              Text String Notation for Dial Sequences and
        Global Switched Telephone Network (GSTN) / E.164 Addresses

Status of this Memo

   This document specifies an Internet standards track protocol for the
   Internet community, and requests discussion and suggestions for
   improvements. Please refer to the current edition of the "Internet
   Official Protocol Standards" (STD 1) for the standardization state
   and status of this protocol. Distribution of this memo is unlimited.

Abstract

   This memo describes the full set of notations needed to represent a
   text string in a Dial Sequence. A Dial Sequence is normally composed
   of Dual Tone Multi Frequency (DTMF) elements, plus separators and
   additional "actions" (such as "wait for dialtone", "pause for N
   secs", etc.) which could be needed to successfully establish the
   connection with the target service: this includes the cases where
   subaddresses or DTMF menu navigation apply.

1. Introduction

   Since the very first devices interacting with GSTN services appeared,
   a need for a unique text string representation of commonly called
   telephone numbers, and more generally DTMF sequences and actions, was
   foreseen.

   This memo describes the full text string representation method. This
   specification was explicitly created to provide an easy, unique and
   complete reference which MUST be used by all other specifications
   needing a text string representation for a Dial Sequence.

   The specification was collected directly from Dial Sequence
   definitions which are already described in existing Standard Track
   specifications (such as [6] [7] [8] [9]), and is fully synchronized
   with them. Full compatibility is thus assured, and as a consequence,
   this specification results in a compendium of existing definitions.

This notation is a fully compatible compendium of existing notations,
and should be used in all specifications needing a text string
representation of a Dial Sequence.

Although the commonly called "telephone numbers" are normally used to
generate a Dial Sequence when establishing a connection, the full
abstract E.164 addresses [2], i.e., the universal addressing on the
Global Switched Telephone Network (GSTN), have further elements which
cannot be dialled. Thus abstract E.164 addresses cannot be fully
converted into a Dial Sequence or fully represented using this
notation.

1.1. Terminology and Syntax conventions

In this document the formal definitions are described using ABNF
syntax, as defined in [3]. This memo also uses some of the "CORE
DEFINITIONS" defined in "APPENDIX A - CORE" of that document.

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 BCP 14, RFC 2119 [4].

The following terms are also defined in this document:

    Dial Sequence:
        a series of DTMF elements and human or device "actions";

    phone-string:
        a text representation of a Dial Sequence;

    GSTN address: a commonly called "telephone number" on the GSTN,
        i.e., a diallable subset of an E.164 abstract address or any
        private numbering schema diallable address;

    gstn-phone:
        a text representation of a GSTN address;

    subaddr-string:
        a text representation of a GSTN subaddress (which includes ISDN
        subaddresses [2] and T.33 subaddresses [5]);

    post-dial:
        a text representation of a post dialling sequence.

2. The "Dial Sequence" definition

   The possible elements composing a Dial Sequence can vary from a
   minimum number, up to a really large and complex collection: in fact,
   the sequences already needed to dial a gstn-phone, which is a subset
   of the generic Dial Sequence, well represents this variety and
   complexity of cases.

   In particular, a Dial Sequence is composed by:

   -   "DTMF elements": normally available as "keys" on numeric keypads
       of dialling devices;

   -   "actions": normally performed by the agent (human or device)
       composing the Dial Sequence;

   -   "separators": used only to improve human readability of a Dial
       Sequence.

2.1. The "phone-string" definition

   The text representation of the Dial Sequence elements is defined in
   the phone-string specification:

       phone-string = 1*(DTMF / pause / tonewait / written-sep)

       DTMF = (DIGIT / "#" / "*" / "A" / "B" / "C" / "D")
                       ; special DTMF codes like "*", "#", "A", "B",
                       ; "C", "D" are defined in [1].
                       ; Important Note: these elements only apply for
                       ; alphabetic strings used in DTMF operations.
                       ; They are NOT applicable for the alphabetic
                       ; characters that are mapped to digits on phone
                       ; keypads in some countries.

       pause = "p"

       tonewait = "w"

       written-sep = ("-" / ".")

   Note:
       DTMF are the "DTMF elements", pause and tonewait are the "actions"
       and written-sep are the "separators".

   The "pause" and "tonewait" elements interpretation of the phone-
   string depends on the specific devices and implementation using the
   specification. Thus their exact meaning is not mandated in this

document. The next section provides some examples drawn from common
practice. Both "pause" and "tonewait" are case insensitive.

Implementation of "pause" and "tonewait":

   - one instance of a "pause" SHOULD be interpreted as a pause of
      one second between the preceding and succeeding dial string
      elements;

   - a "tonewait" SHOULD be interpreted as a pause that will last
      until the calling party hears a dial tone or another indication
      that more dial string characters may be processed. An off-hook
      indication MAY also be interpreted as this kind of indication
      (meaning that the audio channel has been opened to the
      receiving party);

   - because these characters are not a part of the GSTN subscriber
      address (telephone number) per se, any dial string characters
      that succeed either a "pause" or "tonewait" SHOULD be sent
      using DTMF signalling.

The use of written-sep elements is allowed in order to improve human
readability of the phone-string. The written-sep are elements which
can be placed between dial elements, such as digits etc. Any
occurrences of written-sep elements in a phone-string MUST NOT result
in any action. Conformant implementations MAY drop or insert
written-sep into the phone-string they handle.

The phone-string definition is used in the following sections to
explicitly describe the encoding of some specific subcases where it
applies.

3. The "gstn-phone" definition

In order to access a GSTN address, a human or a device must perform a
Dial Sequence. Thus, a GSTN address can be represented using the
phone-string elements. In particular, diallable E.164 numeric
addresses [2] represent a limited subset of all possible GSTN
addresses, while the complete complex case needs a full encoding
schema, as it also includes a local or private addressing schema.

In order to describe this distinction and provide anyhow a complete
encoding schema, the following definition of "gstn-phone" is
provided:

    gstn-phone = (global-phone / local-phone)

3.1. The "global-phone" definition

   The purpose of the global-phone element is to represent diallable
   E.164 numeric addresses. As such, it uses a subset of a phone-string
   definition only.

   The syntax for a global-phone element is as follows:

      global-phone = "+" 1*(DIGIT / written-sep)

   Any other dialling schemes MUST NOT use the leading "+" defined here.
   The "+" sign is strictly reserved for the standard "global-phone"
   syntax, and, even if not specifically part of the phone-string
   definition, it is needed to uniquely label a global-phone.

3.2. The "local-phone" definition

   The local-phone element is intended to represent the set of possible
   cases where the global-phone numbering schema does not apply. Given
   the different and complex conventions currently being used in the
   GSTN system, the local-phone definition supports a large number of
   elements.

   The detailed syntax for local-phone elements is as follows:

      local-phone = [exit-code] dial-number

      local-phone =/ exit-code [dial-number]

      exit-code = phone-string
                   ; this will include elements such as the digit to
                   ; access outside line, the long distance carrier
                   ; access code, the access password to the service,
                   ; etc...

      dial-number = phone-string
                   ; this is in many cases composed of different elements
                   ; such as the local phone number, the area code
                   ; (if needed), the international country code
                   ; (if needed), etc...

   Notes:
      The "+" character is reserved for use in a global-phone and MUST
      NOT be used in a local-phone string;

      Please note that a local-phone string MUST NOT be a null string,
      i.e., at least an exit-code, or a dial-number or both MUST be
      present.

4. The "subaddr-string" definition

   In GSTN service, there are cases where a subaddress is required to
   specify the final destination. To specify these subaddresses, a Dial
   Sequence is also used, and thus the "subaddr-string" can be encoded
   as:

       subaddr-string = phone-string

   Note:
       Within actual uses of subaddresses, some specific services can
       limit the possible set of phone-string elements allowed. In
       particular, there are ISDN subaddresses [2] [8], which restrict
       the phone-string elements to 1*(DIGIT / written-sep) and service
       specific subaddresses, like the fax service T.33 subaddress [5]
       [7], which restrict phone-string elements to 1*(DIGIT).

5. The "post-dial" definition

   In some cases, after the connection with the destination GSTN device
   has been established, a further dialling sequence is required to
   access further services. A typical example is an automated menu-
   driven service using DTMF sequences. These cases may be represented
   using the "post-dial" definition below:

       post-dial = phone-string

6. Examples

   In order to clarify the specification we present, here are a limited
   set of examples. Please note that all the examples are for
   illustration purposes only.

   A GSTN address in Italy, dialled from U.S.A., using local-phone,
   without written-sep:

       01139040226338

   A GSTN address in Germany, using global-phone and written-sep ".":

       +49.81.7856345

   A GSTN address in U.S.A. using global-phone and written-sep "-":

       +1-202-455-7622

A post-dial sequence, pausing, dialling 1, waiting for dial tone,
dialling 7005393, waiting again for dial tone and dialling 373; note
the use of four "p" elements (pppp) to specify a longer initial
pause:

    pppp1w7005393w373

A Dial Sequence in Italy (long distance call), using local-phone,
with exit-code "9", long distance access "0", area code "40", pause
"p" and written-sep ".":

    9p040p22.63.38

A Dial Sequence using exit-code "0", a wait for dial tone, local-
phone for an International "800" toll-free number dialled from
Belgium (international prefix "00"), and a post-dial sequence to
access a voice mailbox with userID "334422" and Personal
Identification Number (PIN) code "1234":

    0w00800-39380023pp334422p1234

7. Conclusions

   This proposal creates a full standard text encoding for Dial
   Sequences, including GSTN and diallable E.164 addresses, and thus
   provides a unique common representation method both for standard
   protocols and applications.

   Some definitions, like these corresponding to an alias of the generic
   phone-string element, are somewhat a theoretical distinction; however
   they are useful to provide a more subtle distinction, allowing other
   specifications to be more exact in a consistent way.

   The proposal is consistent with existing standard specifications.

8. Security Considerations

   This document specifies a means to represent Dial Sequences, which
   could include GSTN addresses and private codes sequences, like
   Personal Identification Numbers, to access special services. As
   these text strings could be transmitted without encoding inside
   protocols or applications services, this could allow unauthorized
   people to gain access to these codes. Users SHOULD be provided
   methods to prevent this disclosure, like code encryption, or
   masquerading techniques: out-of-band communication of authorization
   information or use of encrypted data in special fields are the
   available non-standard techniques.

9. Collected ABNF Syntax

   In this section we provide a summary of ABNF specifications.

      phone-string = 1*(DTMF / pause / tonewait / written-sep)

      DTMF = (DIGIT / "#" / "*" / "A" / "B" / "C" / "D")

      written-sep = ("-" / ".")

      pause = "p"

      tonewait = "w"

      gstn-phone = (global-phone / local-phone)

      global-phone = "+" 1*(DIGIT / written-sep)

      local-phone = [exit-code] dial-number

      local-phone =/ exit-code [dial-number]

      exit-code = phone-string

      dial-number = phone-string

      subaddr-string = phone-string

      post-dial = phone-string

10. References

10.1. Normative References

   [1] ETSI I-ETS 300,380 - Universal Personal Telecommunication (UPT):
       Access Devices Dual Tone Multi Frequency (DTMF) sender for
       acoustical coupling to the microphone of a handset telephone
       (March 1995).

   [2] ITU E.164 - The International Public Telecommunication Numbering
       Plan E.164/I.331 (May 1997).

   [3] Crocker, D. Ed. and P. Overell, "Augmented BNF for Syntax
       Specifications: ABNF", RFC 2234, November 1997.

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

   [5] ITU T.33 - Facsimile routing utilizing the subaddress;
       recommendation T.33 (July, 1996).

10.2.   Informative References

   [6] Allocchio, C., "Minimal GSTN address format in Internet Mail",
       RFC 3191, October 2001.

   [7] Allocchio, C., "Minimal FAX address format in Internet Mail", RFC
       3192, October 2001.

   [8] Allocchio, C., "GSTN Address Element Extensions in E-mail
       Services", RFC 2846, June 2000.

   [9] Vaha-Sipila, A., "URLs for Telephone Calls", RFC 2806, April
       2000.

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