1034 Series high density DSP firmware	6.11.0	1
TR1034 Series high density DSP firmware (with V.34/T.38 fax)	6.11.0	1
TR1034 Series ultra-high density DSP firmware	6.11.0	1

Note: Windows users should use the "File/Product version" and not the "File Version" in the "File Version Information" tab in the File Properties dialog box to view version information.

Firmware Files

The following table lists the firmware (embedded software) included with this release. The checksums were produced using the csum program that is provided in source and executable form in the *Firmware**csum* directory.

Filename	Bytes	Checksum	Description
cp.bin	2945040	8823D487	**C**ontrol **P**rocessor firmware Use with all Brooktrout hardware platforms
dsp1000_ld.hex	771775	7939087F	**L**ow **D**ensity DSP firmware Supports V.34 and V.17 fax Use with LP01, LP02, LE01 and LP03 HW platforms
dsp1000.hex	278775	1A1A4B7A	Medium Density DSP firmware Supports V.17 fax Use with HP02 HW platforms
dsp1000_v34.hex	636906	46562325	Medium Density DSP firmware Supports V.34, V.17 and T.38 fax Use with HP02 HW platforms
dsp1000_ud.hex	303467	4E043834	**U**ltra High **D**ensity DSP firmware Supports V.17 fax Use with HP03 and HE01 HW platforms
dsp1034_ud.hex	684379	36024D4C	**U**ltra High **D**ensity DSP firmware Supports V.34, V.17 and T.38 fax Use with HP03, HE02, and HE01 HW platforms

Supported Operating Systems

A supported operating system is one for which this SDK has been designed and tested.

Windows

This SDK is supported for the following versions of Windows:

- Windows Server 2019 64-bit
- Windows Server 2016 64-bit
- Windows Server 2012 R2 64-bit
- Windows Server 2012 64-bit
- Windows Server 2008 R2 64-bit
- Windows 10 Enterprise Edition 32-bit and 64-bit versions

Red Hat Linux/CentOS

This SDK is supported for the following versions of Red Hat/CentOS Linux. The base kernel (listed) is supported, together with any patches. The SDK also includes a Linux rebuild feature to support updated kernels.

- Red Hat Enterprise/CentOS Linux 7.0 (3.10.0-123.el7), 64-bit version
- Red Hat Enterprise/CentOS Linux 6.0 (2.6.32-71.el6), 32-bit and 64-bit versions

Supported Virtual Machines

The supported virtual machines (VM) are listed below. It is recommended to use only two VMs when running Brooktrout-based applications. If more than two VMs are used, there may be performance issues. Note: Virtualization systems chosen for Brooktrout-based applications should be configured for enterprise or private virtual environments that permit customization of virtual machine (VM) settings and hypervisor performance tuning. Virtual environments running Brooktrout-based applications must also restrict the number of VMs hosted on a single platform to facilitate the real-time low-latency scheduling demands required for high quality media processing. Density capacity in virtual environments may vary and is generally a factor of the host platform capacity and the number of VMs running Brooktrout-based applications. Generally, the aggregate density of all VMs will be less than the bare metal capacity of the platform.

VMWare

- SR140 only
- VMware ESXi Server version 6.x or running any supported Windows or Red Hat Linux guest operating system
- VMware ESXi Server version 5.x or running any supported Windows or Red Hat Linux guest operating system
- VMware ESXi Server version 4.x or later running any supported Windows or Red Hat Linux guest operating system

Hyper-V™

- SR140 only
- Windows Server 2012 Hyper-V Windows Server 2012 R2 Hyper-V running any supported Windows or Red Hat Linux guest operating system
- Windows Server 2008 R2 Hyper-V running any supported Windows or Red Hat Linux guest operating system

Xen

- SR140 only
- Citrix XenServer v6.0 or later within the v 6.x product line, running any supported Windows or Red Hat Linux guest operating system
- Citrix XenServer v5.5.0 or later within the v 5.x product line, running any supported Windows or Red Hat Linux guest operating system

KVM

- SR140 only
- KVM with QEMU Guest Agent 1.5.3 or later running on Red Hat Enterprise 7.0 or higher, running any supported Windows or Red Hat Linux guest operating system

Supported Hardware Platforms

The Brooktrout series of hardware platforms are supported by this SDK. Depending on the software downloaded to the platforms at runtime.

The following table describes the supported hardware platforms for this release:

HW Platform	Form Factor	Telephony Bus	IP Interface	Maximum Channels
LP02 TruFax® Analog* LP02 TR1034 Analog/DID*	Half length, universal PCI	N/A	N/A	2 ALS 4 DID
LP01-L TR1034 Analog*	Full length, universal PCI	N/A	N/A	8
LP01-B TR1034 BRI* LP01-B TruFax® BRI*	Half length, universal PCI	N/A	N/A	4
HP02-H TR1034 T1/E1	Full length, universal PCI	H.100	1	30
HP03-H TR1034 T1/E1*	Full length, universal PCI	H.100	1	96
LE03 TR1034 Analog LE03 TruFax® Analog	Low Profile, PCI Express	N/A	N/A	2 or 4 ALS 2 ALS
LE02 TruFax® Analog* LE02 TR1034 Analog/DID*	Half length, PCI Express	N/A	N/A	2 ALS 4 DID
LE01-L TR1034 Analog*	Full length, PCI Express	N/A	N/A	8
LE01-B TR1034 BRI LE01-B TruFax® BRI	Half length, PCI Express	N/A	N/A	4
HE01-H TR1034 T1/E1*	Full length, PCI Express	H.100	1	30
HE02 TR1034 T1/E1	Low Profile, PCI express	N/A	N/A	30

* Product no longer available for sale. Please refer to the Retired Product page on the Dialogic web site at http://www.dialogic.com/en/products/others/retired-products.aspx for information on the Software Support period for specific board models.

Note: The model name and number of your hardware platform also appears on a label on the circuit board.

SR140 Product Family

There are two major SR140 products, the original full SR140 and the SR140-L. Each product differs in the available functionality, with the full SR140 having the highest functionality. The tables below summarize the feature set available for the different SR140 products over the course of their release history.

Note: Full SR140 and SR140-L licenses cannot co-exist in the same system.

Full SR140 Release History

Release	Date	Example Model Name	Feature Set
R1	Jul 2005	SR140-4F	• T.38 V17 • Adv. Fax (Very High Res, MMR, JBIG/Color pass-through)
R2	Feb 2008	SR140-4F-V34	• T.38 V34 • T.38 V17 • Adv. Fax (Very High Res, MMR, JBIG/Color pass-through)
R3	Nov 2009	SR140-4-R3	• G711 V34 fax pass-through • G711 V17 fax pass-through • IVR • T.38 V34 • T.38 V17 • Adv. Fax (Very High Res, MMR, JBIG/Color pass-through)

SR140-L Release History

Release	Date	Example Model Name	Feature Set
R1	June 2010	SR140-L-4-R1	• Maximum 8 channels per system • T.38 V17 • Adv. Fax (Very High Res, MMR, JBIG/Color pass-through)

SR140-IAF Release History

Release	Date	Example Model Name	Feature Set
R1	March 2013	SR140-Feature-IAF150-4	• Maximum 60 supported channels per system • T.38 IAF speeds up to 150kbps • Optional Add-on to full SR140 license

SR140-Security Release History

Release	Date	Example Model Name	Feature Set
R1	Oct 2017	SR140-4-Feature-Security	• Optional add-on to full SR140 license • Enables SIP over TLS and SRTP security features on supported channels

Supported SR140 Virtual Modules

This SDK release supports SR140 host-based fax modules, available in the following configurations. Specific part numbers for each license type are available on the Dialogic website at http://www.dialogic.com/en/products/fax-boards-and-software/foip/sr140.aspx#Where_to_buy.

SR140 Full

SR140 licenses are available in a variety of densities ranging from 2 to 60 channels.

These licenses can be combined on standard servers to support hundreds of ports.

The system limit depends upon many factors including the FoIP transport method, your application demands, operating system, physical or virtual machine, and host processor capacity.

DEMO and EVAL license types cannot be combined with any other SR140 license including DEMO and EVAL licenses.

SR140-L

SR140-L licenses provide a more basic feature set for lower density fax processing environments and are available in 2-, 4-, and 8-channel densities.

These configurations can be combined to support a maximum of 8 ports in a single server, depending upon your application. DEMO license types cannot be combined with any other SR140 license including DEMO and EVAL licenses.

SR140-L Upgrade licenses are also available to bring the feature set supported to that equivalent to a full SR140 license. Refer to page 13 for more information.

SR140-IAF

SR140-IAF licenses are optional feature licenses that add IAF support to an SR140 Full license up to 60 IAF-enabled channels in a server. The IAF feature license can only be used with full SR140 licenses and will not co-exist with SR140-L licenses

The system limit depends upon many factors including the FoIP transport method, your application demands, operating system, physical or virtual machine, and host processor capacity.

DEMO license types cannot be combined with any other SR140 license including DEMO and EVAL licenses.

SR140-Security

SR140-Security licenses are optional feature licenses that add security feature support to an SR140 Full license. The SR140-Security license can only be used with full SR140 licenses and will not co-exist with SR140-L licenses. The amount of security channels in a system must be equal or greater than the number of full SR140 channels for security features to be enabled.

Multi use SR140-DEMO License Activation Keys

The following License Activation Key can be used multiple times by different users to obtain a demonstration of the SR140. Different license keys are available for different products. There are two keys available, one produces a diagonal watermark and another produces a watermark in the right hand margin which may be more suitable for demonstrating OCR applications.

Title	License Activation Key	Description
SR140-DEMO-2-R3	650553011091	Full SR140 with diagonal watermark
SR140-DEMO-2-R3	755734006197	Full SR140 with right margin watermark
SR140-L-DEMO-2-R1	991762916424	SR140-L with diagonal watermark
SR140-L-DEMO-2-R1	720218074497	SR140-L with right margin watermark

Supported Fax over IP Equipment

The Dialogic® Brooktrout® SR140 FoIP Fax Software products are compliant to the IETF SIP standard and follow T.38 and H.323 ITU recommendations. Solutions created using Brooktrout SR140 software will interoperate with equipment that also properly adheres to these standards/recommendations. However, given that not all implementations of T.38 are guaranteed to be alike, Dialogic provides a list on our website of equipment and SIP trunks that we have successfully tested: http://www.dialogic.com/interoperability/fax.htm. This list should be considered a subset of the equipment and SIP trunks that are interoperable with Dialogic® Brooktrout® Fax Products. Refer to the Field Tested FoIP Interoperability page (http://www.dialogic.com/en/interoperability/fax/field-tested-foip.aspx) for a list of additional devices that are successfully being used by our SR140 customers.

System Configurations

The following sections list recommended system configurations for hardware-based applications developed for this SDK. This SDK may operate properly in systems containing more ports than shown here, but Dialogic has not tested systems other than the configurations listed in this section.

Hardware-based applications

The following tables list the maximum number of ports recommended for each hardware platform and minimum system requirements to support these densities. System requirements are representative of configurations tested by Dialogic.

Hardware System Density Requirements

Hardware Platform	Operations	Recommended System Density Max ports	Max boards
LP01-L TR1034 Analog*	V.34 Fax	32 ports	4 boards
LP01-B TR1034 BRI*	V.34 fax	16 ports	4 boards
LP01-B TruFax® BRI*	V.17 fax	16 ports	4 boards
LP02 TR1034 Analog/DID*	V.34 fax on ALS, V.17 fax on DID	16 ports	4 boards
LP02 TruFax® Analog*	V.17 fax	8 ports	4 boards
HP02-H TR1034 1 T1/E1	V.34 fax over T1/E1 or fax over IP	120 ports	4 boards
HP03-H TR1034 1 T1/E1 or 1 Ethernet*	V.34 fax over T1/E1 or fax over IP	384 ports (V17) 240 ports (V34)	4 boards
LE01-L TR1034 Analog*	V.34 Fax	32 ports	4 boards
LE01-B TR1034 BRI	V.34 fax	16 ports	4 boards
LE01-B TruFax® BRI	V.17 fax	16 ports	4 boards
LE02 TR1034 Analog/DID*	V.34 fax on ALS, V.17 fax on DID	16 ports	4 boards
LE02 TruFax® Analog*	V.17 fax	8 ports	4 boards
LE03 TR1034 Analog	V.34 Fax	16 ports	4 boards
LE03 TruFax® Analog	V.17 fax	8 ports	4 boards

HE01-H TR1034 1 T1/E1 or 1 Ethernet*	V.34 fax over T1/E1 or fax over IP	120 ports	4 boards
HE02 TR1034 1 T1/E1	V.34 fax over T1/E1	120 ports	4 boards

* Product no longer available for sale. Please refer to the Retired Product page on the Dialogic web site at http://www.dialogic.com/en/products/others/retired-products.aspx for information on the Software Support period for specific board models.

Intel System Performance Requirements

Max Number of Ports	Processor	Memory	Max Number of Boards
192	Pentium 4 2.4 GHz	512 MB	2
384	One or Two Xeon 2.0 GHz	1 GB	4

Regulatory Compliance

Please refer to the Product Declarations and Global Approvals section on the Dialogic website for the latest information: https://www.dialogic.com/others/declarations

Software Installation

To install and configure the developer software for the Dialogic® Brooktrout® Product Series on Windows platforms, please start with Chapter 1 – Quick Start in the *Dialogic® Brooktrout® Fax Products SDK Installation and Configuration Guide*. The Dialogic® Brooktrout® Product Series SDK includes all user documentation in the */Documents* directory.

For SR140 products, a license must be activated following the procedure listed in the *SR140 (Windows or Linux) Users Guide*. TR1034 products do not require license activation.

Usage Notes

SIP URI Considerations

SIP URI's must conform to RFC 2396-Uniform Resource Identifiers (URI) Generic Syntax. Any reserved character that is required to be passed to the remote device in a SIP URI must be escaped before forming the URI. An escaped octet is encoded as a character triplet, consisting of the percent character "%" followed by the two hexadecimal digits representing the octet code. For example, "%2C" is the escaped encoding for the US-ASCII comma character.

Interoperating in a network consisting of V.34 T.38 capable devices

If the equipment you are communicating with includes V.34 T.38 capable devices, and any other non-V.34 T.38 equipment can correctly negotiate the T.38 fax version, you can change the default settings to support V.34 as follows:

```
t38_fax_version = 3
t38_max_bit_rate = 33600
rtp_ced_enable=false
```

Applications using DID phone lines

When writing an application that collects DID digits, try to minimize the delay between the collection of the digits and when the application answers the call. If the call is not answered within 200 ms after the last DID digit, the CO (or PBX) may timeout and disconnect the call.

Systems with Intel 5500 Series or 5600 processors

Dialogic recommends disabling C-state support in the BIOS and/or OS of systems with Intel 5500 or 5600 processors; this may be referred to as CPU Power Saving Mode. This recommendation is due to Intel Errata AAK120 *Rapid Core C3/C6 Transition May Cause Unpredictable System Behavior* which affects all steps (C-0, C-1, D-0) of the 5500 Series processor and BD59 *Package C3/C6 Transitions When Memory 2x Refresh is Enabled May Result in a System Hang* affecting all steps (B-1) of the 5600 Series processors. In particular we experienced erratic timing behavior on Intel 5500 based systems during testing of Red Hat 6.0, which added support for the C6 Intel C-State.

Fax Pass-through (G711 RTP) Design Consideration

G711 RTP, particularly V.34 G711 RTP is more sensitive to network impairments than T.38. Please refer to Appendix A for a section on design considerations to help provide guidance to those deploying G711 RTP.

Known Issues and Limitations

This section lists the known issues/limitations on the product. These are classified in functional categories. The notation "*IPYnnnnn*" or "*BRKT-nnnn*" are used to reference a specific issue in Dialogic's change request tracking database.

Installation, packaging and configuration

- BRKT-223, IPY90652, IPY55491 – The Brooktrout system software may have dependencies on multiple versions of Windows system dll's (such as msvcrt80.dll) due to the use of pre-built libraries. Developer created install packages are expected to use the Microsoft side by side assembly feature of Windows to handle this. Installing the Brooktrout SDK or msi files will install the needed redistributable files automatically. Details on how to determine which re-distributable files are installed by the msi file can be found in the SDK Developer Guide. Developers may also use the Brooktrout merge modules to add the needed redistributable files to their own installers. Alternately, the needed Microsoft redistributable can be installed manually using this link: http://www.microsoft.com/downloads/details.aspx?familyid=766a6af7-ec73-40ff-b072-9112bab119c2&displaylang=en
- BRKT-224, IPY54089 - If an application built using the Bfv API library uses ACE, that ACE library's symbols may conflict with those of the ACE library embedded in the Bfv API. This can cause runtime problems.
- BRKT-128, IPY56463 – SR140 IPv6 with CUCM or Cisco router. If using IPv6 and CUCM or a Cisco Router be aware that Cisco does not support link-local IPv6 addresses.
- BRKT-226, IPY56106, IPY56192 – SR140 IPv6. If using IPv6, the local IPv6 address must be configured in the sip_ContactV6 parameter.
- BRKT-227, IPY56207 – SR140 Linux loopback. If using Linux and IPv6, in order to make a loop-back call use the IPv6 address instead of [::1]. If using Linux and IPv4, in order to call the address 127.0.0.1 you must not specify an address in the sip_Contact parameter.

Call Control

- BRKT-228, IPY53972 – If caller ID is enabled on FXS loop start lines, the "number of rings" parameter must be set to 2 or greater in order to detect the caller ID.
- BRKT-229, IPY54298 – On single-span digital TR1034 models, using R2 signaling, a MFR2 call might be dropped when all channels receive or originate calls simultaneously. The dropped calls will return with "Misc error: Channel not in connected state" errors.
- BRKT-231, IPY54142 - When using H.323, fast-start and no tunneling. With certain remote devices the connect message will not be sent when the remote end has disabled tunneling and is configured for fast-start. The symptom is inbound calls not sending the connect message to the remote end. The workaround is to enable tunneling on the remote end.
- BRKT-230, IPY57181- Cisco Cube will fail to re-invite the SR140 to T.38 when the SR140 is configured to support multiple audio codecs for G.711 when using SIP (Cisco bug id CSCsi10343). The workaround is to select only one of the audio codecs.
- BRKT-755 – ECC Verbose logging for processing an encoded certificate when using TLS will generate an error stating insufficient buffer for certificate. This is not an error and can be ignored.

Fax

- BRKT-233, IPY80657, IPY54862 – When receiving a V.34 fax using MMR compression over the wire, 1200x1200 resolution, and either A3 or B4 page width, an error can occur if the received fax data is stored on the host in MH compression. To prevent an error from this rare case, the data should be stored onto the host using either MR or MMR compression. Use the API function BfvFaxSetReceiveFmt to set the compression.
- BRKT-122, BRKT-118, IPY56054, IPY56116 – Cisco 2821 using V34 T38. When using V34 T38 on a Cisco 2821, received faxes may fail returning various hangup codes. The greater the number of simultaneous channels using T38 V34 on the 2821, and the more complex the image, the higher the failure rate. Cisco TAC 617057035.

- BRKT-131, IPY56586 - Cisco 2901 using V34 T38. Sent or received faxes may fail returning various hangup codes. This is due to a variety of issues including; all calls to non-V34 fax devices failing, in V17 mode all faxes would be limited to 9600bps and ECM mode disabled. Cisco TAC 6107057091, 617057073 and 615450733. Cisco reports these TACs are resolved with IOS 15.2.2T, this has not yet been verified by Dialogic.
- BRKT-126, BRKT-516, IPY56389 - V.34 G711 fax pass-through is very sensitive to VM timing inaccuracies, causing various fax failures which increase with high loads. We are actively researching solutions to better address this.
- BRKT-156, IPY56980 –SR140 V.17 G.711 fax pass through when using Windows on VMware has excessive PPRs. Due to the timing inaccuracies, an excessive number of PPRs were experienced, although fax completion rates were acceptable.
- BRKT-234, IPY57260 - Due to improper free memory space calculations done by the driver, under certain uncommon timing conditions depending on the pattern of data being transferred and the speed of the system, data may be dropped. This has been seen as a HNG_INTERRUPT_OVERRUN error under T.38 Internet Aware Fax.

Miscellaneous

- BRKT-232, IPY54004 – Calls may terminate on DID lines if sample application debug information is sent to the screen. Debug output sent to the screen delays the time the application answers the incoming call after DID digits are detected. Some DID lines will hang up if this delay exceeds 200ms. Pipe the debug output to a file to avoid this situation.

Deprecated functionality

This section lists functionality which is supported in this release, but is not recommended for new designs because it will not be supported in a future release. For a list of currently unsupported functionality, please refer to the Brooktrout Bfv APIs Reference Manual.

Appendix A - Fax Pass-through (G711 RTP) Network Design Considerations

In spite of being similar in nature, voice and fax pass-through calls are affected differently by IP network impairments. Because fax pass-through calls' data cannot be altered during its transport, these calls are more susceptible to IP problems than voice calls. Voice calls may experience some degradation from certain network impairments, and the parties involved on the call might not even realize the degradation is occurring. In addition, there are mechanisms in place for most compressed audio codecs such as predictive algorithms and packet loss concealment techniques that can assist in masking many network problems. These techniques, however, do not protect fax pass-through transmissions.

Pass-through and T.38 fax calls may also respond differently to certain IP network impairments. The following table lists specific impairments and descriptions of how each one may impact T.38 and pass-through calls.

Impairment	Definition	Description
Packet Loss	A relative measure of the number of packets that were not received compared to the total number of packets transmitted.	Fax pass-through calls are very sensitive to packet loss, especially when carrying high-speed modem modulations. Lab testing shows that as little as 0.02 percent packet loss can cause pass-through calls to fail. T.38 fax calls may use the protocol's redundancy mechanism to handle substantially more packet loss than pass-through. It has been shown that T.38 calls can succeed with up to 10 percent random packet loss.
Delay	The finite amount of time it takes a packet to reach the receiving endpoint after being transmitted from the sending endpoint.	The recommendation for voice is to keep the one-way latency (mouth-to-ear) to less than 150 ms. In the case of fax pass-through and T.38 calls, delay is not typically as much of an issue as it can be for voice.
Jitter	The delay variation between packets or the difference in the end-to-end delay between packets.	Average one-way jitter of less than 30 ms is the recommendation to ensure voice QoS. With T.38 and fax pass-through, average jitter less than 30 ms is not quite as critical.
Clock Skew	The running sum of the differences between when packets actually arrive at a destination and when they were expected.	Synchronization issues between a voice gateway and an IP endpoint are more critical for fax pass-through than for T.38 and voice. When using the pass-through transport method for long fax calls, there can be issues because of the lack of clock synchronization between the DSPs on the voice gateway and an IP endpoint. The gateway and endpoint use different clocks therefore, a clocking discrepancy, ever so slight in some cases, will always exist between the rates that packets are generated and consumed. This slight clocking discrepancy can cause playout buffer underrun/overrun on the voice gateway, which can result in bad image lines or PPRs in Error Correction Mode (ECM).

It should also be noted that Voice Activity Detection (VAD) and silence suppression should be disabled for fax pass-through calls on gateways that do not already perform this action upon detection of fax signals. This is needed in order to avoid fax signal clipping that can be caused by VAD algorithms that are used to suppress silence in voice calls.