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Principles of Operation for the TPC.INT Subdomain: Radio Paging -- Technical Procedures

Status of this Memo

This memo provides information for the Internet community. This memo does not specify an Internet standard of any kind. Distribution of this memo is unlimited.

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1. Introduction

As an adjunct to the usual, two-way electronic mail service, it is at times useful to employ a one-way text notification service, called radio paging. This memo describes a technique for radio paging using the Internet mail infrastructure. In particular, this memo focuses on the case in which radio pagers are identified via the international telephone network.

The technique described by this memo, mapping telephone numbers to domain names, is derived from the TPC.INT subdomain. Consult RFC 1530, "Principles of Operation for the TPC.INT Subdomain: General Principles and Policy" for overview information.

2. Naming, Addressing, and Routing

A radio pager is identified by a telephone number, e.g.,

```
+1 415 940 8776
```

where "+1" indicates the IDDD country code, and the remaining string is a telephone number within that country.

In addition to a telephone number, a PIN may also be required to uniquely identify a radio pager.

2.1. Addressing

This number is used to construct the address of a radio paging server, which forms the recipient address for the message, e.g., one of:

```
pager.ATOM@6.7.7.8.0.4.9.5.1.4.1.tpc.int
pager-alpha.ATOM@6.7.7.8.0.4.9.5.1.4.1.tpc.int
pager-numeric@6.7.7.8.0.4.9.5.1.4.1.tpc.int
```

where "ATOM" is an RFC 822 atom [1], an opaque string for use in recipient identification when communicating with the paging network, and the domain-part is constructed by reversing the telephone number, converting each digit to a domain-label, and being placed under "tpc.int". (The telephone number must not include any international access codes.)

Note that the mailbox syntax is purposefully restricted in the interests of pragmatism. To paraphrase STD 11, RFC 822, an atom is defined as:

```
atom    = 1*atomchar

atomchar=   <any upper or lowercase alphabetic character
              (A-Z a-z)>
          / <any digit (0-9)>
          / "!" / "#" / "$" / "%" / "&" / "'" / "*" / "+"
          / "-" / "/" / "=" / "?" / "^" / "_" / "`" / "{"
          / "|" / "}" / "~"
```

Finally, note that some Internet mail software (especially gateways from outside the Internet) impose stringent limitations on the size of a mailbox-string. Thus, originating user agents should take care in limiting the local-part to no more than 70 or so characters.

2.2. Routing

The message is routed in exactly the same fashion as all other electronic mail, i.e., using the MX algorithm [2]. Since a radio paging server might be able to access many radio pagers, the wildcarding facilities of the DNS [3,4] are used accordingly. For example, if a radio paging server residing at "dbc.mtview.ca.us" is willing to access any radio pager with a telephone number prefix of

```
+1 415 940
```

then this resource record might be present

```
*.0.4.9.5.1.4.1.tpc.int.       IN MX 10 dbc.mtview.ca.us.
```

Naturally, if several radio paging servers were willing to access any radio pager in that prefix, multiple MX resource records would be present. (The DNS servers for the TPC.INT subdomain perform a rudimentary form of load balancing by rotating the order of the MX records returned on each query.)

It should be noted that the presence of a wildcard RR which matches a radio paging server's address does not imply that the corresponding telephone number is valid, or, if valid, that a radio pager is identified by the phone number. Rather, the presence of a wildcard RR indicates that a radio paging server is willing to attempt access.

3. Procedure

When information is to be sent to a radio pager, the user application constructs an RFC 822 message, containing a "Message-ID" field and a textual content (e.g., a "text/plain" content [5]).

The message is then sent to the radio paging server's electronic mail address. The radio paging server begins by looking at the local part of the address.

3.1. Alpha-numeric Radio Pagers

If the local-part is either "pager.ATOM" or "pager-alpha.ATOM" then this indicates that the recipient is using an alpha-numeric radio pager, and ATOM either identifies a paging network (CARRIER), or a radio pager identity number (PIN), or both, according to these rules:

(1) if ATOM consists entirely of numeric characters, then ATOM is a PIN, and the domain-part refers to the IXO access telephone number for a radio paging carrier; otherwise,

(2) if ATOM does not contain a hyphen character ("-"), then ATOM is a CARRIER, a local database is consulted to determine the corresponding IXO access telephone number, and the telephone number corresponding to the domain-part is used to identify the radio pager; otherwise,

(3) if ATOM does contain a hyphen character ("-"), then everything to the left of the first hyphen is a CARRIER, and everything to the right of that hyphen is a PIN, a local database is consulted to determine the corresponding IXO access telephone number, and the PIN is used is used to identify the radio pager.

If the local-part starts with "pager.", then the message sent to the radio pager consists of the body of the message; otherwise, if the local-part starts with "pager-alpha.", then the radio paging server determines which information in the headers and body of the message are used when constructing the paging message. For example, some radio paging servers might choose to examine the "To" and "Subject" fields, in addition to the body, whilst other radio paging servers might choose to simply send the body verbatim.

3.2. Numeric Radio Pagers

If the local-part is the literal string "pager-numeric" then this indicates that the recipient is using a numeric pager, and the radio pager dials the telephone number corresponding to the domain-part.

The message sent to the radio pager consists of the body of the message, which must consist solely of digits.

3.3. MAILing versus SENDing

An SMTP client communicating with a radio paging server may use attempt either the MAIL or SEND command. The radio paging server MUST support the MAIL command, and MAY support any of the SEND, SOML, or SAML commands.

If the MAIL command is used, then a positive completion reply to both the RCPT and DATA commands indicates, at a minimum, that the message has been queued for transmission into the radio paging network for the recipient, but is at least queued for transmission into the radio paging network.

If the SEND command is used, then a positive completion reply to both the RCPT and DATA commands indicates that the message has been accepted by the radio paging network for delivery to the recipient.

If the SOML or SAML command is used, then a positive completion reply to both the RCPT and DATA commands indicates that the message may have been accepted by the radio paging network for delivery to the recipient.

3.4. Latency

Although the Internet electronic mail service tends to perform delivery in a timely and reliable manner, some paging services will wish to provide a higher degree of assurance to their clients, in particular guaranteeing that a positive reply code means that the page has been sent on the radio paging network. For such requirements, the primary constraints are server implementation and client/server network connectivity.

A client that uses the SEND or SAML commands is explicitly requesting real-time transmission on the radio paging network and is requiring that the server reply code will carry a statement of success or failure about that transmission.

The IP level of the Internet performs datagram store-and-forward service, but gives the end system hosts the appearance of direct connectivity, by virtue of allowing interactive service. The Internet electronic mail service adds another layer of store-and-forward indirection, so that messages may go through any number of relays (and/or gateways). This may introduce arbitrarily large delays of minutes, hours, or days.

A client that configures their Internet attachment to permit "direct" SMTP connectivity to a radio paging server will be able to submit paging requests to the server directly, without additional SMTP-relaying. That is, transmission from radio paging client to server will be one "SMTP-hop"only. This will eliminate any possibility of non-deterministic delay by the Internet itself.

The combination of configuring radio paging server and client to allow direct IP/SMTP-level interaction and ensuring that they use SEND or SAML commands only will mean that a client receiving a positive reply from the server is assured that the page has been sent on the radio paging network.

4. Usage Examples

These examples make use of the "iddd.tpc.int" subdomain. The DNS servers for this subdomain, upon encountering a domain of the form:

```
NUMBER.iddd.tpc.int
```

automatically create a CNAME RR of the form:

R.E.B.M.U.N.iddd.tpc.int

e.g.,

14159408776.iddd.tpc.int

will be treated as

6.7.7.8.0.4.9.5.1.4.1.tpc.int

4.1. A MIME Example

```
To: pager-alpha.98765@18005551234.iddd.tpc.int
cc: Marshall Rose <mrose@dbc.mtview.ca.us>
From: Carl Malamud <carl@malamud.com>
Date: Thu, 22 Jul 1993 08:38:00 -0800
Subject: First example, for an alphanumeric pager
Message-ID: <19930908220700.1@malamud.com>
MIME-Version: 1.0
Content-Type: text/plain; charset=us-ascii

A brief textual message sent to the radio paging network
having an IXO access telephone number of "+1-8005551234"
to the radio pager having a PIN of "98765".
```

4.2. A Non-MIME Example

```
To: pager-numeric@14159408776.iddd.tpc.int
From: Carl Malamud <carl@malamud.com>
Date: Thu, 22 Jul 1993 08:38:00 -0800
Subject: Second example, for a numeric pager
Message-ID: <19930908220700.2@malamud.com>

2026282044
```

5. Server Configuration Example

A hypothetical radio paging carrier, e.g.,

Pigeon Paging

might choose to integrate its radio paging services with Internet e-mail in the following fashion:

(1) The radio paging carrier establishes a top-level domain name, e.g.,

```
pigeon.net
```

(2) The radio paging carrier installs and operates one or more radio paging servers, each having a unique entry in the DNS, e.g.,

```
ixo1.pigeon.net.              IN A  a.b.c.d
```

Each of these radio paging servers runs an SMTP server which implements the SEND command as described in Section 3.3 above.

(3) The radio paging carrier coordinates with the administrators of the TPC.INT subdomain to have the appropriate MX records added to the DNS, assigning cost values in the MX records to reflect any difference in the quality of service between the radio paging servers, e.g.,

```
4.3.2.1.5.5.5.0.0.8.1.tpc.int. IN MX  5 ixo1.pigeon.net.
4.3.2.1.5.5.5.0.0.8.1.tpc.int. IN MX  5 ixo2.pigeon.net.
```

which would provide both load-balancing and redundancy (particularly if the servers were located at different points in the Internet). At this point, messages can be sent using the addressing formats described in Section 2.2 above.

(4) The radio paging carrier may choose to make available a client program which uses the SMTP SEND command, in order to achieve "real-time" delivery of messages into the radio paging network.

(5) Finally, the radio paging carry may choose to assign each of its customers a mailbox, e.g.,

```
mrose@pager.pigeon.net
```

which maps to the TPC.INT address for the customer’s radio pager.

The system(s) listed in the DNS for this domain would maintain the appropriate mail aliases for this mapping, e.g.,

```
R: 220 pager.pigeon.net SMTP ready
S: HELO malamud.com
R: 220 pager.pigeon.net
S: EXPN mrose
R: 250 <pager-alpha.98765@18005551234.iddd.tpc.int>
```

At the carrier's discretion, these systems may also be the systems running the radio paging servers. However, this needn't be the case. For example, consider a situation where a client program which uses the SMTP SEND command, wants to ensure that it is talking to radio paging server for an address: e.g.,

```
R: 220 pager.pigeon.net SMTP ready
S: EHLO malamud.com
R: 220-pager.pigeon.net
R: 220 SEND
S: VRFY mrose
R: 551 User not local;
       try <pager-alpha.98765@18005551234.iddd.tpc.int>
```

or

```
R: 220 pager.pigeon.net SMTP ready
S: EHLO malamud.com
R: 220-pager.pigeon.net
R: 220 SEND
S: VRFY mrose
R: 250 <pager-alpha.98765@18005551234.iddd.tpc.int>
```

6. Security Considerations

Internet mail may be subject to monitoring by third parties, and in particular, message relays.

7. Acknowledgements

This document was motivated by RFC 1568 [6] and RFC 1645 [7]. In addition, David Crocker, Carl Malamud, and Perry Metzger also provided substantive comments.

8. References

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