

The Internet-Ready Paper-Based Communications Solution

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Abstract

A new set of proposed standards has been developed for integration of facsimile transmission and the Internet, and products based on these standards are now available. An Internet fax unit sends a TIFF file as an e-mail attachment to another Internet fax or a PC with an e-mail address. On receipt of such an E-mail, an Internet fax prints out the image data as a legacy fax machine does. The image data received by a PC can be displayed with a TIFF viewer, realizing paper-less fax communications.

A second-generation Internet fax will add color image transmission/reception capability and accept photo images directly from digital cameras. It has a new mode of operation in which it does not send a TIFF file as an e-mail attachment. Instead, the scanned image is sent to and stored in a predetermined WWW server, and the Internet fax unit just sends an e-mail to notify the recipient of the URL of the image.

Introduction

From one point of view, a fax can be described as a means of remote printing across a PSTN network. Moreover, a fax machine functions as a stand-alone unit which enables hardcopy images to be sent and received without demanding any special knowledge of computers on the part of the user.

As modem technology has evolved, the speed of data transfer across PSTN networks has increased from that specified in the V.34 standard to that dictated by the V.90 standard. However, data transfer across Internet networks directly connected to a LAN can take place at much higher rates.

Internet fax transmission is achieved by using the Internet in place of the PSTN network. It retains the convenient operating features of the fax while offering a total image data communications solution boasting an excellent affinity with the computer environment.

What is an Internet Fax?

The Internet fax is a device which compresses scanned image data into TIFF files, attaches them to an e-mail and sends them to another Internet fax or personal computer with an e-mail account. This is achieved by enabling the fax

to handle the existing Internet TCP/IP and SMTP protocols, as well as the MIME protocol.

The image data received by the personal computer can even function as a paper-less fax by displaying it using a TIFF viewer. In environments involving in-company communications consisting of such elements as groupware, e-mail and Intranets, the Internet Fax can serve as a useful bridge.

The mailing addresses of the transmission destinations are typed in from the Internet fax machine. Frequently used addresses may be abbreviated and registered in advance. If they are pre-registered in the form of a mailing list on the mail server, a multi-destination broadcast function can be achieved. The number of multi-destination addresses which can be registered is unlimited as it is not dependent on the Internet fax itself.

Image data received can be stored in the Internet fax before being forwarded to a PSTN fax machine defined by the telephone number included in the email address. In other words, the Internet fax also functions as a gateway to the PSTN network. In terms of long-distance fax communications, this means that communication costs can be reduced by using the Internet for long distance transfer of data to a receiving Internet fax while incurring only local call charges for onward transmission to the destination PSTN fax.

Outline to Standardization of Internet Faxes

In March 1998, work on standardizing the Internet fax took another step forward when five requests for comment (RFCs) were registered as proposed standards by the Internet Engineering Task Force (IETF). A "proposed standard" actually represents a situation where the stipulations of the proposed standard are to be incorporated into products and products are to be operated in accordance with the standard. In reality, it is a de-facto standard.

In the process of standardization, particular consideration was given to compatibility with existing fax networks.

The first aspect of this compatibility concerns the image format. The TIFF[1] image data format is already an ITU-T recommendation for both black-and-white and color facsimiles. This file format specification is commonly known as TIFF-FX. It formally defines minimal, extended and lossless JBIG modes (Profiles S, F, J) for black-and-

white fax, and base JPEG, lossless JBIG and Mixed Raster Content modes (Profiles C, L, M) for color and grayscale fax. Profile S, the minimal mode, is based on Modified Huffman (MH) compression, which are defined in ITU-T Rec. T.4.[2] Profile F specifies Modified Read (MR) and Modified Modified Read (MMR) compressions, which are defined in ITU-T Rec. T.4 and T.6.[3]

If compatibility with fax networks is taken into account, it was very natural and important for these file formats or profiles to be adopted. As a result, files formatted according to this specification use the image/tiff MIME Content Type. The above contents were mentioned in RFC2301[12].

The image/tiff MIME sub-type registration were originally mentioned in RFC1528[4] but then additional descriptions were given as RFC2302[13] for the Internet fax.

The second aspect of the compatibility concerns the method by which telephone numbers are mapped to e-mail addresses. In order for the Internet fax to function as a gateway device for PSTN fax machines, the telephone number attributes must be provided in the e-mail address to specify the transmission destinations. RFC2303[14] makes mention of the "minimal PSTN address format in Internet Mail." This document describes a simple method for encoding the PSTN addresses in the local-part of an Internet e-mail address, along with an extension mechanism to allow encoding of additional standard attributes needed for email gateways to PSTN-based services.

RFC2304[15] further describes a simple method for encoding the PSTN addresses, which indicate that a fax machine is connected, in the local-part of an Internet e-mail address. By incorporating what is described in these two RFCs, the Internet fax can function as a gateway device to PSTN networks and create a seamless connection between an Internet and a PSTN network.

In reference to the four RFCs mentioned above, RFC2305[16] describes the configuration of the basic mechanism for facsimiles using Internet mail as "a simple mode of facsimile using Internet Mail."

The current specification employs standard protocols and file formats such as TCP/IP, Internet mail protocols [5,6,7], MIME[8,9,10], and TIFF for Facsimile[11,12,13]. It can send images not only to other Internet-aware facsimile devices but also to Internet-native systems, such as PCs with common email readers which can handle MIME mail and TIFF for Facsimile data. The specification facilitates communication among existing facsimile devices, Internet mail agents, and the gateways which connect them.

In this simple mode, only black-and-white image data are handled and the only requirement concerning the image file format is the use of TIFF (profile S) for facsimiles so that implementation in fax machines is facilitated.

In terms of the operating status, what has been defined is that which can be implemented immediately. A number of companies have started to incorporate the features of this RFC into their products.

As far as Matsushita Graphic Communication Systems is concerned, we have already developed Internet fax machines which incorporate the provisions of RFC2305 and have launched them onto the market.

Fig. 1 shows one such Internet fax machine.



Figure 1. Conformed proposed standards Internet Fax Panasonic UF-770

Problems Encountered in Current Internet Faxes

Security Issues

A method involving S/MIME or something similar to provide e-mail itself with security functions is one possible means of addressing security concerns. These problems are not limited to Internet fax alone but concern all applications which make use of the Internet. Many and varied encoding techniques have been discussed and developed as solutions. These problems will no doubt be solved one day through the adoption of one technique or other.

Capability Exchanges, Delivery Checks

With existing PSTN fax machines, communication was performed by exchanging details of the capabilities of the transmitting and receiving facsimile at the commencement of transmission and by adopting the best system for maintaining compatibility at both the sending and receiving ends. Further, upon completion of the transmission, every process up to the verification as to whether the data was received properly was defined as a series of fax transmission protocols.

The simple Internet fax transmission mode described in RFC2305 intentionally refrained from addressing issues concerned with capability details exchange and delivery confirmation. This was done in order to give an initial boost to the Internet fax community.

However, capability detail exchange and delivery confirmation systems are now being discussed by the IETF.

Second-Generation Internet Fax Proposed by MGCS

The transmission of color images using the Internet fax can be achieved by incorporating the standards stipulated in RFC2301 through RFC2305 whose standardization has been pushed forward. However, a different standard specially devoted to color images has been advanced by MGCS as a matter for second-generation Internet facsimiles.

Problems with Current Standards

When larger and larger volumes of data are involved as with color images and when the data is bundled with e-mail, a low-speed communications route will be significantly stressed at times when a dial-up connection is attempted from a location outside the office. Furthermore, the mail distribution system is subject to excessively high loads if color images are bundled and launched from a mailing list. The issue of compatibility between the Internet fax and existing PSTN network fax machines has been considered very carefully but the fact remains that hardly any color fax machines are actually connected to PSTN networks. Applying existing standards and configuring models which completely incorporate these standards in spite of this fact is absurd.

Solutions for Color Image Data in the Internet Environment

Images provided on World Wide Web (WWW) sites are the most typical color images handled in an Internet environment. In short, we believe that pursuing compatibility with the WWW is a more realistic option and one which will accelerate the use of color images.

In the light of the reasons given above, MGCS has developed a system which turns web sites into locations where images are stored and relayed and which can be set to enable or disable images to be received according to the convenience of the receiver for the second-generation Internet fax. It proposes that this system serve as the color image Internet fax standard.

Fig. 2 shows the transmission sequence for the second-generation Internet fax machines proposed by MGCS.

This sequence will now be described in detail. The scanned data is compressed using the JPEG or some other data format, and uploaded using FTP to the prescribed web server. Next, the e-mail address of the transmission destination is input, and an e-mail is sent by SMTP. No images are bundled with this e-mail which is used to transmit information on the locations of the images. When the receiver receives the e-mail, he or she knows that there is a request from the sender to transmit color images. Based on the information in the e-mail, the receiver goes to the web server mentioned above to fetch the images using HTTP[17]. When the fetched image data is printed out automatically, the whole series of operations is akin to the functions of a fax machine.

If a personal computer is connected at the transmission destination, the functions associated with an Internet fax are provided by using a general-purpose mailer program to receive the e-mail and using a general-purpose web browser to peruse the images.

If the system that is proposed by us is used, Internet fax machines will function not only as fax machines but also as devices which will upload hand-drawn images (paper-based image data) to web sites in accordance with the procedure for transmitting faxes. This enables the provision of an environment in which web pages can be created without the need for any knowledge of computers. It will also be

possible to connect a digital still camera directly, introduce the image data from the camera, send it and attach it to web pages.

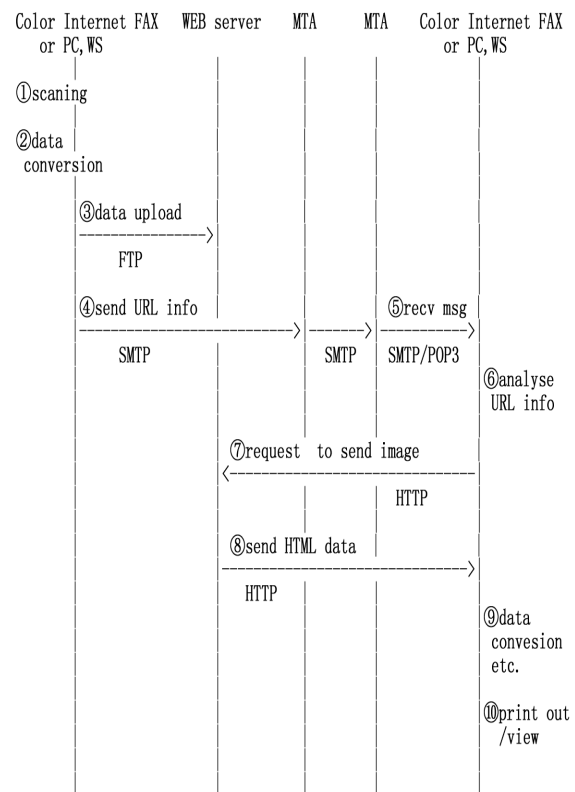


Figure 2. A sequence of transaction on second-generation Internet FAX

The new mode of operation has the potential to create a new cultural form which has never existed in the past.

Fig. 3 shows a prototype of the second-generation Internet fax machine which was developed by MGCS. The operation panel dispenses with buttons and consists of a liquid-crystal display and touch panel. Since the image data received can be shown on the LCD display, there is no need to print out the images unless so desired.



Figure 3. A second-generation Internet FAX

Concluding Remarks

Needless to say, it is important for Internet fax machines to be compatible with the existing PSTN fax machines connected to PSTN networks. However, it is even more important to consider their harmonization with the mechanisms already used widely in the Internet environment. If the functions provided for an Internet fax machine are used by a personal computer or work station already connected to the Internet environment, the community will probably undergo a steady expansion. This means that the trend to paper-less forms of communication will be taken to the next new phase.

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Biography

Yoshihiro Ida received his B.E. in Mechanical Engineering from Meiji University and joined Matsushita Graphic Communication Systems, Inc. in 1984. He was engaged in the development of optical disk filing systems. He has been in Networking Product Development Center since 1996 and is in charge of Color Internet Fax now. His current interests include networking protocols. He is a member of WIDE Project.

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