Network Working Group
Request for Comments: 4142
Category: Standards Track

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November 2005

Full-mode Fax Profile for Internet Mail (FFPIM)

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Abstract

Classic facsimile document exchange represents both a set of technical specifications and a class of service. Previous work has replicated some of that service class as a profile within Internet mail. The current specification defines "full mode" carriage of facsimile data over the Internet, building upon that previous work and adding the remaining functionality necessary for achieving reliability and capability negotiation for Internet mail, on a par with classic T.30 facsimile. These additional features are designed to provide the highest level of interoperability with the standards-compliant email infrastructure and mail user agents, while providing a level of service that approximates what is currently enjoyed by fax users.

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1. Introduction

This specification defines "full mode" carriage of facsimile data over the Internet, building upon previous work in A Simple Mode of Facsimile Using Internet Mail [RFC3965] and Extended Facsimile Using Internet Mail [RFC2532]. This specification also adds the remaining functionality necessary to achieve reliable and capable negotiation for Internet mail, on par with classic [T30] facsimile. These additional features are designed to provide the highest level of interoperability with the standards-compliant email infrastructure and mail user agents, while providing a level of service that closely approximates the level of service currently enjoyed by fax users.

Basic terminology is discussed in [RFC2542]. Implementations that conform to this specification MUST also conform to [RFC3965] and [RFC2532].

The new features are designed to be interoperable with the existing base of mail transfer agents (MTAs) and mail user agents (MUAs), and to take advantage of existing standards for optional functionality (e.g., positive delivery confirmation and disposition notification). Enhancements described in this document utilize the existing Internet email messaging infrastructure, where possible, instead of creating fax-specific features that are unlikely to be implemented in non-fax messaging software.

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

2. Content Negotiation

Classic facsimile service is interactive, such that a sending station can discover the capabilities of the receiving station, prior to sending a facsimile of a document. This permits the sender to transmit the best quality of facsimile supported by both the sending station and the receiving station. Internet mail is store-and-forward, with potentially long latency, such that before-the-fact negotiation is problematic.

Use of a negotiation mechanism permits senders to transfer a richer document form than is permitted when using the safer-but-universal default form. Without this mechanism, the sender of a document cannot be certain that the receiving station will be able to support the form.

The capabilities that can be negotiated by an FFPIM participant are specified in [RFC2534] and [RFC2879]. Implementations that are conformant to FFPIM MUST support content negotiation as described there.

2.1. UA-based Content Negotiation

One method for exchanging the capabilities information uses a post-hoc technique, which permits an originator to send the best version known to be supported by the recipient, and to also send a better suited version if the recipient requests it. This mechanism is specified in [RFC3297]. FFPIM implementations MUST support this mechanism.

2.2. ESMTP-based Content Negotiation

Another method uses an ESMTP option specified in [RFC4141]. It requires support for content negotiation along the entire path the email travels. Using this mechanism, receiving ESMTP servers are able to report capabilities of the addresses (mailboxes) they support, and sending email clients are able to signal both permission and constraints on conversions.

FFPIM participants MAY support this mechanism.

NOTE: This specification provides for content conversion by unspecified intermediaries. Use of this mechanism carries significant risk. Although intermediaries always have the ability to perform damaging transformations, use of this specification could result in more exploitation of that potential and, therefore, more misbehavior. Use of intermediaries is discussed in [RFC3238].

2.3. Interactions between UA and ESMTP Negotiation Mechanisms

FFPIM participants must ensure that their use of the UA and ESMTP methods for content negotiation is compatible. For example, two mechanisms might consult two different repositories of capabilities information, and those repositories might contain different information. Presumably, this means that at least one of these repositories is inaccurate. Therefore, the larger problem is one of correctness, rather than synchronization.

This specification does not require a particular method of using the mechanisms together.

3. Content Format

FFPIM allows the transfer of enhanced TIFF data relative to [RFC3965] and [RFC2532]. The details for these enhancements are contained in [RFC3949]. Implementations that are conformant to FFPIM SHOULD support TIFF enhancements.

It should also be noted that the content negotiation mechanism permits a sender to know the full range of content types that are supported by the recipient. Therefore, requirements for support of TIFF represent a functional minimum for FFPIM.

4. Security Considerations

As this document is an extension of [RFC3965] and [RFC2532], the Security Considerations sections of [RFC3965] and [RFC2532] apply to this document, including discussion of PGP and S/MIME use for authentication and privacy.

It appears that the mechanisms added by this specification do not introduce new security considerations. However, the concerns raised in [RFC2532] are particularly salient for these new mechanisms.

Use of this specification should occur with particular attention to the following security concerns:

* Negotiation can be used as a denial of service attack.

* Negotiation may lead to the use of an unsafe data format.

* Negotiation discloses information and therefore raises privacy concerns.

Use of the ESMTP CONNEG option permits content transformation by an intermediary, along the mail transfer path. When the contents are encrypted, the intermediary cannot perform the conversion, because it is not expected to have access to the relevant secret keying material. When the contents are signed, but not encrypted, conversion will invalidate the signature. Therefore, permission to convert SHOULD NOT normally be used with signed or sealed messages.

5. References

5.1. Normative References

[RFC4141] Toyoda, K. and D. Crocker, "SMTP and MIME Extensions for Content Conversion", RFC 4141, November 2005.

[RFC3949] Buckley, R., Venable, D., McIntyre, L., Parsons, G., and J. Rafferty, "File Format for Internet Fax", RFC 3949, February 2005.

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

[RFC2532] Masinter, L. and D. Wing, " Extended Facsimile Using Internet Mail", RFC 2532, March 1999.

[RFC2534] Masinter, L., Wing, D., Mutz, A., and K. Holtman, "Media Features for Display, Print, and Fax", RFC 2534, March 1999.

[RFC2542] Masinter, L., "Terminology and Goals for Internet Fax", RFC 2542, March 1999.

[RFC2879] Klyne, G. and L. McIntyre, "Content Feature Schema for Internet Fax (V2)", RFC 2879, August 2000.

[RFC3297] Klyne, G., Iwazaki, R., and D. Crocker, "Content Negotiation for Messaging Services based on Email", RFC 3297, July 2002.

[RFC3965] Toyoda, K., Ohno, H., Murai, J., and D. Wing, "A Simple Mode of Facsimile Using Internet Mail", RFC 3965, December 2004.

5.2. Informative References

[RFC3238] Floyd, S. and L. Daigle, "IAB Architectural and Policy Considerations for Open Pluggable Edge Services", RFC 3238, January 2002.

[T30] ITU-T (CCITT), "Procedures for Document Facsimile Transmission in the General Switched Telephone Network", Recommendation T.30, July 1996.

Appendix A. Direct Mode

Email is a store-and-forward service, typically with highly variable delay between the time a message leaves the sender's realm and the time it arrives in the receiver's realm. The number of relays between sender and receiver is also unknown and variable. By contrast, facsimile is generally considered to be direct and immediate.

An email profile that fully emulates facsimile must solve several different problems. One is to ensure that the document representation semantics are faithful. Another is that the interaction between sender and receiver is similar to that of telephony-based facsimile. In particular, it must ensure the timeliness of the interaction. The specifications for FFPIM and its predecessors enable email to emulate the former, the information (semantics) activities of facsimile.

The ESMTP CONNEG option sets the stage for achieving the latter, with email-based facsimile transfer that has interactive negotiations, on a par with telephony-based facsimile. The key, additional requirement is to achieve timeliness. Ultimately, timeliness requires configuring sender and receiver email servers to interact directly. The sender's MTA must directly contact the receiver's MTA. With typical email service configurations, the content and interaction semantics of facsimile can be emulated quite well, but timeliness cannot be assured.

To achieve direct sending, the originating MTA must not use sending-side intermediaries such as outbound enterprise MTAs. Instead, it must be configured to do transmissions directly to hosts specified in email addresses, based on queries to the public DNS. To achieve direct receiving, the target MTAs must have DNS A records, without MX records. That is, they also must be configured not to use intermediaries.

The sender may then use ESMTP Conneg to determine the capabilities of the receiver. Afterwards the sender will use the capabilities information to tailor the TIFF message content it sends.

Appendix B. Acknowledgements

The IETF Fax working group, in collaboration with the IETF and the ITU, has diligently participated in a multi-year effort to produce Internet-based emulation of classic facsimile via email profiles. The effort benefited from the group's willingness to provide an initial, minimal mechanism, and then develop the specification to include more facsimile features as implementation and operation experience was gained.

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Acknowledgement

Funding for the RFC Editor function is currently provided by the Internet Society.