

# ENUM

## International Status on Standardization and Deployment

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# ENUM and VoIP as a Trigger

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- ENUM is tightly linked with numbering and therefore with the regulatory framework
- Deployment of ENUM is also tightly linked with the deployment of VoIP
- Deployment of VoIP causes a direct conflict between Telco's and ISP's
- Deployment of ENUM involves NRA's and Registries (in Europe primarily the ccTLD's)
- ENUM and VoIP therefore causes a lot of questions and issues to surface.

# Areas of Conflict

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National Regulatory Authorities

(New)

Numbering

Telecommunication  
Law

(De)regulation

## ENUM and VoIP

ISP's and  
other SP

Telco's

ccTLD's  
(Registries)

Privacy Law

Consumers

Consumer and  
Privacy  
protection

# Warm-up:

## The ENUM Problem Statement

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- How do you find a service on the Internet?
  - Also from the PSTN?
- How do you find “islands of connectivity” across domain boundaries?
- Why not use phone numbers?



**Voice**



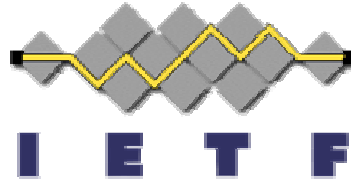
**Video**



**Text**



# ENUM in a nutshell



- take phone number

+43 1 979 33 21

- turn it into a FQDN

1.2.3.3.9.7.9.1.3.4.e164.arpa.

- ask the DNS

mailto:richard@stastny.com

- return list of URI's

sip:richard@iphone.at

# How does ENUM work ?

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Telephone Number (TN): +43 1 979 33 21 translates to:



1.2.3.3.9.7.9.1.3.4.e164.arpa



Tier 1 resolution to NS of authority ( [pointer only](#) )

1.2.3.3.9.7.9.1.3.4.e164.arpa. IN NS ns1.iphone.at



Tier 2 resolution to NAPTR record and SIP URL controlled at the end office

```
IN NAPTR 10 10 "u" "E2U+sip" !^.*$!SIP:richard@iphone.at"
```



set up call

# (Very short) ENUM History

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- Sept. 2000 – IETF ENUM WG – RFC2916
- 2001 – Various Workshops (ITU-T, Europe, US, Asia, ...)
- 2002 – ITU-T Interim Procedures (IAB, RIPE-NCC)
  - ITU-T generic TLD Investigation
  - ETSI TS 102 051 "ENUM Administration in Europe"
- 2003 – ETSI TS 102 172 "Minimum Requirements for Interoperability of European ENUM Trials"
  - IETF various enumservices on standards track
  - IETF RFC2916bis WGLC
- 2004 – Planned:
  - IETF new RFC, IANA registered enumservices
  - ITU-T final decision on ENUM domain
  - ETSI ENUM Interop

# (Very short) ENUM Trial History

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- 2002 – US ENUM Forum
  - Trial Platforms in AT, UK, SE, DE, CN, ...
  - Austrian ENUM Trial in operation (Sept. 2002)
- 2003 – Various national and international ENUM Trials using different scenarios and numbering resources and using different ENUM-enabled products
  - National and international Demos and Presentations (IETF, ITU-T, VON, ICANN, ...)
  - SIP communities start using ENUM (FWD, Sipphone, iptel, at43, ...)
  - Pre-commercial deployment starts
- 2004 – ENUM ready for production and deployment



# ENUM Delegations

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## Delegations in e164.arpa as of 16. November 2003

- 31 Netherlands
- 33 France
- 358 Finland
- 36 Hungary
- 374 Armenia
- 40 Romania
- 41 Switzerland
- 420 Czech
- 421 Slovakia
- 423 Liechtenstein
- 43 Austria
- 44 UK
- 46 Sweden
- 48 Poland
- 49 Germany
- 55 Brazil
- 86 China
- 246 Diego Garcia
- 247 Ascension
- 290 Saint Helena
- 971 UAE
- 87810 VISIONng UPT

<http://www.ripe.net/enum/request-archives/>

# Lessons learnt in the ENUM Trials

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- Basic issues solved
  - ENUM technology works,
  - ENUM policy and administration: most problems solved,
  - but shift in focus for the business models.
- The original business model of ENUM for residential subscribers with opt-in for existing numbers has problems:
  - second line service,
  - privacy problems with multiple services (e-mail spam)
  - Validation and re-validation problem, ...
- but the major problem is: How to overcome Metcalfe's Law?
  - *The usefulness, or utility, of a network equals the square of the number of users*
- so new approaches are needed.

# New approaches to ENUM needed

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- New approaches for IP Communications:
  - ENUM for IP-based private networks ("PBX") with direct dial in
  - Numbers "ported" to IP-based networks (using ENUM for routing)
  - non-geographic number ranges for IP Communications, using ENUM
- and then the re-launch of the original ENUM model starting with teleworkers and road warriors to overcome Metcalfe's Law
  - Note: IP Communications is not IP Telephony
    - it is VoIP PLUS
    - Instant Messaging, Presence, Video, Chat, SMS, and, ...

# Scenarios for IP Communications

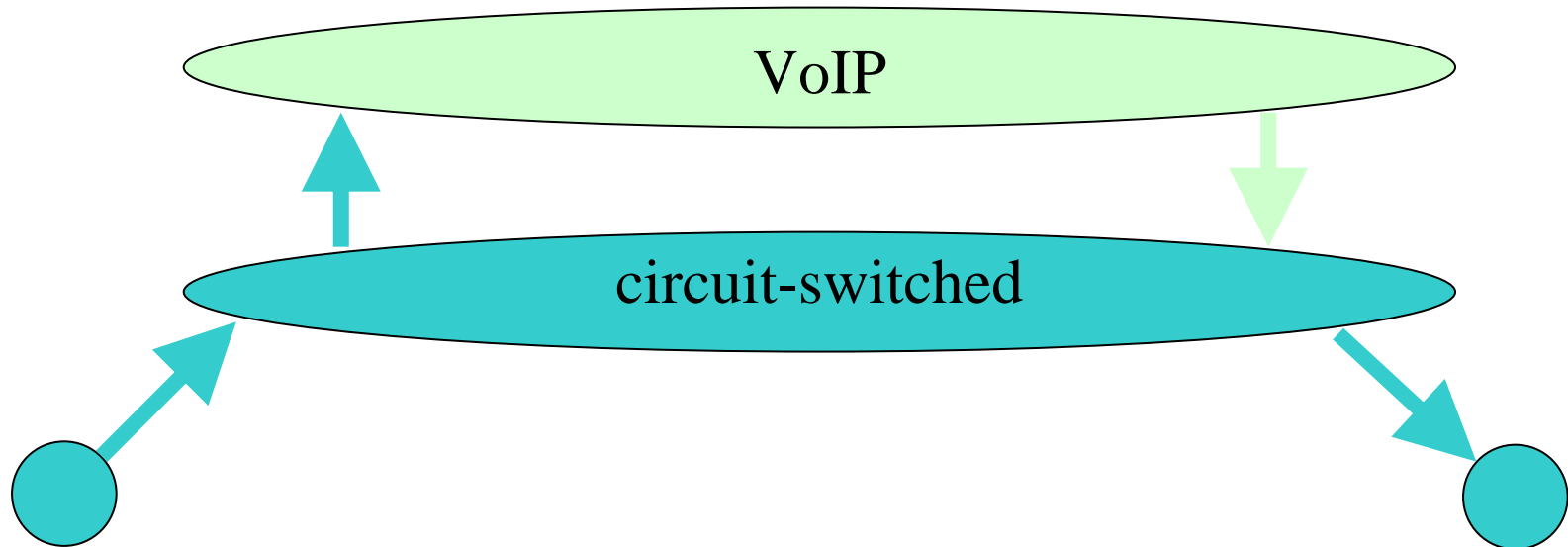
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- The following end-to-end scenarios exist:
  1. PSTN/ISDN via IP to PSTN/ISDN
    - good ol' voice bypass, IP trunking, not discussed here
  2. IP Communications to IP Communications
    - e.g. hotmail, aol, FWD, sipphone, skype, Telio, ...
    - most including IM, presence, chat, etc.
  3. VoIP to PSTN/ISDN
    - e.g. Vonage, Telio, ...
  4. PSTN/ISDN to VoIP
    - e.g. Vonage, libretel with 2-stage dialing
- How can the last three scenarios be merged?
- What are the impacts of this merger on naming, addressing and numbering?

# PSTN via IP to PSTN

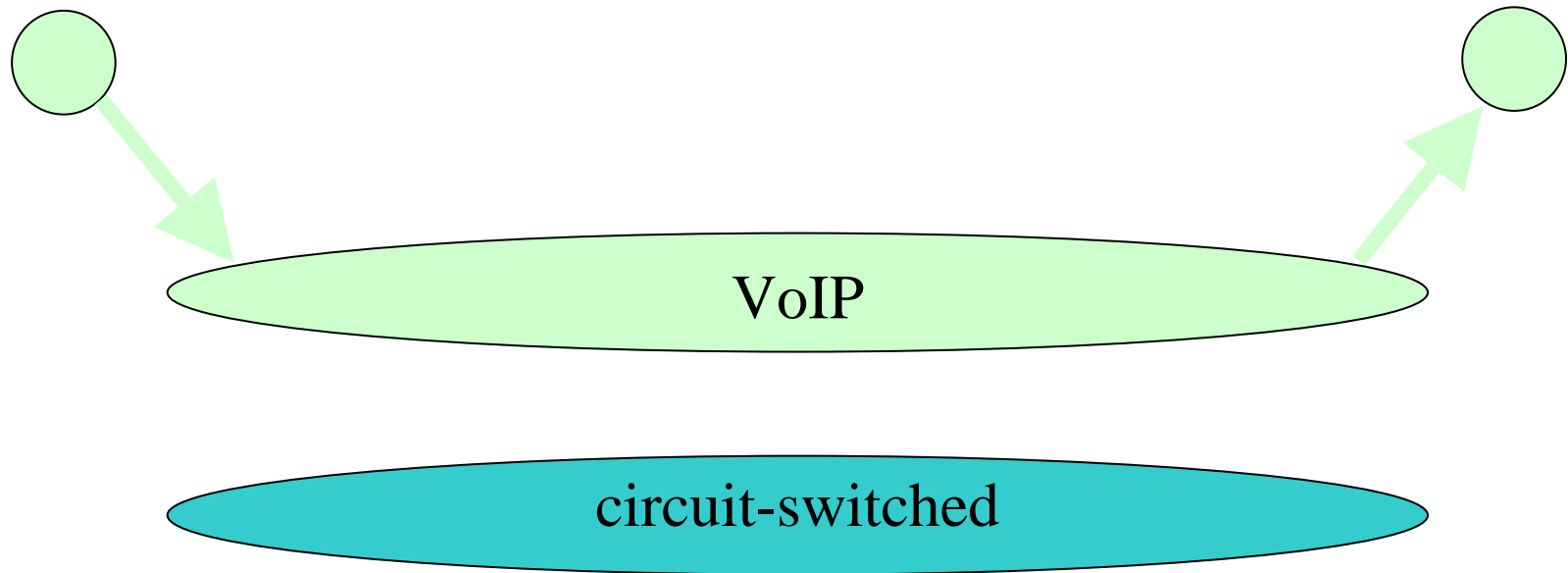
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By-Pass



# IP Communications to IP C.

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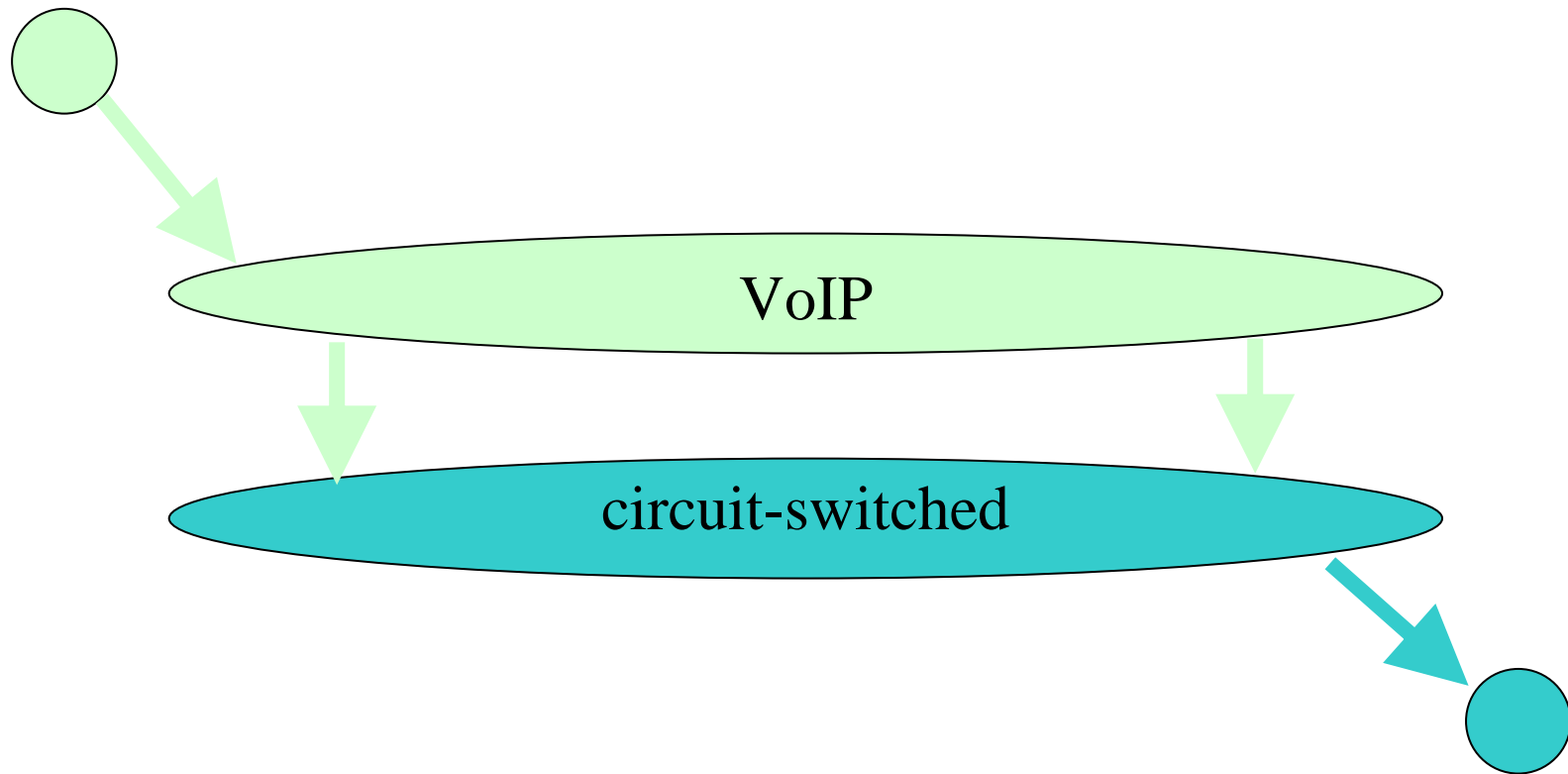
# IP Communication to IP C.

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- Naming and Addressing is done by Internet means:
  - usage of IP addresses, URIs and alphanumeric UserIDs
  - if you stay within an Administrative Domain (AD), you use a name (UserID) e.g. richard, marc or frank
  - if you access another AD, you use an URI (Address-of-Record) e.g. richard@aol.com
- SIP Servers translate URIs to Contact Addresses and the DNS translate these finally to IP addresses
- The problem:
  - you soon run out of UserIDs like richard, marc and frank

# IP C. to PSTN/ISDN

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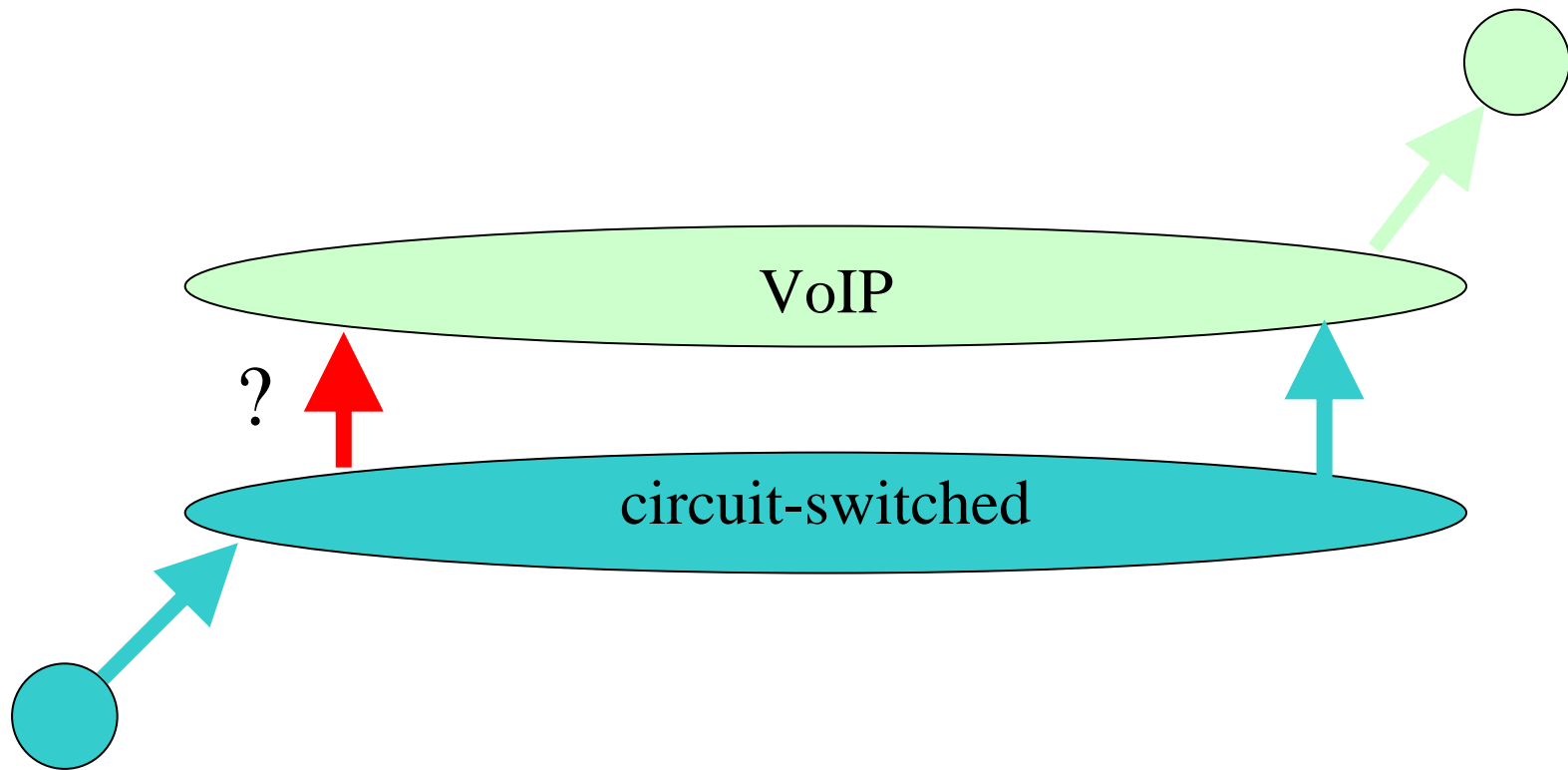
# IP C. to PSTN/ISDN

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- This is easy
- Provided you have an outbound VoIP/PSTN gateway
- you just enter a phone number
  - either in a mutually agreed dialing plan or
  - in the international format +4317978032
- The PSTN is doing the rest
- The problem:
  - The call may not be routed as long as possible on the Internet, incurring long distance charges
  - If the call finally terminates on the Internet, so you may also not have an optimal routing (again cost, but more important: QoS)

# PSTN/ISDN to IP

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# PSTN/ISDN to IP

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- This is a problem
  - 2-stage dialing is not very elegant
- Internet names and addresses are not recognized by the PSTN/ISDN
  - So you need a phone number attached to an Internet Name (AoR)
- The phone number needs to be recognized by the PSTN/ISDN to be routed to a VoIP Gateway
- The phone number needs to be translated to an Internet name (URI – AoR) e.g. with ENUM

# Interlude

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- What happened in the meantime in the administrative domains featuring UserIDs like richard, marc and frank?
  - The second and all other Richards got e.g. RichS, SRich and Rich1234
- in addition, IP phones, "ATAs" and "WiSIP" phones got popular featuring numeric keypads
  - so numeric UserIDs appeared: e.g. 8781@iptel.org, 16421@fwd.pulver.com
  - this "phone" numbers can be dialed directly (like private numbers)
  - Note also: private networks (PBX) migrating to IP use numeric UserIDs as aliases for user convenience in any case
- What about dialing the host part iptel.org on IP phones?
  - Surprise, suprise, cross trunking as used in private networks was re-invented
  - you now dial e.g. \*\*478 8781 to reach 8781@iptel.org from FWD
- The problem:
  - more then 10 to 20 cross connections in one domain are not feasible
- **so a global solution is needed**

# The following solutions have been proposed:

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1. Standardize (centrally manage) the prefixes  
or
2. Create a new numbering and dialing plan for IP  
Communications  
or
3. Use an existing resource = E.164
  - Since this is the way all PBXs migrating to IP will  
(and have to) go anyway
  - The proposal is to implement 3.:
    - **obtain an E.164 number range  
(stub number+DDI range)**
    - **allocate DDI "extensions" as userids**
    - **export the fully qualified numbers in ENUM**

# ENUM as glue

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- An URI (AoR) entered in an ENUM domain related to an E.164 number allows you:
  - to reach any destination on IP from the PSTN/ISDN
    - requirements on the PSTN/ISDN see next slide
  - to reach any destination on IP directly from IP
    - by dialing the full E.164 number as default
    - dialing local numbers and cross connections is still possible
    - if a proper numbering and dialing plan is used
      - see I-D: draft-stastny-enum-numbering-voip-00.txt
- and to reach any destination existing only on the PSTN
  - but only calls to numbers not found in ENUM are routed via the PSTN

# So which E.164 Numbers to use?

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- National Geographic Numbers
- National Non-geo Numbers for Private Networks
- National Non-geo Mobile and Personal Numbers
  - National Non-geo Numbers for IP Telephony
  - National Non-geo Numbers for ENUM
- Global Personal (Mobile) Numbers (87810 UPT)

# What is required on the PSTN/ISDN?

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1. Numbers both on the PSTN/ISDN and in ENUM (opt-in)
  - Calls originating on IP are routed directly on IP
  - Calls originating on the PSTN are routed and terminated on the PSTN
2. Numbers ported out (locally) to VoIP providers
  - Calls originating on IP are routed directly on IP
  - Calls originating on the PSTN are routed on the PSTN and terminated on IP
3. Numbers routed directly to IP via ENUM
  - "Personal Mobile Number" ranges are assigned for this purpose
  - If significant enough (max 7 digits), they may be recognized early
  - and routed to the nearest VoIP ENUM-enable gateway
  - e.g. +87810, +43723, ...



# VISIONng, ENUM and UPT +87810

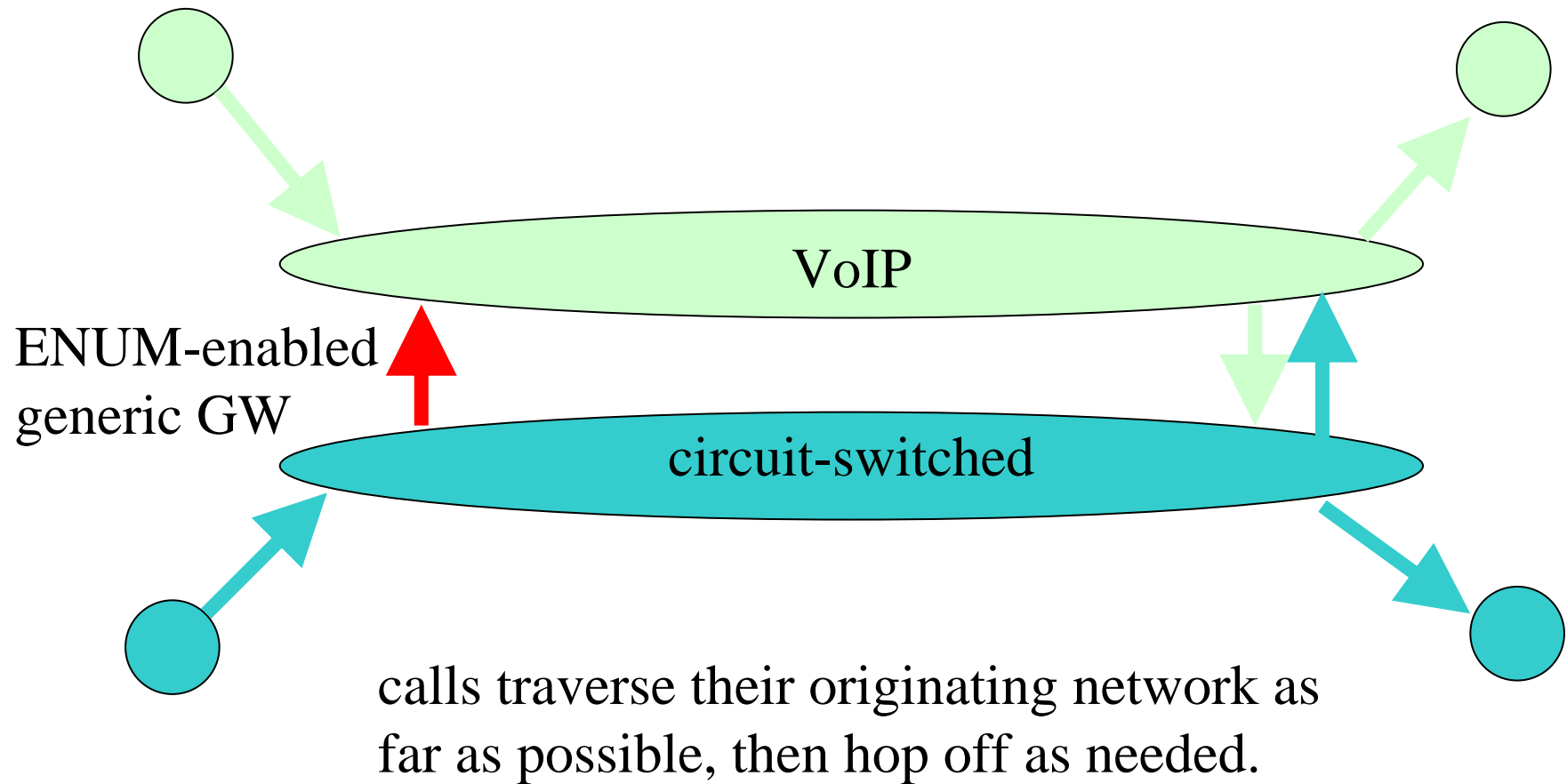
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- The VISIONng Assoc. was founded in 2001
- The mission of VISIONng is to provide a framework for the deployment of worldwide inter-domain and multi-vendor IP Communication Services based on international standards.
- ITU-T has assigned a part of the country code for UPT to VISIONng for deployment of an Universal Personal Telecommunication Service:

+878 10

- In May 2002 VISIONng requested an ENUM delegation from RIPE NCC for trial purposes and got approval from ITU-TSB
- This VISIONng ENUM Trial was implemented in parallel to the Austrian ENUM Trial within +43
- In October 2003 VISIONng requested a permanent delegation in e164.arpa from ITU-T and got approval from ITU-T SG2.
- VISIONng is planning commercial deployment in 2004.

# Evolution Roadmap by SBC



# What is required on IP?

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- ENUM enabled VoIP Gateways (exist)
- ENUM enabled IP-PBX (exist)
- ENUM enabled SIP proxies and H.323 gatekeeper (exist)
  - and/or
- ENUM enabled IP phones and soft clients (exist)
  
- Number ranges for residential users (under discussion)
- Number ranges for corporate users (exist partially)
  - see next slide for the options

# Options for corporate users

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- Assumptions:
  - the company has already an E.164 number, a private numbering plan and a mapping of this private numbering plan to the E.164 number with DDI
  - The company migrates to IP Communications, connects to the Internet, but keeps the PSTN/ISDN connection
- Step1: Opt-in in ENUM with existing number
  - e.g. ÖFEG +43179780-32 (2 digit DDI)
  - calls from IP use ENUM, calls from PSTN use PSTN access
- Step2: Use in addition an ENUM-enabled number
  - e.g. ÖFEG +8781063334281-32 (2-digit DDI) or +437802345-32
  - calls to this number from the PSTN are routed to IP directly
- Step3: Port out the geographic number to IP
  - dump the PSTN access, use common VoIP gateway from provider
  - calls from IP may use any number, calls from the PSTN may prefer +87810 but may still use +43179780-32



# Large Scale IPC Trial at43

- Large Scale Trial on IP Communications using ENUM
- University of Vienna ~100.000 Students
  - re-use of existing student account credentials via RADIUS
  - iptel.org SIP Express Router as SIP proxy with call routing, ENUM processing, PSTN interworking
  - some functions based on Asterisk open-source IP-PBX:
    - voice-mail, conference bridge, IVR,
  - PSTN Connection: CISCO 5300 PSTN/ISDN Gateway with PRA
  - Various Soft- and Hard-phones, WiFi-Phones, ...
  - IP Connection to other universities, communities and "IP-PBX"
  - Applications: Crash test for VoIP, Chat, IM, Presence, **SMS, use of SIM-Cards...**
- IP calls free, PSTN->IP calls by caller; IP->PSTN with call-by-call accounting
- Naming, Numbering and Addressing with ENUM
  - Base: sip:<student-id>@sip.univie.ac.at
  - Austrian number for private networks: +43 59966 nnnnnn
  - global UPT number: +87810 2843 nnnnnn

ORIGIN 6.6.9.9.5.3.4.e164.arpa.

\* NAPTR 100 10 "u" "E2U+sip" "!"^¥¥+4359966(.\*)\$!sip:¥¥1@sip.univie.ac.at!" .

# The End

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**Thank you for  
your attention**

*Contact (not Content) is King*