

**INTERCOPE**



## Fax over IP

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## **About this document**

This document describes how Fax over IP works in general and how it is implemented in MessagePlus/Open. It is intended to be read by system administrators, systems architects and engineers considering, planning or implementing a Voice over IP infrastructure. More detailed information on specific topics can be obtained by contacting Intercope through any of the addresses on the final page of the document.

## **Fax continues to be an important method of business communications**

## **Inclination for Fax over IP**

## **Technical setup, protocols and MPO implementation**

### **Introduction**

Despite the rise of email and the Internet, fax continues to be an important method of business communications. The legal acceptance and the real-time characteristics of fax transmission, and therefore the inherent difficulty of compromising fax messages, are key components in its acceptability as a reliable and trusted method of communication.

Recently, as businesses have started to migrate their voice traffic to IP (VoIP) networks, there has also been a natural inclination to want to migrate their fax traffic to IP (FoIP) as well.

The remainder of this document describes the technical setup of FoIP, discusses the two major protocols used for FoIP and the FoIP implementation with MessagePlus/Open, the enterprise messaging solution of INTERCOPE.

## Converging voice and data networks

## Integrating fax into IP networks

### Why Fax over IP?

Today, most companies use conventional telephone networks (Public Switched Telephone Networks, or PSTN) and IP networks. Typically, telephone networks are dedicated to voice and fax communication, while IP networks are dedicated to data transfer such as file transfer, Web access, email etc.

By implementing VoIP, the two networks can converge and companies benefit in many ways from having a single IP network providing voice and data services. In this scenario FoIP has an enormous potential to reduce communication costs, particularly in large organizations. Integrating fax servers with the IP network enables companies to simplify network management and to significantly reduce maintenance costs. The major benefits include:

- With FoIP faxes remain digital end-to-end over IP networks, until they reach the PSTN endpoint gateway closest to the destination. This way, fax-related long distance costs are reduced to virtually zero. Internal faxes can be routed between branch offices without incurring any long distance call charges
- FoIP enables organizations that have already made investments in VoIP networks to break free from legacy PBX telephony, specialized hardware and the leased lines that traditional fax servers still require.
- Reduction of network management and maintenance costs with a single converged IP based fax, voice and data network.
- FoIP scales with your VoIP system to ensure easy upgrade paths that adjust to changing business needs, with no need for additional fax boards, lines and servers.
- FoIP provides centralized administration and management capabilities, as well as a single point of configuration for the IP telephony network.

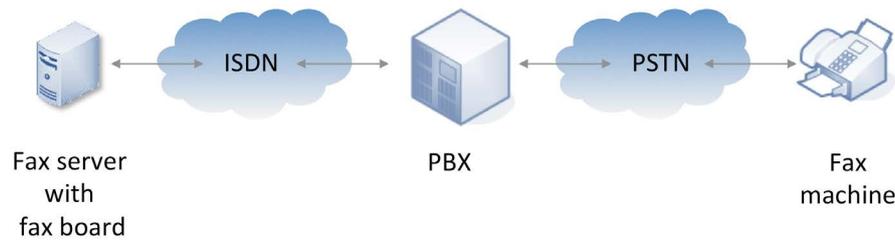
## How Real-time Fax over IP works

Let's look at a traditional PSTN based T.30-only fax transmission. Sending a fax this way requires three fax components:

- A T.30 protocol engine. While T.30 is a mature technology, an effective T.30 implementation is complex due in a large part to the challenge of connecting with the installed base of 200 million fax machines whose own compliance to the standard varies considerably.
- An image conversion engine. The sending device must adapt (scale and/or transcode) the image to meet the capabilities of the receiver. The receiver must check the received file for errors and try to correct ones that occur.
- A modem to transmit and receive the protocol and image data across the PSTN network.

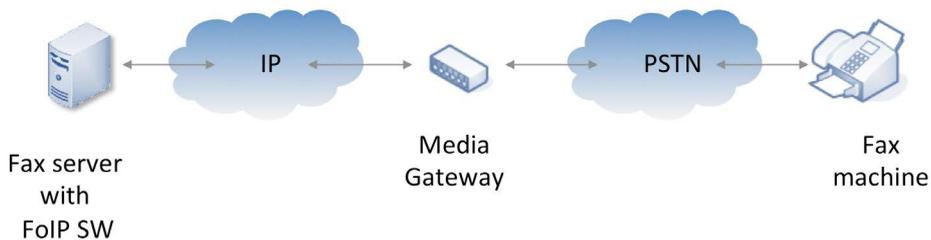
With telephony based fax transmissions a fax server connects through fax boards either to the company's Private Branch Exchange (PBX) or directly to the Public Switched Telephone Network (PSTN):

### Traditional PSTN based T.30-only fax transmission



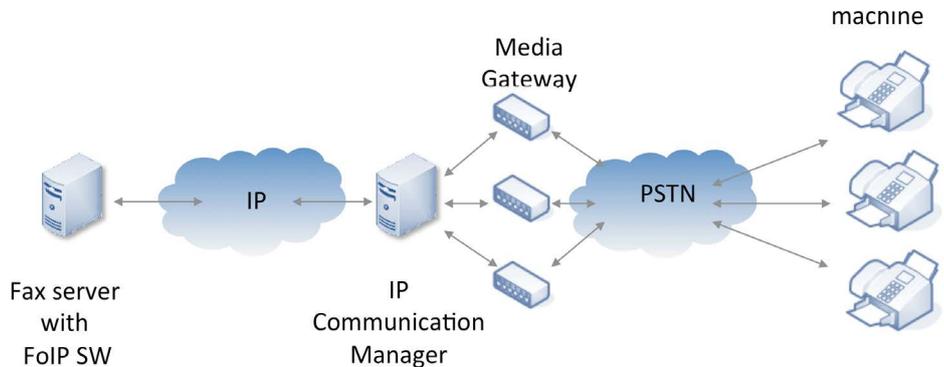
The functionality of these elements is still required in IP environments. When the remote fax machine is still connected to the PSTN there are two types of devices used for the implementation, an IP endpoint which is typically a fax server and a media gateway. Here's how they fit in a basic IP fax scenario:

### Fax transmission over IP



Instead of connecting directly to a specific media gateway in practice typically a communication manager is used (like a traditional PBX in the phone network) to connect the fax server to various media gateways for different calls:

## Fax over IP with Communication Manager



## How real-time fax over IP works

For outgoing faxes typically a fax server (the IP endpoint) transfers the fax to a media gateway. The receiving media gateway, in turn, transform the data into traditional PSTN signals and then sends them to the receiving fax machine using standard modem modulation. The receiving fax machine has a T.30 protocol engine that communicates with the T.30 protocol engine in the fax server through the gateway.

## Management of incoming calls

For faxes originating from a remote fax machine, the sending fax machine sends a fax via the PSTN to a media gateway. The media gateway transforms the fax to IP packets and sends those to the fax server (IP endpoint).

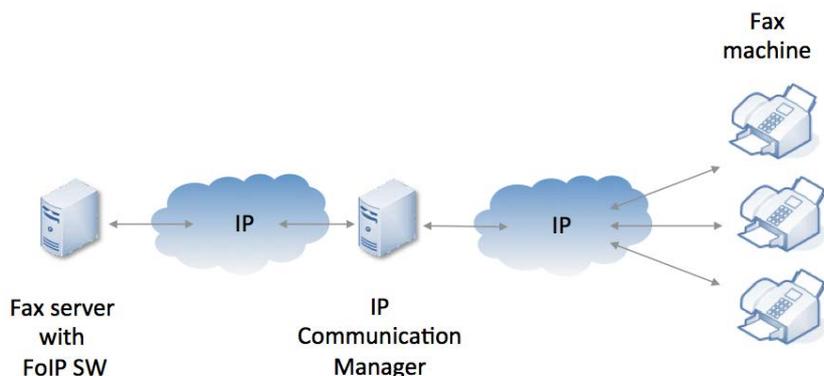
## IP call control

In all cases the calls must be established first using an IP call control protocol such as the Session Initiation Protocol (SIP) or H.323. The call control protocol is responsible for the initial call set-up and tear-down.

## Carrier network with VoIP and FoIP

In the near future carriers will also transfer voice and faxes exclusively via IP. In this case a media gateway is no more required, but voice and faxes are sent via IP directly from the corporate network to the carrier network. The receiving fax device will either directly support FoIP or the data will be bridged to ISDN or analogue signals by a gateway or router.

## Fax over IP with without bridge to PSTN



## Two major protocols

There are two major protocols to implement FoIP which can have significant implications for the quality of service which can be achieved when faxes are transmitted / received via an IP network:

### G.711 - fax pass through

- G.711 (fax-pass-through)  
A protocol where the T.30 fax call is carried in a VoIP call encoded audio format

### T.38 - fax relays

- T.38 (fax relay)  
A protocol which has been specifically designed to transport fax data via an IP network without being converted to an audio stream.

### G.711 - Reliability heavily dependent on the network load

G.711 has not been optimized to transport fax over IP networks, needs a high bandwidth and is very error prone when IP packets are lost due to network congestions and to timing constraints. As a result the reliability of fax over IP via G.711 is heavily dependent on the bandwidth and quality of the network deployed and very inconsistent depending on the network load. Due to timing constraints it may also be necessary to install the FoIP interface on physical machines instead of virtualized environments.

### Much better results with T.38 under non optimal network conditions

T.38 provides much better results under non optimal network conditions. The protocol needs significant less bandwidth for a fax transmission and supports packet redundancy to mitigate the effects of packet loss. T.38 uses a variety of techniques to keep the fax communication reliable from failing when even significant delay, jitter, and packet-loss occur.

G.711 can deliver acceptable results in optimal network conditions. However in most cases this cannot be guaranteed. T.38 in contrast is much more resistant against network congestions and timing constraints.

**MessagePlus/Open supports G.711 and T.38. However INTERCOPE strongly recommends to use T.38 to avoid severe problems with a high rate of transmission and reception abortions.**

### More detailed technical information

A detailed technical discussion of G.711 and T.38 can be found in the White Paper "**Considerations for Using T.38 versus G.711 for Fax over IP**" from Dialogic.

## No fax boards required

### Implementation with MessagePlus/Open

In MessagePlus/Open, real-time Fax over IP is implemented by exploiting the Dialogic SR140 API. This API is a pure software based solution. No fax boards are required, only an Ethernet connection from the server running the MPO fax line class to the IP network through which fax calls are to be routed. This allows implementing a complete MessagePlus/Open system in virtualized environments such as VMware eliminating the need for a physical machine hosting fax boards.

## A mature implementation of all relevant protocols

The SR140 API provides a mature implementation of the standards recommended by the Internet Engineering Task Force (IETF) such as the Session Initiation Protocol (SIP) (RFC 3261), the Session Description Protocol (SDP) (RFC 2327), H.323, MGCP (Media-Gateway-Control-Protocol) and the standards of the International Telecommunication Union (ITU) such as T.38, G.711, and T.30.

## Compatible with all major VoIP suppliers

Based on this technology, MessagePlus/Open is compatible with any T.38 – T.30 gateway that meets these standards, in particular with

- CISCO Unified Communication Manager and Gateway Series
- Avaya Communication Manager and Media Gateway Series
- Nortel Communication Server
- Alcatel OmniPCX
- Siemens HiPath

A detailed list of IP PBXs, Gateways, SIP Trunking interfaces, and other devices which have been tested for Interoperability can be found [here](#).

## No effect for integrated applications

It should be noted that a migration to Fax over IP has no effect on all the other components that may be integrated with MessagePlus/Open no matter whether physical fax boards are used or a purely software-based solution is deployed. In one logical MessagePlus/Open system, physical and virtual fax boards can be used in combination with fax channel modules on different computers, or even on the same computer.

## An ideal solution to migrate fax to VoIP infrastructure

### Summary

MessagePlus/Open includes a mature, reliable and powerful implementation of Fax over IP. As this is a pure software solution there is no need for fax boards reducing cost and allowing the implementation of the complete system in virtualized environments. The solution has been tested for interoperability with equipment from all the major VoIP suppliers.

For companies migrating their voice traffic to IP MessagePlus/Open offers the ideal solution for seamlessly integrating fax functionality into this new infrastructure.

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Fax over IP  
V2.0

