Fax & Modem Transport Modes

Fax/Modem Settings

Users may choose to use one of the following transport methods for fax and for each modem type (V.22/V.23/Bell/V.32/V.34):
   o   Fax relay demodulation / modulation
   o   Bypass using a high bit rate coder to pass the signal
   o   Transparent passing the signal in the current voice coder

When the fax relay mode is enabled, distinction between fax and modem is not immediately possible at the beginning of a session. The channel is therefore in 'Answer Tone' mode until a distinction is determined. The packets being sent to the network at this stage are T.38-complaint fax relay packets.

Configuring Fax Relay Mode

When FaxTransportMode = 1 (relay mode), on detection of fax the channel automatically switches from the current voice coder to answer tone mode, and then to T.38-compliant fax relay mode. When fax transmission ends, the reverse switching from fax relay to voice is performed. This mode switching automatically occurs at both the local and remote endpoints. Users can limit the fax rate using the FaxRelayMaxRate parameter and can enable/disable ECM fax mode using the FaxRelayECMEnable parameter. When using T.38 mode, the user can define a redundancy feature to improve fax transmission over congested IP network. This feature is activated by 'FaxRelayRedundancyDepth' and 'EnhancedFaxRelayRedundancyDepth' parameters. Although this is a proprietary redundancy scheme, it should not create problems when working with other T.38 decoders.
Note: T.38 mode currently supports only the T.38 UDP syntax.

Configuring Fax/Modem Bypass Mode

When VxxTransportType= 2 (FaxModemBypass), Vxx can be one of the V32/V22/Bell/V34/Fax, then on detection of fax/modem, the channel automatically switches from the current voice coder to a high bit-rate coder, as defined by the user via the FaxModemBypassCoderType configuration parameter. During the bypass period, the coder uses the packing factor (by which a number of basic coder frames are combined together in the outgoing WAN packet) set by the user in the FaxModemBypassM configuration parameter. The network packets generated and received during the bypass period are regular voice RTP packets (per the selected bypass coder) but with a different RTP Payload type. When fax/modem transmission ends, the reverse switching from bypass coder to regular voice coder, is carried out.

Supporting V.34 Faxes

V.34 faxes don't comply with the T.38 relay standard.

Note that the CNG detector is disabled (CNGDetectorMode=0) in all the following examples.

Using Bypass Mechanism for V.34 Fax Transmission

In this proprietary scenario, the media gateway uses a high bit-rate coder to transmit V.34 faxes, enabling the full utilization of its speed.

Refer to the following configurations:
```
FaxTransportMode = 2 (Bypass)
V34ModemTransportType = 2 (Modem bypass)
V32ModemTransportType = 2
V23ModemTransportType = 2
V22ModemTransportType = 2
```

In this configuration, both T.30 and V.34 faxes work in Bypass mode.

Or
```
FaxTransportMode = 1 (Relay)
V34ModemTransportType = 2 (Modem bypass)
V32ModemTransportType = 2
V23ModemTransportType = 2
V22ModemTransportType = 2
```

In this configuration, T.30 fax uses T.38 Relay mode while V.34 fax uses Bypass mode.

Using Relay mode for both T.30 and V.34 faxes

In this scenario, V.34 fax machines are compelled to use their backward compatibility with T.30 faxes; as a T.30 machine, the V.34 fax can use T.38 Relay mode.

Refer to the following configuration:
```
FaxTransportMode = 1 (Relay)
V34ModemTransportType = 0 (Transparent)
V32ModemTransportType = 0
V23ModemTransportType = 0
V22ModemTransportType = 0
```

Both T.30 and V.34 faxes use T.38 Relay mode. This configuration forces the V.34 fax machine to operate in the slower T.30 mode.

Configuration Grid (v.4.6 or later)		Fax Signaling Method [IsFaxUsed]			
		No Fax [0] (No protocol signaling)	T.38 [1]	G.711 [2]	Fallback [3]
Fax Transport Modes [FaxTransportMode]	Disable [0]	Transport fax as if voice, no adaptations. Must use G.711 or G.726 for voice, and Silence Suppression off (SCE=0) for this to work. If GW receives INVITE with T.38, it will reject the call by sending 415 media unsupported response Also, if the GW receives REINVITE with G711, with gpmd parameters in SDP, it will reject this REINVITE with 415 response	Standard SIP/H.323 T.38 procedure. Terminating Gateway, on detection of T.30 fax tones, will negotiate T.38 and relay the fax. If far-end party doesn't support T38, the fax will fail. FaxTransportMode setting is irrelevant VxxTransportType should be set to 0 (transparent) to force all fax machines (incl. V34 fax) to use T.38 relay. VxxTransportType should be set to 2 (bypass), to enable V.34 faxes and modems to use Bypass mode. EnableNSE=1, can be used to comply with Cisco Bypass mode.	If terminating GW detects fax or modem, it will send re-INVITE to the originator with G.711, with adaptations. In SDP it will include also gpmd parameter: For G711,A-law: 'a=gpmd:0 vbd=yes;ecan=on (or off, for modems)'. ForG711 µ-law : 'a=gpmd:8 vbd=yes;ecan=on (or off for modems)'. FaxTransportMode, and VxxModemTransportType settings are irrelevant. All will be set automatically to "transparent with events".	If terminating GW detects fax tone signal, it will re-INVITE the originator first with T.38, and if it fails, then with G.711; with adaptations, and with gpmd parameters in SDP FaxTransportMode setting is irrelevant. VxxTransportType should be set to 0 (transparent) to force all fax machines (incl. V34 fax) to use T.38 relay. VxxTransportType should be set to 2 (bypass), to enable V.34 faxes and modems to use Bypass mode. EnableNSE=1, can be used to comply with Cisco Bypass mode.
	T.38 [1]	On fax tones detection, the GW will auto-switch and start sending T.38 packets. This mode is best used between two AudioCodes GWs.			
	Bypass [2]	Proprietary method. Uses the bypass codec when fax is detected, tagged with special RTP payload identifier, with adaptations. Cisco Bypass NSE mode can also be used. Bypass mode is required for V.34 faxes.			
	Events [3]	Use G.711, and apply the adaptations when/if fax is detected. Same as [0] – Disable mode, except with the adaptations.			

Notes:

o   The Fax Signaling Methods in the table above are mostly related to SIP. In H.323, only [0] and [1] can be used.

o   "Adaptations" refer to automatic reconfiguration of certain DSP features to treat fax/modem streams differently than voice, such as turning off the silence suppression, enabling echo cancellation for fax, and disabling for modem, and certain jitter buffering optimizations.

o   The settings for modems are the same as the fax settings above except V.34, which cannot be transmitted with T.38. Modems or faxes that use V.34 (33.6kbps) are supported only in bypass mode; or can be forced to "train-down" to T.30 by setting FaxTransportMode = 1 and VxxModemTransportType = 0.

o   In SIP, a non-zero value of Fax Signaling Method parameter (IsFaxUsed) overrides the FaxTransportMode parameter. For example if IsFaxUsed=1 (T38), the SIP/H323 gateway opens the channel in T.38 mode, without being effected by FaxTransportMode parameter. Only if IsFaxUsed=0, the FaxTransportMode parameter is taken into account.

The exception to this behavior is with H323 GW. If IsFaxUsed=1, and if during H.323 capability negotiation (at call start) the GW founds that the other party doesn't support T.38, the channel is opened according to FaxTransportMode (Transparent or Bypass). In Transparent Mode the codec is left unchanged, therefore only if G711 was selected first the fax will succeed. Note that we assume here that both FaxTransportMode and VxxModemTransport Type parameters are set to same value: 0 or 2 (Transparent or bypass). In Bypass mode it is possible to use also Cisco NSE mode. If Fax and VxxModem are not set to the same value the programmed logic forces it to the same value, according to V34ModemTransportType =0 (transparent) or 2(bypass).

In SIP this behavior is different because there is no T.38 capability negotiation at call start. In SIP the answering party (if it supports T.38) sends REINVITE with T.38, and it is the first time that the originating party knows about T.38 capability of the answering party (starting from ver 5.0 we will support V.152, which will address this issue).

o   If the terminating GW sends REINVITE with T.38 and receives back 415 Media Not Supported, then the originating GW will terminate the call by sending BYE.

o   In addition to FAX parameters (IsFaxUsed and FaxTransportMode) also VxxModemTransportMode parameter effects transport of faxes and modems. All VxxModemTransportType values should be same: 0=transparent or 2=bypass. For example if IsFaxUsed=1, and VxxModemTransportType=0, the V.34 fax machine will be forced to work as T.30 fax, and T.38 will be used. Otherwise, if IsFaxUsed=1 and VxxModemTransportType=2, V34 faxes and modems will use Bypass mode (Audiocodes proprietary or Cisco NSE bypass modes).

o   When IsFaxUsed=2, the FaxTransportMode and VxxModemTransportType parameters will be automatically set to transparent with events.

o   The best way for Fax transport is to configure the SIP GW with IsFaxUsed=3. The gateway will try T.38, and if it fails, it'll switch to transparent mode.

o   There is an additional parameter CNGDetectorMode=2 that enables originating GW to detect the CNG tone and initiate REINVITE with T.38. This parameter should be used only if terminating GW is some other 3rd party GW that doesn't support detecting of answering fax tone. This parameter should be used with IsFaxUsed=1, 2 or 3.