

# Virtual Numbers Implementation Options



by Bernie Hoeneisen, CEO [Ucom.ch](http://Ucom.ch)  
*member of the nrenum.net operations team*

# Basics

## ENUM

- E.164 Number to URI Mapping
- A technology to populate E.164 (telephone) numbers into the Domain Name System (DNS)
- Used to gain reachability information of further services the E.164 number holder chose to announce
  - e.g. Videoconferencing, Instant Messaging, email, ...
- Standards developed in the IETF
- More information:
  - <http://datatracker.ietf.org/wg/enum/charter/>
  - [http://en.wikipedia.org/wiki/Telephone\\_number\\_mapping](http://en.wikipedia.org/wiki/Telephone_number_mapping)
- The domain used for official (Public User) ENUM records is: e164.arpa.
- Official ENUM is governed by ITU and the National Number Regulators

## nrenum.net

- A (Private User) ENUM initiative by the Research and Education community
  - Originally established to fill the gap in those countries not served by official ENUM
- Records are populated and queried under the domain nrenum.net.
  - No access restrictions imposed for querying nrenum.net records
- Service currently hosted by Terena, a “confederation” of European National Research and Education Networks (NRENs)
- More information: <http://nrenum.net/>

# Problem Statement

Certain NRENs wish to address the following challenges by Virtual Numbers (VN), i.e. numbers not necessarily connected to the PSTN:

- A) E.164 number shortage for VoIP and Video systems / challenges with current E.164 numbering policies, such as:
  - Administrative process to get E.164 numbers
  - Issues with National Regulation (such as requirements for numbers in use)
  - PSTN operators “resistance” / policies
  - Costs
- B) Need for short dial numbers
- C) Enabling Global Thematic Virtual Groups
  - e.g.
    - call this Video Conferencing number to talk about cloning biology
    - call that number if you are looking for supersonic aviation experts

# Option 1: Separate Tree

- Create a separate tree (i.e. virtual.nrenum.net)
  - Populate this separate ENUM tree
  - Query this separate ENUM tree
    - in addition to e164.arpa and nrenum.net
- Example
  - 1.2.3.4.5.7.8.9.6.3.virtual.nrenum.net
- Advantages
  - Does not mess with existing infrastructure
  - Opt-In solution / Sandbox
  - Perfect to address short number dialing use case
- Drawbacks
  - Query yet another ENUM tree
  - More complex handling for querier / not ubiquitous
  - PSTN reachability not possible

# Option 2a: Official global CC

- Apply for global Country Code (CC)
  - Out of a special purpose range, e.g. International Networks
  - Official ITU application
  - Dedicated to NREN community
    - Further delegation of prefixes to national NRENs
- Example
  - 1.2.3.4.5.6.7.3.3.8.8.nrenum.net (+8833)
- Advantages
  - No burden at querier (same tree)
  - ITU blessing / No danger of conflicts (separated on E.164 layer)
  - Most clean solution / No side effects at technical layer
  - PSTN reachability possible (if carriers cooperate)
- Drawbacks
  - Get the ITU blessing is expected to be administratively challenging

# Option 2b: Global Special Number Ranges

- Get numbers out of global special purpose number ranges
  - e.g. UPT (Universal Personal Telecommunications)
- Example
  - 1.2.3.4.5.6.7.8.9.8.7.8.nrenum.net (+878)
- Advantages
  - All advantages of option 2a
- Drawbacks
  - Costs / policies / administrative overhead unclear

# Option 2c: Specialized Global Providers

- Cooperate with (global) providers
  - Specialized in services with global numbers
    - Global Area code for IP Communications
  - e.g. Voxbone (iNum Initiative)
  - Get numbers from these providers
- Examples
  - 1.2.3.4.5.0.0.1.5.3.8.8.nrenum.net (+8835100)
- Advantages
  - All advantages of option 2a
- Drawbacks
  - Costs / administrative overhead / policies depending on provider
  - Dependency on other entities and policies
  - less freedom than in 2a

# Option 2d: Use Unused CC

- Choose an unused Country Code and just use it
  - “Guerrilla” option
    - Simply use a CC and hope it will never get assigned
- Examples
  - 1.2.3.4.5.6.7.8.9.3.8.nrenum.net (+83)
  - 1.2.3.4.5.6.7.8.9.0.1.nrenum.net (+10)
- Advantages
  - No burden at querier (same tree)
  - Most freedom
  - Cheap
  - No side effects at technical layer
- Drawbacks
  - Risk of number conflicts (ambiguities), if CC gets assigned in future
  - PSTN reachability not possible



# Option 3a: Official prefix within CCs

- Apply for special purpose prefix
  - Within officially delegated national Country Codes
  - Official application at national number regulation authorities
  - Dedicated to NREN community
- Example:
  - 1.2.3.4.5.6.7.0.7.1.5.3.nrenum.net (+351707)
- Advantages
  - No burden at querier (same tree)
  - Official regulator blessing / No danger of conflicts (separated on E.164 layer)
  - Most clean solution / No side effects at technical layer
  - PSTN reachability possible (if carriers cooperate)
- Drawbacks
  - Get the national regulator blessing may be administratively challenging (depending on the country)

# Option 3b: National Special Number Ranges

- Get numbers out of National special purpose number ranges
  - e.g. National Personal Numbers
- Example
  - 1.2.3.4.5.6.7.8.7.8.1.4.nrenum.net (+41878)
- Advantages
  - All advantages of option 3a
- Drawbacks
  - Costs / administrative overhead / policies vary depending on the country

# Option 3c: Specialized National Providers

- Cooperate with (national) providers
  - Offering special services
    - With number ranges used in whole country or special VoIP providers
  - e.g. Sipgate
  - Get numbers from these providers
- Example
  - 1.2.3.4.5.6.7.8.2.3.9.4.nrenum.net (+4932)
- Advantages
  - All advantages of option 3a
- Drawbacks
  - Costs / administrative overhead / policies vary depending on provider and country
  - Dependency on other entities and policies
  - less freedom than in 3a

# Option 3d:

## Use unused prefix within CCs

- Choose an unused prefix within officially delegated Country Codes and just use it
  - “Guerrilla” option
    - Simply use a prefix and hope it will never get assigned
  - Similar as option 2d
- Example
  - 1.2.3.4.5.6.7.8.9.9.4.1.nrenum.net (+41 - 99)
- Advantages
  - No burden at querier (same tree)
  - Most freedom
  - Cheap
  - No side effects at technical layer
- Drawbacks
  - Risk of number conflicts (ambiguities), if prefix gets assigned in future
  - PSTN reachability not possible

# Option 4: Use Over-dialing

- Use existing “main” number and add more digits to it
  - Over-dialing principle
- Example
  - 9.8.7.1.2.3.4.5.6.7.8.9.3.4.nrenum.net (+43987654321, Ext 789)
- Advantages
  - No burden at querier (same tree)
  - Most freedom
  - Cheap
  - No side effects at technical layer
  - (Limited) PSTN reachability
    - all over-dialing numbers to same “main” number
- Drawbacks
  - Long numbers

# Conclusions (so far)

- First preference  
(and recommendation to follow where possible):
  - Options 3a, 3b, and 3c (**official** options in every **country**)
- Likely investigated further in an upcoming nrenum.net trial:
  - Options 2b and 2c (official **global** options outside ITU)
  - Options 2d and 3d (**unofficial** options; i.e. use unused E.164 space)
  - in particular where
    - Options 3a, 3b, or 3c are not feasible, or
    - Pending discussions (at national level)
- Discontinued (by community decision)
  - Option 1 (separate tree)
  - Option 2a (request dedicated CC from ITU)
  - Option 4 (“over-dialing”)