Proposal for handling virtual numbers by NRENum.net

DRAFT v.1.3

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Why numbering

Since the first automatic telephone exchange was introduced (by the Hungarian researcher Tivadar Puskas in 1877 in Boston, USA) the addressing of subscribers' local loops has been done by numbers. This legacy survived the digitalization as well as the internet age as it is the easiest, machine readable and yet multi-lingual, human understandable resource addressing method. Even if nowadays, when most of the local directories and presence information is based on Unified Resource Identifier (URN@URL) type addresses, numbers are still there as intermediary translators at the back-end.

Telephone numbers are global, uniform, and standardised resource identifiers. Moreover, numbers are also widely used by librarians and archives to categorise thematic groups in standardised way. Up until recently, internet resources are only addressed by IPv4 numbers, however the growth of the Internet now forced to leave this principle and introduce IPv6 including alphanumeric characters. This just gives more incentive for a number mapping solutions. With the advent of IPv6, PSTN numbering (ITU-T E.164) remained the only globally uniform numbering method for addressing end-user resources.

ENUM (E.164 Number Mapping) is a simple protocol that maps single E.164 telephone numbers to one or more service specific URIs used to address internet resources. IP-based devices may register with a local server, a web site, or an IP PBX but there is no universal VoIP directory until ENUM is completed. All E.164 telephone numbers are known to the network because every phone is registered by default in a global arrangement. However, a SIP URI also relies on a user to populate a record in DNS and faces those problems with NAT. That is why many IP to IP calls today route through the PSTN.

Why virtual numbers

ITU-T strictly regulates the number structure of valid E.164 telephone numbers and assigns number blocks to national authorities (telecom regulators) or recently to global entities directly. The national authorities can further delegate the number ranges to local operators within the county or region. This process creates holes in the numbering plan; valid number blocks unassigned to national authorities and assigned number blocks that are reserved or not used by any operators. When the novel IP based (non-PSTN) voice and video communication solutions appeared developers and operators started to use these empty number blocks as well as non-valid E.164-like numbers (we call them "virtual numbers") for experimenting with new services. Recently, there are three major motivations why virtual numbers are still being used:

- To overcome the number shortage or unavailability in some countries (blocks allocated to MCUs or VoIP softphones) manly due to the hierarchical structure of number ranges.

- The need for short numbers used e.g., by virtual organisations or global projects.

- To implement the rearrangement of flat numbering for global, thematic, inter-domain groups using video conferencing rooms/archives (interoperable, open source, open access).

The major issue with using virtual numbers arbitrarily (without any global regulations) is the possibility of mismatching and overbooking number blocks that affects the globally uniform nature of identifiers hence the IP-based global unified communications. Another primary concern, and of course this depends entirely on the implementation of a virtual number space, is the potential for 'accidently' hijacking real numbers which currently belong to a real and legitimate organisation.
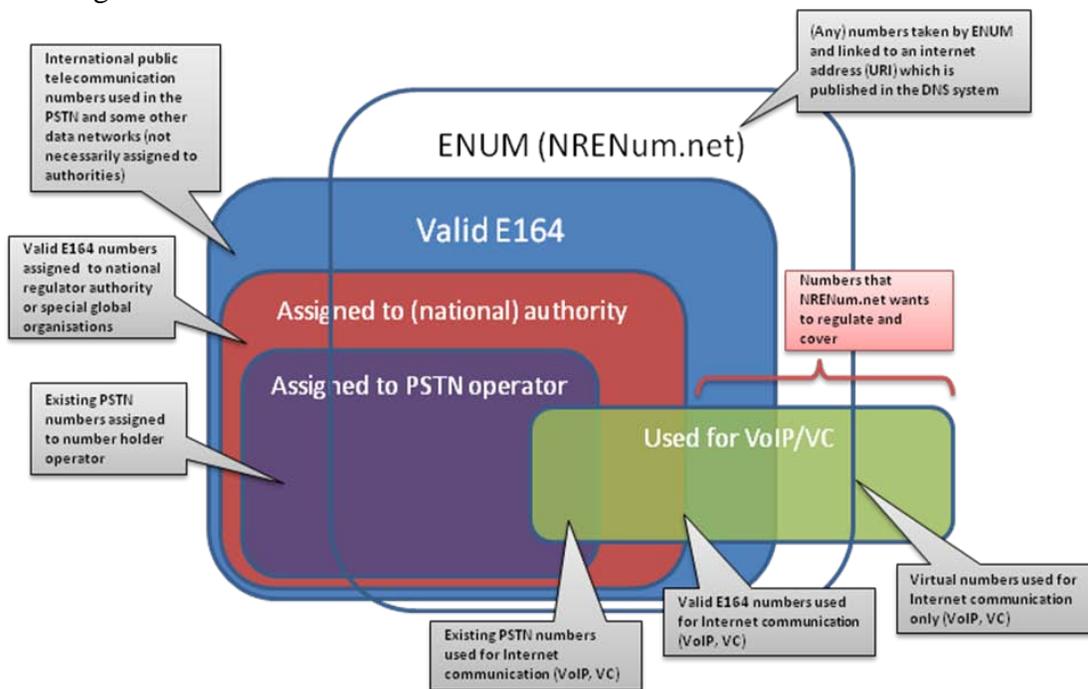
Why NRENum.net

In the recent years NRENum.net has grown to a global, production grade, end-user EUNM service primarily for the research and education community. Governed and operated by NRENs, NRENum.net facilitates globally uniform dialling and service discovery in a technology agnostic manner. The global interoperability and conformance to PSTN dialling can only be ensured by keeping the NRENum.net service tree "clean" (i.e. do not allow virtual numbers in the tree).

However, the global collaboration around NRENum.net creates the unique opportunity to agree on some basic principles about how to handle virtual numbers in a way that does not impact the uniformity. The potential agreements on best common practices, the creation of service prototypes and trials as well as the joint collaborative lobby work may ultimately lead to standardisations efforts.

How to achieve number compliance

By "number compliance" we mean that the virtual number conforms to ITU-T E.164 and it is verifiably owned by the organisation for which is directed or proxies on behalf of, in the NRENum.net tree.

NRENum.net community highly recommends all of its members to start a dialog with the national authorities (regulatory) within the given country or region. The dialog should be aimed at attempting a migration plan towards number space compliance. This may practically mean an agreement that states that unassigned number blocks (i.e. sandbox or super space) within the national numbering/dialling plan can be used by those services and the number blocks will not be assigned to other operators.

- One specific example of this is in the USA where the North American Super Space, numbers start with 0 or 1 immediately after the county code +1, can be used to identify IP-based devices.

- Another use case is in Portugal where FCCN has successfully requested a new number block of 200 numbers from the operator's number pool working together on the VC and VoIP project. Those numbers will then be available as real numbers via both NRENum.net and GDS with PSTN fallback.

- The third known use case is formulating in Australia where negotiation is ongoing between AARNet and the national regulator to get dedicated number blocks assigned. NRENum.net is willing to collect these national use cases and success stories and make them available to others that may help the negotiations.

Note that this virtual number compliance effort obviously does not provide a solution where there is a de-facto number shortage or short dialling numbers violate the valid E.164 number structure. Not to mention that E.164 addresses may cost money!

In those countries or regions where such an agreement cannot be made or the dialog with the regulatory is stalled, NRENum.net proposes an alternative solution at the global level (i.e. outside of the national numbering plans).

What alternative NRENum.net proposes

NRENum.net community proposes to design a global numbering plan that can accommodate both virtual numbers (non compliant number space) and valid E.164 numbers carefully avoiding any clashes. The main principles of such a global numbering plan design are:

- to integrate videoconference and telephony services;

- to be a number-only global addressing scheme (i.e.no alphabetic characters);

- to be compliant with valid E.164 numbering (i.e. avoid clashes);

- to translate to any URI by using NRENum.net (i.e. no separate ENUM tree for virtual numbers)

   Note that these numbers are unlikely to ever be PSTN routable. Therefore their use will be limited, which may work out fine for these scenarios.

The number structure proposed is as follows:

+{INP}{NP}{NUMBER}

+ ### @ %%%%%%%%
+ ### @@ %%%%%%%
+ ### @@@ %%%%%%
+ ### @@@@ %%%%%

INP = Internet Number Prefix, the ITU-T compliant Country Code selected for virtual numbers.
NP = Network Prefix, variable length, to be administered and assigned by "global registry"
NUMBER = subscriber number, variable length, corresponding to the given NP.

- The total number length (i.e. INP+NP+NUMBER) shall be limited to a maximum of 15 digits.

- INP shall be selected in compliance with the spare/unused/reserved ITU-T County Codes (see the list of potential global prefixes). Maximum of 3 digits is preferred.

- INP shall not be similar to any country's emergency number (aka. short number). Route out at least: 1x, 1xx, 911, 06x, 90x, 99x, 819

List of potential global prefixes (INP):

Prefix	Delegated to / Reserved for	Comment
+83	Reserved for E.164 country code expansion	Risk of expansion
+879	**Reserved for national non-commercial purposes**	**Candidate**
+999	Reserved for future global service	Emergency
+881 x	Available for GMSS networks	
+882 xx	Available for international networks	
+883 xxx	Available for international networks	
+878 10 x	VISIONng	
+878 4010 x	Dialed Digits / Packetizer	Contact: Paul Jones
+883 5100 x	Voxbone SA / iNUM	Contact: Rod Ullens
+883 5110 x	Bandwith.com Inc.	

- NP shall be administered and assigned by a centralised global entity. The recently created NRENum.net Operations Team (OT) in conjunctions with the yet formulating Global NRENum.net Governance Committee (GNGC) shall make a decision on this entity.

- NP shall have variable length and be assigned to various purposes such as virtual number legitimization, short numbers, global thematic groups, transnational organisations / projects as appropriate (see the draft list of NP purposes).

- Under the given NP the subscriber number allocation shall be flat.

Note that some NRENs have expressed their intention to guarantee their country code within this new structure. For that reason, the pre-reservation of country codes may be possible.

DRAFT list of NP purposes:

Prefix	Purpose
0	Reserved for NASS compliance
1	Reserved for NASS compliance
2	**Virtual number compliance**
3 x	**Short numbers for global org/projects (x shared)**
4	**Global thematic groups**
5 x	**Transnational commercial organisations (x shared)**
6	Reserved for future use
7	Reserved for future use
8	Reserved for future use
9	Reserved for future use

Examples

Let's assume that the selected global INP is +879. The following examples show how virtual numbers for different purposes can be allocated under that global prefix.

1. The NREN currently uses virtual numbers inside a national numbering plan sandbox (NP=55), but there are no assurances by the national authority that those number blocks will not be allocated to other operators (i.e. there's no number compliance). Therefore, the NREN wants to migrate the national virtual numbers over the global prefix.

```
National virtual number is:              +36 55 119982
Global legitimate number will be:        +879 2 119982
```

   Alternatively, if the NREN wants to keep/guarantee the use of their county code, the original CC can be part of the subscriber number.

```
National virtual number is:              +36 55 119982
Global legitimate number will be:        +879 2 36 119982
```

2. The Multinational Project wants to create its own dialling scheme using short numbers among the project participants. NRENum.net delegates the Project identifier: e.g., number 91.

```
Multinational Project short number is:   {MP} 1234
Global legitimate number will be:        +879 3 91 1234
```

3. In order to implement the rearrangement of flat numbering for global, thematic (subject-specific), inter-domain groups using virtual VC rooms one might want to apply the bibliographic classification convention (e.g., the Dewey Decimal Classification, DDC numbers) to locate a virtual room related to a specific topic.

```
DDC number for "Mathematics - experimental research" is:  {DDC} 510 724
Global legitimate number will be:                         +879 4 510 724
```

4. The Transnational Commercial Organisation mutually wants to comply with NRENum.net. NRENum.net delegates the Organisation identifier: e.g., number 31.

```
Transnational Commercial Organisation SIP URI is:         031600@tco.net
Global legitimate number will be:                         +879 5 31 031600
```