

JJ-90.31

Common interconnection interface
for carrier ENUM
(English Edition)

Version 4.0

August 29, 2018

THE TELECOMMUNICATION TECHNOLOGY COMMITTEE



Introduction

This document provides the TTC original Standard formulated by TTC signaling working group. The working group translated JJ-90.31 Japanese version 4.0. (August 29, 2018) into English, and issued JJ-90.31 English version on August 29, 2018.

In case of dispute, the original to be referred is the Japanese edition of the text.

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CONTENTS

1. Overview.....	6
1.1. Scope.....	6
1.2. Objective	6
1.3. Contents.....	6
2. Terminologies and abbreviations	6
2.1. Terminologies	6
2.2. Abbreviations	7
3. Architecture.....	7
3.1. Number portability method	7
3.2. Database method	7
3.3. Protocol stack	7
3.4. Requirements on telecommunication carrier's networks	8
4. Interface specifications between different carrier's networks.....	8
4.1. Layer 3.....	8
4.1.1. DSCP (Differentiated Service Code Point).....	8
4.2. Layer 4.....	9
4.3. ENUM	9
4.3.1. Message format.....	9
4.3.1.1. Header section.....	9
4.3.1.2. Query section	9
4.3.1.3. Answer / authority / additional information section.....	10
4.3.2. Common procedures.....	10
4.3.2.1. Query	11
4.3.2.1.1. RCODE field.....	11
4.3.2.1.2. Iterative/recursive query	11
4.3.2.1.3. Retransmission interval of the query.....	11
4.3.2.1.4. Other recommendations	11
4.3.2.2. Answer.....	11
4.3.2.2.1. RCODE field.....	11
4.3.2.2.2. TTL (Time to Live)	11
4.3.2.2.3. Return of the final answer.....	12
4.3.3. NAPTR resource record	12
4.3.3.1. Query	12
4.3.3.2. Answer.....	12
4.3.3.2.1. ORDER field.....	14
4.3.3.2.2. PREFERENCE field	14
4.3.3.2.3. FLAGS field	14
4.3.3.2.4. SERVICES field.....	14
4.3.3.2.5. REGEXP field.....	14
4.3.3.2.6. REPLACEMENT field	15
Appendix i (Informative): Sequence and message encoding examples	16
i.1. General	16
i.2. ENUM sequence example	16
i.2.1. Basic ENUM query (query/answer)	16
i.2.2. ENUM answer using backref expressions (answer)	20

<Reference Information>

1. Relationship to International Recommendations

This Standard is specified with reference to the international standards and national standards listed in Clause 3.

2. Change History

Edition and Version	Date of issue	Contents of changes
English Edition, Version 1.0	August 27, 2015	Published
English Edition, Version 2.0	May 26, 2016	Expansion of the coverage of "E2U+pstn:sip" service in SERVICES field, modifications related to the data length of fields, support of ENDS0 on ENUM, clarification of case sensitivity of FLAGS/SERVICES fields and retransmission interval of the ENUM query to the same ENUM server.
English Edition, Version 3.0	May 25, 2017	Addition of the use of backref expressions in ENUM answer.
English Edition, Version 4.0	August 29, 2018	Specifying IP packet priority (DSCP values) in the interconnection of Carrier ENUM, addition of specifications for 1XY services, clarifications on ENUM specification and modifying document composition.

3. References

3.1. Normative references

The following documents are the latest version of normative references at the time of publication. All the references may be revised with technical change(s). This Standard provides clarifications on the requirements in conformance with the following normative references. Therefore, careful analysis of the technical impact on this Standard is required when updating a version of an existing normative reference.

[JT-E164 Sup.2] "Number portability", TTC standard JT-E164 Supplement2 Version 1, The Telecommunication Technology Committee, August 2015.

[JT-Q769.1] "ISDN user part enhancements for the support of number portability", TTC standard JT-Q769.1 Version 2, The Telecommunication Technology Committee, November 2000.

3.2. Normative references (TTC standards based on IETF RFCs)

The following documents are TTC standards based on the standards developed by IETF, referenced in this Standard.

[RFC 1035] "DOMAIN NAMES – IMPLEMENTATION AND SPECIFICATION", TTC standard JF-IETF-RFC1035 Version 1, The Telecommunication Technology Committee, May 2015.

[RFC 2474] "Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers", TTC standard JF-IETF-RFC2474, The Telecommunication Technology Committee, May 2009.

[RFC 2597] "Assured Forwarding PHB Group", TTC standard JF-IETF-RFC2597, The Telecommunication Technology Committee, May 2010.

[RFC 3261] "SIP: Session Initiation Protocol", TTC standard JF-IETF-RFC3261 Version 1, The Telecommunication Technology Committee, June 2005.

[RFC 3402] "Dynamic Delegation Discovery System (DDDS) Part Two: The Algorithm", TTC standard JF-IETF-RFC3402 Version 1, The Telecommunication Technology Committee, May 2015.

[RFC 3403] "Dynamic Delegation Discovery System (DDDS) Part Three: The Domain Name System (DNS) Database", TTC standard JF-IETF-RFC3403 Version 1, The Telecommunication Technology Committee, May 2015.

- [RFC 3764] "enumservice registration for Session Initiation Protocol (SIP) Addresses-of-Record", TTC standard JF-IETF-RFC3764 Version 1, The Telecommunication Technology Committee, May 2015.
- [RFC 3966] "The tel URI for Telephone Numbers", TTC standard JF-IETF-RFC3966 Version 1, The Telecommunication Technology Committee, June 2005.
- [RFC 4694] "Number Portability Parameters for the "tel" URI", TTC standard JF-IETF-RFC4694 Version 1, The Telecommunication Technology Committee, November 2007.
- [RFC 4769] "IANA Registration for an Enumservice Containing Public Switched Telephone Network (PSTN) Signaling Information", TTC standard JF-IETF-RFC4769 Version 1, The Telecommunication Technology Committee, May 2015.
- [RFC 6116] "The E.164 to Uniform Resource Identifiers (URI) Dynamic Delegation Discovery System (DDDS) Application (ENUM)", TTC standard JF-IETF-RFC6116 Version 1, The Telecommunication Technology Committee, May 2015.
- [RFC 6891] "Extension Mechanisms for DNS (EDNS(0))", TTC standard JF-IETF-RFC6891 Version 1, The Telecommunication Technology Committee, May 2016.

3.3. Non-normative references

The following document is a non-normative reference, referenced in this Standard.

- [IR.34] "Guidelines for IPX Provider networks (Previously Inter-Service Provider IP Backbone Guidelines)", GSMA IR.34 Version 13.0, October 2016.

4. Industrial Property

The status of the "IPR Licensing Statement" submission is provided on the TTC web site.

5. Responsible Working Group

Signalling Working Group

1. Overview

1.1. Scope

This Standard specifies the carrier ENUM interface standard to acquire the URI associated with E.164 numbers between domestic telecommunications carriers.

1.2. Objective

The purpose of this Standard is to improve telecommunications carrier's inter-connectivity by unifying the domestic telecommunications carrier's interpretations about the specifications of the interface to acquire the URI information associated with E.164 numbers.

1.3. Contents

To properly handle the URI acquisition from E.164 numbers by using ENUM, this Standard specifies the following mandatory items with which the domestic telecommunication carriers should comply. Regarding the items subjected to the inter-operator agreement, each item number of inter-operator agreement is shown in "{" and "}".

- (1) Architecture applied for carrier ENUM (Clause 3)
 - a) Number portability method (Subclause 3.1)
 - b) Database method (Subclause 3.2)
 - c) Protocol stack (Subclause 3.3)
 - d) Requirements on telecommunication carrier's networks (Subclause 3.4)
- (2) Interface specifications between different carrier's networks (Clause 4)
 - a) Layer 3 (Subclause 4.1)
 - b) Layer 4 (Subclause 4.2)
 - c) ENUM (Subclause 4.3)

Moreover, the following item is described as referential information.

- (3) Sequence and message encoding examples (Appendix i)

2. Terminologies and abbreviations

2.1. Terminologies

The terms related to this Standard complies with [JT-E164 Sup.2], [RFC 6116] and [RFC 3261].

The following terms are used in this Standard.

Term	Definition
Originating carrier network	A network of a carrier that serving an originating user.
Donor carrier network	A network of a carrier that acquired a user's number.
Terminating carrier network	A network of a carrier that serving a terminating user.
Recipient carrier network	A network of a carrier that currently serving a number portability user.
Block of E.164 numbers	A number consisted of CC (Country Code) and NDC (Network Destination Code), which is created by removing SN (Subscriber Number) from an E.164 number [JT-E164 Sup.2]. In Japan, the number block is 7 digits because CC equals 81 and NDC is 5 digits.
Native number	An E.164 number belonging to a block of E.164 numbers assigned to a donor carrier network, which is allocated for non-number portability user.
Number portability number	An E.164 number allocated for number portability user.

2.2. Abbreviations

The abbreviations used in this Standard are as shown below.

CC	Country Code
DB	Data Base
DNS	Domain Name System
DSCP	Differentiated Services Code Point
ENUM	E.164 Number Mapping
FQDN	Fully Qualified Domain Name
IMS	IP Multimedia Subsystem
IP-POI	IP Point Of Interconnection
IPv4	Internet Protocol Version 4
NAPTR	The Naming Authority Pointer
NDC	Network Destination Code
PHB	Per Hop Behavior
SIP	Session Initiation Protocol
SN	Subscriber Number
UDP	User Datagram Protocol
URI	Uniform Resource Identifiers

3. Architecture

This Standard specifies the messages exchanged over the carrier ENUM interface (NNI (ENUM)) in Figure 3-1) for the communications using SIP among different carrier's networks such as IMS network.

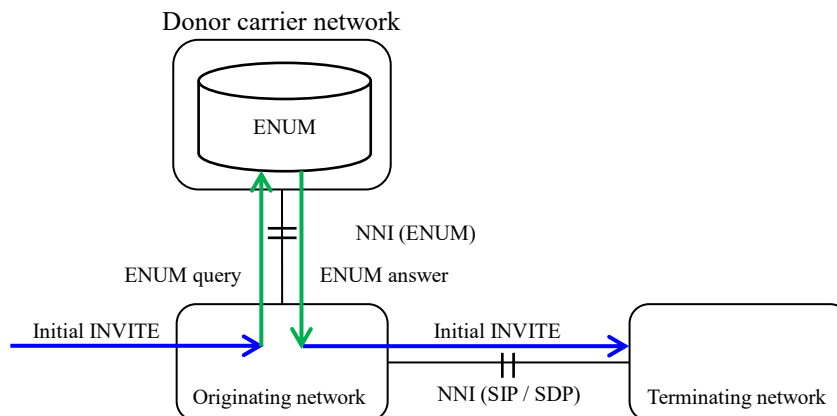


Figure 3-1 / JJ-90.31: Architecture for the communication using ENUM

3.1. Number portability method

For the number portability method, this Standard specifies the interface specification on the premise of All Call Query method (referring originating DB method) as specified in [JT-E164 Sup.2].

3.2. Database method

For the database configuration, this Standard specifies the interface specification on the premise of distributed database approach (Solution A, each operator's individual NP data is collected in each operator's individual database (no sharing of NP data among operators)) as specified in [JT-E164 Sup.2].

Note that both Tier0 and Tier1 are not used in this Standard. Although [JT-E164 Sup.2] defines both real time DB and non-real time DB, the ENUM server in this Standard corresponds to the real time DB.

3.3. Protocol stack

Figure 3.3-1 shows the protocol stack of the ENUM in this Standard. Subclause 4.1 describes layer 3-related specifications, Subclause 4.2 describes layer 4-related specifications and Subclause 4.3 describes ENUM-related

specifications.

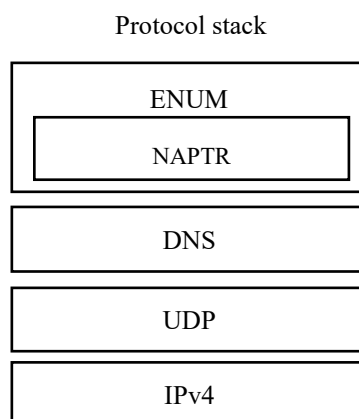


Figure 3.3-1 / JJ-90.31: Protocol stack of ENUM

3.4. Requirements on telecommunication carrier's networks

The requirements on the telecommunication carrier networks which use the carrier ENUM interface are as shown below.

(1) Originating carrier's network

- The IP address(es) of ENUM server(s) of a donor carrier network per block of E.164 numbers shall be already known.
- It shall be possible to transmit an ENUM query as specified in this Standard.

(2) Donor carrier's network

- It shall be possible to provide ENUM interface for the block of E.164 number acquired by its own telecommunications carrier.
- It shall be possible to transmit an ENUM answer according to Subclause 4.4.2 in this Standard.

(3) Terminating carrier's network

- No requirement is specified in this Standard.

4. Interface specifications between different carrier's networks

4.1. Layer 3

IPv4 is applied as the IP version for sending and receiving of ENUM messages in this Standard. The operator who deploys an ENUM server shall inform the IP address (list) of ENUM server(s) to the peer operator of inter-connection beforehand. {Item 1}

4.1.1. DSCP (Differentiated Service Code Point)

The DSCP value (see [RFC 2474]) shall be set as described in Table 4.1.1-1 for the packets of DNS, as same as [IR.34].

Table 4.1.1-1 / JJ-90.31: DSCP value for the packets of DNS

Protocol	IP Transport	
	PHB	DSCP
ENUM/DNS	AF31 (NOTE 1)	011010 (NOTE 1)
NOTE 1: The element conforms to [RFC 2597].		

NOTE 2: It should be noted that the DSCP value defined in this subclause needs to be set despite the priority of call (e.g., call from priority users, emergency call).

4.2. Layer 4

UDP is applied as the transport layer protocol for sending and receiving of ENUM messages in this Standard.

The operator who deploys ENUM server(s) shall inform an ENUM query listening port number(s) of the ENUM server(s) to the peer operator of inter-connection beforehand. {Item 2}.

4.3. ENUM

This Standard specifies domestic supplemental specifications for ENUM based on [RFC 1035] and [RFC 6891].

4.3.1. Message format

The DNS message format complies with Subclause 4.1 in [RFC 1035].

A DNS message consists of header section, query section, answer section, authority section and additional information section. In the following, the DNS message format, the definition of each field and the setting value of each field are described.

4.3.1.1. Header section

Figure 4.3.1.1-1 shows the format of the header section, and Table 4.3.1.1-1 shows the definition of each field in the the header section.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	bit
ID																
QR	OPCODE				AA	TC	RD	RA	Z			RCODE				
QDCOUNT																
ANCOUNT																
NSCOUNT																
ARCOUNT																

Figure 4.3.1.1-1 / JJ-90.31: Format of the header section

Table 4.3.1.1-1 / JJ-90.31: Definitions of the fields in the header section

Field name	Definition	Setting value
ID	Identifier for query	Complying with Subclause 4.1.1 in [RFC 1035].
QR	Message type	Complying with Subclause 4.1.1 in [RFC 1035].
OPCODE	Query type	Complying with Subclause 4.1.1 in [RFC 1035].
AA	Identifier to prove direct response from authority server	Complying with Subclause 4.1.1 in [RFC 1035].
TC	Identifier to indicate whether truncation of data size is performed or not	Complying with Subclause 4.1.1 in [RFC 1035].
RD	Request of recursive query	Complying with Subclause 4.3.2.1.2 in this Standard.
RA	Identifier to indicate the availability of recursive query	Complying with Subclause 4.1.1 in [RFC 1035].
Z	Spare (reserved for future use)	Complying with Subclause 4.1.1 in [RFC 1035].
RCODE	Response Code	Complying with Subclause 4.1.1 in [RFC 1035].
QDCOUNT	The number of entries in the query part	Complying with Subclause 4.1.1 in [RFC 1035].
ANCOUNT	The number of resource records in the answer section	Complying with Subclause 4.1.1 in [RFC 1035].
NSCOUNT	The number of resource records in the authority section	Complying with Subclause 4.1.1 in [RFC 1035].
ARCOUNT	The number of resource records in the additional information section	Complying with Subclause 4.1.1 in [RFC 1035].

4.3.1.2. Query section

Figure 4.3.1.2-1 shows the format of the query section, and Table 4.3.1.2-1 shows the definitions of each field in the

query section.

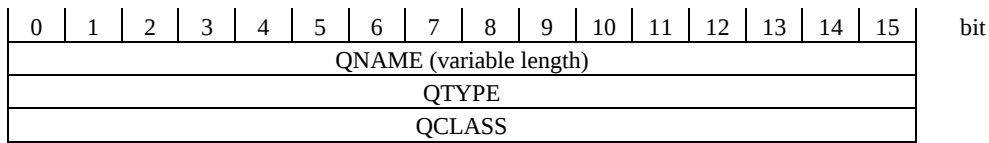


Figure 4.3.1.2-1 / JJ-90.31: Format of the query section

Table 4.3.1.2-1 / JJ-90.31: Definitions of the fields in the query part

Field name	Definition	Setting value
QNAME	Domain name to which a query is sent	Complying with Subclause 4.1.2 in [RFC 1035].
QTYPE	Query type	Complying with Subclause 4.1.2 in [RFC 1035].
QCLASS	Query class	Complying with Subclause 4.1.2 in [RFC 1035].

4.3.1.3. Answer / authority / additional information section

Figure 4.3.1.3-1 shows the format of the resource records which are used in the answer section, the authority section and the additional information section, and Table 4.3.1.3-1 shows the explanations about each field in the resource record format.

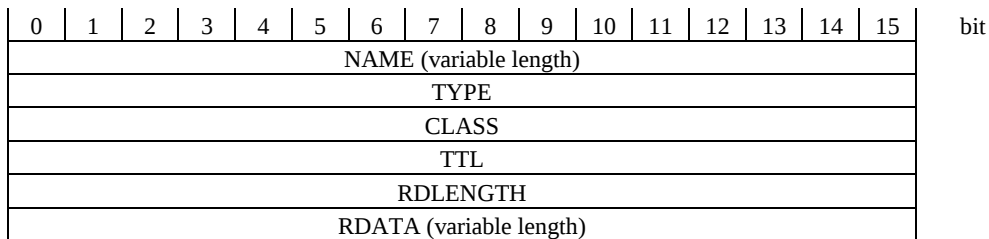


Figure 4.3.1.3-1 / JJ-90.31: Format of the resource records

Table 4.3.1.3-1 / JJ-90.31: Definitions of the fields in the resource record format

Field name	Definition	Setting value
NAME	Name of domain pertained to	Complying with Subclause 4.1.3 in [RFC 1035].
TYPE	Meaning of the information in RDATA field	Complying with Subclause 4.1.3 in [RFC 1035].
CLASS	Class of the information in RDATA field	Complying with Subclause 4.1.3 in [RFC 1035].
TTL	Period of time in which resource record can be cached.	Complying with Subclause 4.1.3 in [RFC 1035]. However, it complies with Subclause 4.3.2.2.2 in this Standard in the case of the answer section.
RDLENGTH	Length in octets of RDATA field	Complying with Subclause 4.1.3 in [RFC 1035].
RDATA	Resource data whose format is specified in TYPE field and CLASS field	It complies with Subclause 4.3 in this Standard.

4.3.2. Common procedures

In this Standard, EDNS0 defined in [RFC 6891] shall be supported at the ENUM interface then an OPT Pseudo resource record shall be set in an additional information section, and each field of the OPT Pseudo resource record shall be set complying with Table 4.3.2-1. The requestor's deliverable UDP payload size and responder's deliverable UDP payload size shall be set in the CLASS field of the OPT Pseudo resource record by octet unit. In this Standard, the CLASS field value of the OPT Pseudo resource record shall be equal to or greater than 1280 octets, and shall be equal to or less than 4096 octets.

Table 4.3.2-1 / JJ-90.31: Definitions of the fields in the OPT Pseudo resource record format

Field name	Definition	Setting value
NAME	Route domain	Complying with [RFC 6891].
TYPE	Type of resource record	Complying with [RFC 6891].
CLASS	requestor's UDP payload size	Set a value within a range of 1280 to 4096.
TTL	extended RCODE and flags	Complying with [RFC 6891].
RDLLENGTH	length of all RDATA	Complying with [RFC 6891].
RDATA	Extended contents in case of option is used	Complying with [RFC 6891].

In the case that there are multiple ENUM server addresses to be queried in a terminating carrier network, an originating carrier network can send an ENUM query to another ENUM server address when a timer defined in the originating carrier network is expired after sending the ENUM query or when a DNS error containing a value other than 0 in the RCODE field is received.

4.3.2.1. Query

4.3.2.1.1. RCODE field

The RCODE field in an ENUM query shall be set to 0.

4.3.2.1.2. Iterative/recursive query

"Recursive query" shall be used for query to ENUM servers in this Standard. Therefore, the recursive desired (RD) field in the ENUM message shall be set to 0.

4.3.2.1.3. Retransmission interval of the query

In this Standard, in order to reduce the load of ENUM servers, the retransmission interval of ENUM query to the same ENUM server shall be greater than 1 second.

4.3.2.1.4. Other recommendations

It is possible to send a query to the ENUM server without using cache even before expiry of the cache lifetime.

4.3.2.2. Answer

4.3.2.2.1. RCODE field

For a successful ENUM answer, the RCODE field in the ENUM answer shall be set to 0.

For an ENUM error response, the RCODE field in the ENUM answer shall be set to a value other than the 0.

Table 4.3.2.2.1-1 / JJ-90.31 Definition of RCODE field

Value	Definition	
0	No error condition	-
1(NOTE 1)	Format error	The ENUM server was unable to interpret the query.
2	Server failure	The ENUM server was unable to process this query due to an internal problem in the ENUM server.
3(NOTE 1)	Name Error	The record of a domain name referenced in the query does not exist.
4(NOTE 1)	Not Implemented	The ENUM server does not support the requested kind of query.
5(NOTE 1)	Refused	The ENUM server refuses to perform the specified operation for policy reasons.
NOTE 1: It is possible that the value is sent to an originating carrier network due to a reason such as misimplementation, mistakes of setting in an originating carrier network or ENUM server. However it is not expected to receive in general operation.		
NOTE 2: In this table, the RCODE values defined in [RFC 1035] are described.		

4.3.2.2.2. TTL (Time to Live)

It is recommended to set the TTL value (the lifetime of cache) and MinimumTTL (the lifetime of negative cache) to 60.

4.3.2.2.3. Return of the final answer

In this Standard, in order to reduce the number of ENUM messages exchanged on the ENUM interface, the donor carrier network shall perform resolutions in its own network and return a final answer only to the originating carrier network.

4.3.3. NAPTR resource record

As specified in Subclause 4.1 of [RFC 3403], for ENUM query / answer, 35 shall be set in the QTYPE field of the query section in the and in the TYPE field of the answer section.

4.3.3.1. Query

Regarding to the procedures to create an ENUM query from an E.164 number, this Standard specifies domestic supplemental specifications against Clause 3 of [RFC 1035] and Clause 3 of [RFC 6116]. "+81CD177" shall be treated as an E.164 number.

The rules of the conversion from E.164 number to valid domain name to be set to QNAME in the query section of ENUM Query are as shown below. Note that ".e164enum.net" shall be set to the top level domain for the rearmost domain of ENUM query.

1. Removing "+" at the head and visual-separator from E.164 number
Example) "+81-3-5297-2571" → "81352972571"
2. Aligning the numbers in reverse
Example) "81352972571" → "17527925318"
3. Inserting a period "." between number digits
Example) "17527925318" → "1.7.5.2.7.9.2.5.3.1.8"
4. Adding ".e164enum.net." at the end
Example) "1.7.5.2.7.9.2.5.3.1.8" → "1.7.5.2.7.9.2.5.3.1.8.e164enum.net."

4.3.3.2. Answer

The format of NAPTR resource record to be set to RDATA field in the answer section complies with Subclause 4.1 of [RFC 3403]. Figure 4.3.3.2-1 shows the format of NAPTR resource record, and Table 4.3.3.2-1 shows the definition of each field in the NAPTR resource record.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	bit
ORDER																
PREFERENCE																
FLAGS (variable length)																
SERVICES (variable length)																
REGEXP (variable length)																
REPLACEMENT (variable length)																

Figure 4.3.3.2-1 / JJ-90.31: Format of NAPTR resource record

Table 4.3.3.2-1 / JJ-90.31: Definition of each field in the NAPTR resource record

Field name	Definition	Setting value
ORDER	Order of processes in the case that multiple NAPTR resource records exist.	Complying with Subclause 4.3.3.2.1 in this Standard.
PREFERENCE	Priority of the processes for NAPTR resource records in which ORDER field's value is the same	Complying with Subclause 4.3.3.2.2 in this Standard.
FLAGS	Specifying the behaviors of the resource record	Complying with Subclause 4.3.3.2.3 in this Standard.
SERVICES	Specifying the services which are the target of resource records	Complying with Subclause 4.3.3.2.4 in this Standard.
REGEXP	This is separated by delimiter (delim-char part) to specify the conversion rules (ere part) based on POSIX expanded regular expression and the strings which are the target of the conversion.	Complying with Subclause 4.3.3.2.5 in this Standard.
REPLACEMENT	Used instead of REGEXP at the domain output. (This has exclusive relationship with REGEXP. When this is not used, "." is specified.)	Complying with Subclause 4.3.3.2.6 in this Standard.

In this Standard, the procedures to search/send an ENUM answer based on a received ENUM query complies with Clause 3 in [RFC 1035] and Clause 3 in [RFC 6116].

An ENUM server in a donor carrier network shall return an answer section including NAPTR resource record set to "E2U+sip" in SERVICES field for ENUM query to the E.164 number belonging to the donor carrier's block of E.164 numbers (CC+NDC). Moreover, in addition to one answer section including "E2U+sip", the another answer section set to including NAPTR resource record set to "E2U+pstn:sip" in SERVICES field shall be set until the migration of all domestic interconnect interfaces to IP-POI is completed.

Table 4.3.3.2-2 shows examples of SIP URIs of two NAPTR resource record in ENUM answer for each E.164 number complying with the format specified in the following subclauses.

Table 4.3.3.2-2 / JJ-90.31: Examples of SIP URI in ENUM answer for ENUM query to each E.164 number

E.164 number in ENUM Query	Ere part in ENUM answer	SERVICES field value	Examples of SIP URI
Native number	^.*\$	E2U+sip	sip:+81422601111@example1.ne.jp;user=phone
		E2U+pstn:sip	sip:+81422601111;npdi@example1.ne.jp;user=phone
Native number	^(.*)\$	E2U+sip	sip:1@example1.ne.jp;user=phone
		E2U+pstn:sip	sip:1;npdi@example1.ne.jp;user=phone
Number portability number	^.*\$	E2U+sip	sip:+81422602222@example2.ne.jp;user=phone
		E2U+pstn:sip	sip:+81422602222;npdi;rn=+81422610051@example2.ne.jp;user=phone
Number portability number	^(.*)\$	E2U+sip	sip:1@example2.ne.jp;user=phone
		E2U+pstn:sip	sip:¥1;npdi;rn=+81422610051@example2.ne.jp;user=phone
Unallocated number	^.*\$	E2U+sip	sip:+81422603333@example1.ne.jp;user=phone
		E2U+pstn:sip	sip:+81422603333;npdi@example1.ne.jp;user=phone
Unallocated number	^(.*)\$	E2U+sip	sip:¥1@example1.ne.jp;user=phone
		E2U+pstn:sip	sip:¥1;npdi@example1.ne.jp;user=phone

4.3.3.2.1. ORDER field

In this Standard, the ORDER field value shall be set according to [RFC 3403].

The value is determined based on inter-operator agreements. {Item 3}

4.3.3.2.2. PREFERENCE field

In this Standard, the PREFERENCE field value shall be set according to [RFC 3403].

The value is determined based on inter-operator agreements. {Item 4}

4.3.3.2.3. FLAGS field

In this Standard, the FLAGS field value shall be set to "u" which outputs URI according to [RFC 6116]. Note that "u" is case-insensitive.

4.3.3.2.4. SERVICES field

In this Standard, the "E2U+sip" defined in [RFC 3764] and "E2U+pstn:sip" defined in [RFC 4769] are allowed to be set. Note that alphabets used in the SERVICES field are case-insensitive.

NOTE: When the service for implementing number portability in a carrier ENUM conforming to this standard is added, the NAPTR resource record of this field is to note the possibility of being added.

4.3.3.2.5. REGEXP field

This Standard specifies domestic supplemental items against the REGEXP field in Clause 3 of [RFC 3402].

(1) The character "!" shall be set to delimiter (delim-char part).

(2) The characters "^.*\$" or "^(.*)\$" shall be set to the conversion part (ere part).

4.3.3.2.5.1. URI

In this Standard, SIP URI shall be specified as the URI method in REGEXP field.

4.3.3.2.5.1.1. SIP URI format

In this Standard, the SIP URI format in REGEXP field complies with the format in [RFC 3261] and [RFC 3966]. Figure 4.3.3.2.5.1.1-1 shows the SIP URI format.

<code>sip:<global-number-digits><par>@<hostport>;<uri-parameter></code>

Figure 4.3.3.2.5.1.1-1 / JJ-90.31: Format of SIP URI

The requirements for SIP URI populated in the REGEXP field differ from services specified by SERVICES field. The components of SIP-URI are described in following Subclauses for each SERVICES fields allowed in this Standard.

4.3.3.2.5.1.2. global-number-digits part

In this Standard, if "^.*\$" is set to the ere part of REGEXP field, an E.164 number shall be set to global-number-digits part regardless of the values of SERVICES field. This value shall be same as the value of the E.164 number queried in the ENUM Query. Moreover, visual-separator shall not be included.

If "^(.*)\$" is set to the ere part of REGEXP field, then "¥1" shall be set to global-number-digits part.

4.3.3.2.5.1.3. par part

In this Standard, the settings of par part for each SERVICES field are specified below.

- When "E2U+sip" [RFC 3764] is set to SERVICES field, tel URI parameter shall not be populated to par part.
- When "E2U+pstn:sip" [RFC 4769] is set to SERVICES field, "npdi" tel URI parameter defined in [RFC 4694] shall be populated to par part. Moreover, "rn" tel URI parameter shall be populated to the SIP URI associated with an E.164 number of a number portability user, until the migration of all domestic interconnect interfaces to IP-POI is completed (the setting of "rn" tel URI parameter is optional, when all interconnect interfaces among all domestic operator's networks are IP-POI.). If "rn" tel URI parameter is populated, a network routing number to a Recipient carrier network (Clause 3 of [JT-Q769.1]) shall be set to a value in the global-number form. Other tel URI parameters shall not be included.

4.3.3.2.5.1.4. hostport part

In this Standard, the same domain specified in Request-URI of a SIP request outside an existing dialog shall be populated in the hostport part of a SIP URI in NAPRT resource record regardless of the values of SERVICES field. As shown in Table 4.3.3.2.5.1.4-1, the value of SIP domain differs depending on whether an E.164 number in the query is that of number portability user or not.

Table 4.3.3.2.5.1.4-1 / JJ-90.31: Setting value of hostport part

E.164 number in the ENUM Query	Setting value
E.164 number of number portability user	SIP domain of a recipient carrier network is populated.
E.164 number other than the above (NOTE)	SIP domain of the donor carrier network is populated.
NOTE: if an E.164 number is managed in the donor carrier network.	

4.3.3.2.5.1.5. uri-parameter part

In this Standard, "user=phone" shall be set as the SIP URI parameter set to uri-parameter part regardless of the values of SERVICES field. Moreover, other parameters shall not be included.

4.3.3.2.6. REPLACEMENT field

In this Standard, "." shall be populated.

Appendix i (Informative): Sequence and message encoding examples

i.1. General

This appendix describes examples of general sequence and messages encoding related to ENUM.

The examples of sequence and message encoding described in this appendix are just referential information for implementation.

i.2. ENUM sequence example

Appendix Table i.2-1 shows the sequence name described in this appendix and the corresponding clause or Subclause. Moreover, an example in the case that an IMS network uses the carrier ENUM interface specified in this Standard is described.

Appendix Table i.2-1 / JJ-90.31: List of described sequence and message encoding examples

No.	Sequence name	Corresponding Subclause
1	Basic ENUM query (query/answer)	Appendix i.2.1
2	ENUM answer using backref expressions (answer)	Appendix i.2.2

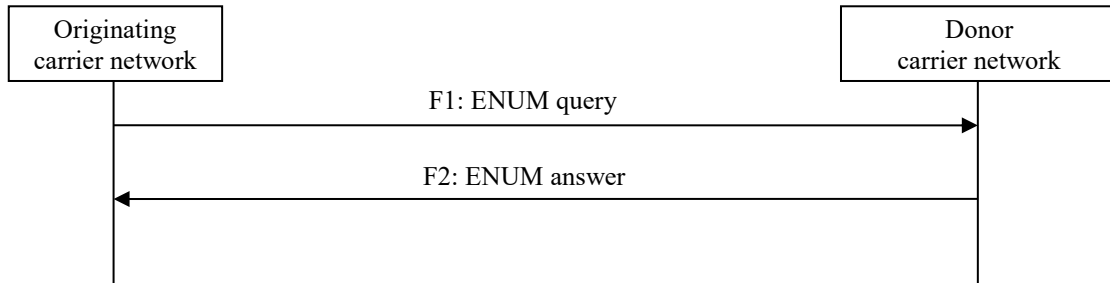
i.2.1. Basic ENUM query (query/answer)

This Subclause describes a sequence and message encoding example when performing basic ENUM query between the originating carrier network and the donor carrier network and acquiring URI information of a number portability user.

The values of each field in each table are written with alphanumeric characters and symbols to make it easy to understand; however, values converted to binary are used in actual ENUM query/answer.

The values in each table are just examples and appropriate values shall be populated for actual ENUM query/answer.

Terminating user number: 0422-60-9999
Terminating carrier network's SIP domain name: example2.ne.jp
Network routing number: 0422-61-0051
ENUM server name: ns.example1.ne.jp
ENUM server IP address: 192.0.2.123



Appendix Table i.2.1-1 / JJ-90.31: Basic ENUM query (query/answer)

F1: ENUM Query

		Field name	Setting value
Header section	ID		1
	QR		0
	OPCODE		0
	AA		0
	TC		0
	RD		0
	RA		0
	Z		0
	RCODE		0
	QDCOUNT		1
	ANCOUNT		0
	NSCOUNT		0
	ARCOUNT		1
Query section	QNAME		9.9.9.0.6.2.2.4.1.8.e164enum.net.
	QTYPE		35
	QCLASS		1
Additional information section	NAME		0
	TYPE		41
	CLASS		1280
	TTL	EXTENDED-RCODE	0
		VERSION	0
		DO	0
		Z	0
	RDLENGTH		0
	RDATA		No settings

F2: ENUM answer

	Field		Setting value
Header section	ID		1
	QR		1
	OPCODE		0
	AA		1
	TC		0
	RD		0
	RA		0
	Z		0
	RCODE		0
	QDCOUNT		1
	ANCOUNT		2
	NSCOUNT		1
	ARCOUNT		2
Query section	QNAME		9.9.9.9.0.6.2.2.4.1.8.e164enum.net.
	QTYPE		35
	QCLASS		1
Answer section	NAME		9.9.9.9.0.6.2.2.4.1.8.e164enum.net.
	TYPE		35
	CLASS		1
	TTL		60
	RDLENGTH		65
	RDATA	ORDER	100
		PREFERENCE	10
		FLAGS	u
		SERVICES	E2U+sip
		REGEXP	!^,*\$!sip:+81422609999@example2.ne.jp;user=phone!
		REPLACEMENT	.
Answer section	NAME		9.9.9.9.0.6.2.2.4.1.8.e164enum.net.
	TYPE		35
	CLASS		1
	TTL		60
	RDLENGTH		91
	RDATA	ORDER	100
		PREFERENCE	20
		FLAGS	u
		SERVICES	E2U+pstn:sip
		REGEXP	!^,*\$!sip:+81422609999;npdi;rn=+81422610051@example2.ne.jp;user=phone!
		REPLACEMENT	.
Authority section	NAME		0.6.2.2.4.1.8.e164enum.net.
	TYPE		2
	CLASS		1
	TTL		86400
	RDLENGTH		18
	RDATA		ns.example1.ne.jp.
Additional information section	NAME		ns.example1.ne.jp.
	TYPE		1
	CLASS		1
	TTL		86400
	RDLENGTH		4
	RDATA		192.0.2.123
Additional information section	NAME		0
	TYPE		41
	CLASS		1280
	TTL	EXTENDED-	0

		RCODE	
		VERSION	0
		DO	0
		Z	0
	RDLENGTH		0
	RDATA		No settings

i.2.2 ENUM answer using backref expressions (answer)

This Subclause describes an ENUM answer message example to the ENUM Query described in subclause i.2.1 when using backref expressions.

F2: ENUM answer

	Field		Setting value
Header section	ID		1
	QR		1
	OPCODE		0
	AA		1
	TC		0
	RD		0
	RA		0
	Z		0
	RCODE		0
	QDCOUNT		1
	ANCOUNT		2
	NSCOUNT		1
	ARCOUNT		2
Query section	QNAME		9.9.9.9.0.6.2.2.4.1.8.e164enum.net.
	QTYPE		35
	QCLASS		1
Answer section	NAME		9.9.9.9.0.6.2.2.4.1.8.e164enum.net.
	TYPE		35
	CLASS		1
	TTL		60
	RDLENGTH		65
	RDATA	ORDER	100
		PREFERENCE	10
		FLAGS	u
		SERVICES	E2U+sip
		REGEXP	!^(.*)\$!sip:¥1@example2.ne.jp;user=phone!
		REPLACEMENT	.
Answer section	NAME		9.9.9.9.0.6.2.2.4.1.8.e164enum.net.
	TYPE		35
	CLASS		1
	TTL		60
	RDLENGTH		91
	RDATA	ORDER	100
		PREFERENCE	20
		FLAGS	u
		SERVICES	E2U+pstn:sip
		REGEXP	!^(.*)\$!sip:¥1;npdi;rn=+81422610051@example2.ne.jp;user=phone!
		REPLACEMENT	.
Authority section	NAME		0.6.2.2.4.1.8.e164enum.net.
	TYPE		2
	CLASS		1
	TTL		86400
	RDLENGTH		18
	RDATA		ns.example1.ne.jp.
Additional information section	NAME		ns.example1.ne.jp.
	TYPE		1
	CLASS		1
	TTL		86400
	RDLENGTH		4
	RDATA		192.0.2.123
Additional information section	NAME		0
	TYPE		41
	CLASS		1280
	TTL	EXTENDED-RCODE	0

		VERSION	0
		DO	0
		Z	0
	RDLENGTH		0
	RDATA		No settings