

ENUM

Linking the VoIP Islands together

The Future of VoIP

ISOC.nl and AG Next

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* The opinions expressed here may or may not be that of my company

- What is ENUM?
- How does it work?
- International Status
- ENUM Use Cases
 - ENUM for enterprises
 - ENUM enabled numbers
 - ENUM for ported numbers
- The Future of ENUM

- The Internet is (or is intended to be) a network without central intelligence → a stupid network
- The Internet is based on the end-to-end principle
 - Every user may reach any other user via the IP address
 - All “services” may be offered anywhere and may be accessed from everywhere
 - This is of course also valid for voice and other communication “services”
- Voice and other communications do not need a “service” provider at all, they are applications.
 - Jon Peterson, ITU-IETF NGN Workshop, Geneva, May 2005

- Routing on the Internet for IP Realtime Communications (and other “applications”) is done with Uniform Resource Identifiers (URI)
 - by resolving them via the DNS to globally reachable and unique IP-addresses
- Routing on the PSTN is done with phone numbers (globally reachable and unique E.164 numbers)
- E.164 numbers cannot be routed on the Internet natively, they need to be translated first to URIs
 - which in turn are translated to IP addresses
- This is done by a mapping database e.g. **ENUM**

- Electronic or E.164 NUMber mapping is defined by the Internet Engineering Task Force (IETF) in RFC3761 as:
- **the mapping of „Telephone Numbers“ to Uniform Resource Identifiers (URIs) using the Domain Name System (DNS) in the domain e164.arpa**
 - URIs are used to identify resources on the Internet (e.g. <http://enum.nic.at>)
- The purpose of ENUM is to enable the convergence between the PSTN and the Internet

- take an E.164 phone number

+43 720 203 211

- turn it into a FQDN

1.1.2.3.0.2.0.2.7.3.4.e164.arpa.

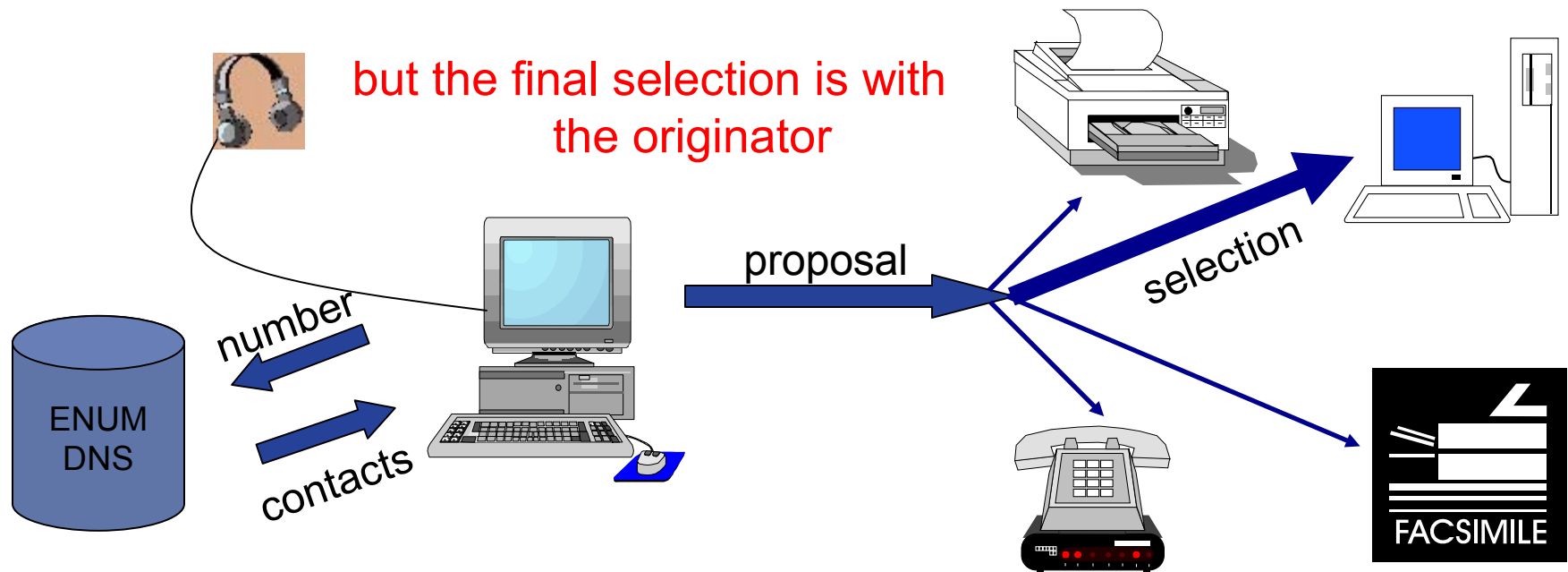
- query the DNS (for NAPTR)

- returns list of URIs

sip:richard.stastny@iphone.at
mailto:richard.stastny@oefeg.at
sms tel:+436644204100

```
IN NAPTR 100 100 "u" "E2U+sip" !^.*$!SIP:richard@iphone.at! .
```

- It's there ...
- It works...
- It's global...
- It scales...
- It's reliable...
- It's open...
- Anyone can use it...



The result of an ENUM DNS query are the contact methods and the preferred order

- The basic idea of ENUM was
 - to allow **end-users**
 - to **opt-in** with their **EXISTING** phone-numbers on the PSTN
 - into **e164.arpa**
 - to provide **OTHER end-users** with the capability
 - to look up contact **URIs** on the **Internet** the above end-user wants to **link** to this **number**
- This approach has some draw-backs (as we found out in Austria)

- 1999 – IETF ENUM WG formed
- 2000 – IETF ENUM WG – RFC2916
- 2001 – Int. and nat. workshops (ITU-T, Europe, US, Asia, ...)
- 2002 – ITU -T Interim Procedures (IAB, RIPE-NCC)
 - ETSI TS 102 051 "ENUM Administration in Europe"
 - National Consultations and ENUM–Trials started (Austria)
- 2003 – ETSI TS 102 172 "Minimum Requirements for Interoperability of European ENUM Trials"
 - more national ENUM–Trials joined
- 2004 – ETSI ENUM Workshop (Feb 2004)
 - IETF new RFC3761
 - Enumservices registration at IANA ongoing
 - US LLC for CC 1 formed
 - 1st commercial ENUM service worldwide in Austria
- 2005 – ETSI TS 102 172 V2 "Minimum Requirements for Interoperability of ENUM Implementations" published
 - ETSI TR 102 055 "Infrastructure ENUM" published
 - ENUM-driven number range opens in Austria (+43780)
- 2006 – ?

Delegations in e164.arpa as of today

- 31 Netherlands
 - 33 France Trial
 - 353 Ireland
 - 354 Iceland
 - 358 Finland Trial
 - 36 Hungary
 - 374 Armenia
 - 40 **Romania**
 - 41 Switzerland
 - 420 Czech Republic Trial?
 - 421 Slovakia Trial?
 - 423 Liechtenstein Trial
 - 43 **Austria**
 - 44 UK Trial
 - 46 Sweden Trial
 - 47 Norway
 - 48 **Poland**
 - 49 Germany Trial
 - 246 Diego Garcia
 - 247 Ascension
 - 290 **Saint Helena**
 - 55 Brazil
 - 61 Australia Trial
 - 63 Philippines ?
 - 66 Thailand
 - 65 Singapore Trial
 - 82 Korea Trial
 - 86 China Trial
 - 88234 Global Networks ?
 - **87810 VISIONng UPT**
 - 971 UAE
 - 1 North America soon to come?
 - additional Asian countries (Japan, Taiwan...) have trials, but not in .arpa
- <http://www.ripe.net/enum/request-archives/>
<http://www.centri.org/kim/enum/index.html>

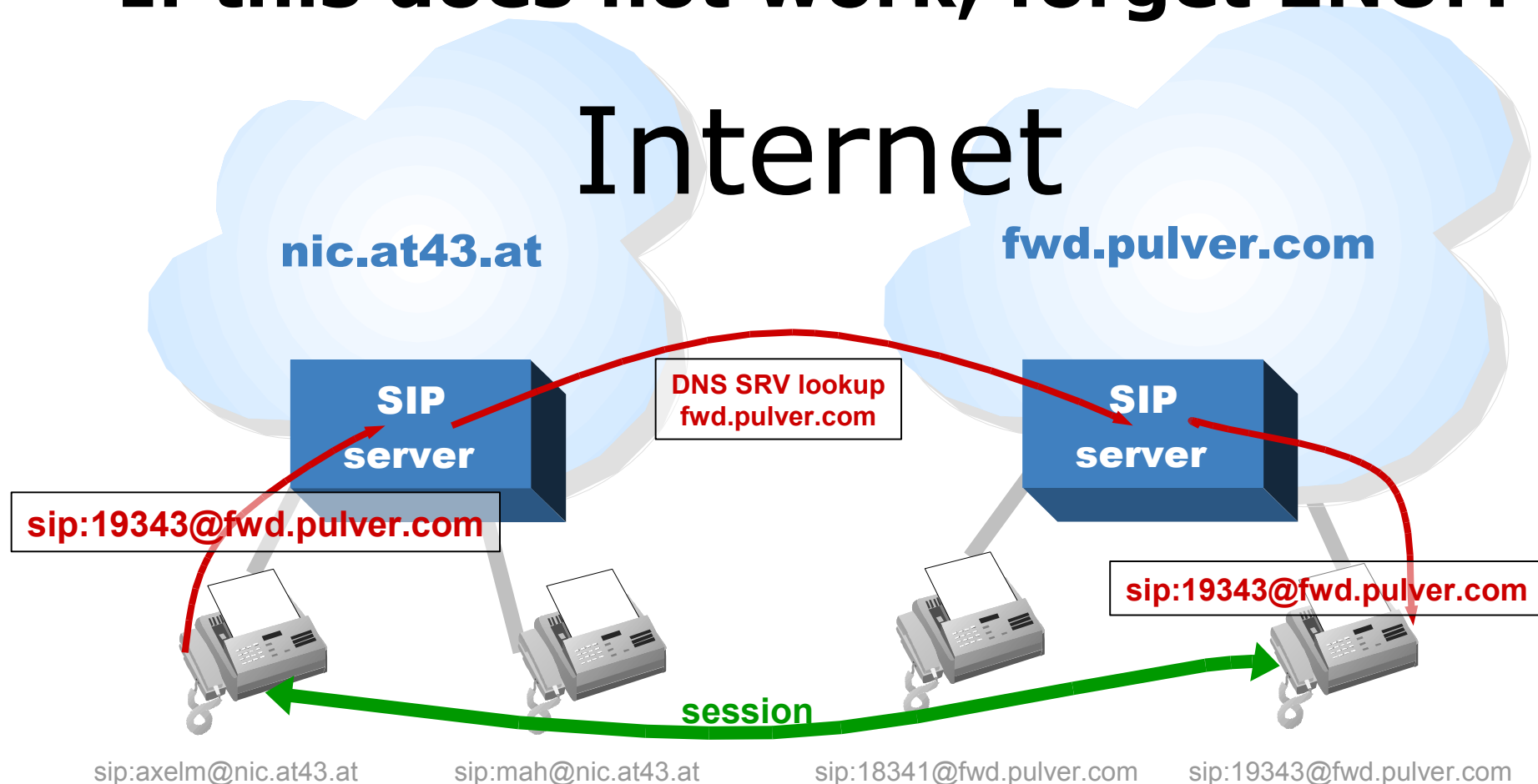
- The trial started in September 2002
- The commercial service started December 2004 for
 - Geographic, mobile, corporate, nomadic (720) and free-phone (800) numbers
- On 17. May 2005 the ENUM enabled number range 780 was added
- To subscribe, you may use any registrar providing this number range (see www.enum.at) e.g. www.my-enum.at

- ENUM works, so there is no need for further trials,
- but:
 - the basic idea of ENUM has some drawbacks
- Basic Lesson: – you cannot sell ENUM
 - You can only sell a product or
 - a service (application)
- so new approaches are needed

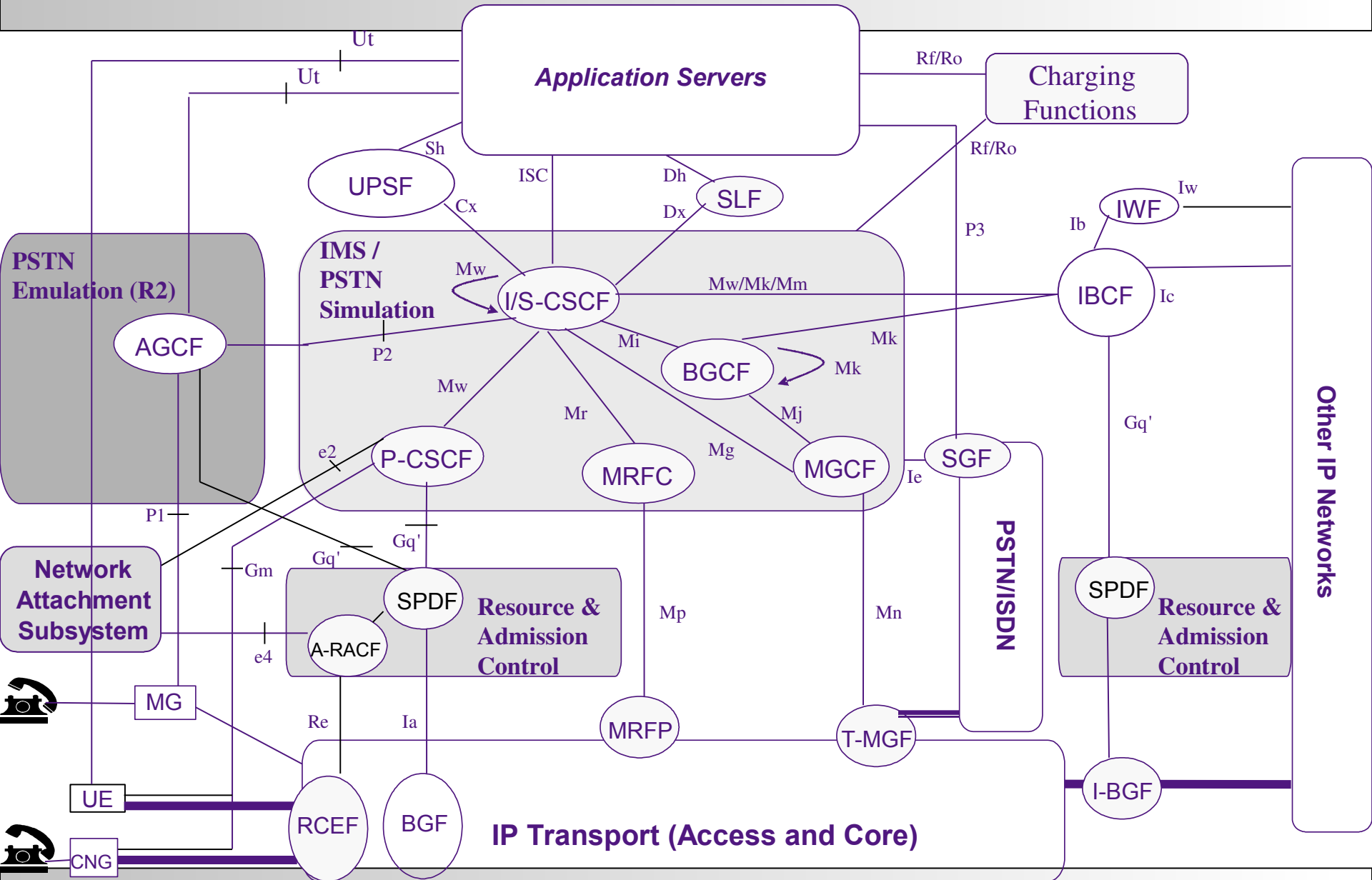
- Privacy concerns reduced the usability of ENUM basically to VoIP,
- **BUT most VoIP providers do not provide end-users with SIP URIs to be reached on the Internet without termination fees**
- Why should an end-user pay for the benefit of other users?
- How to overcome Metcalfe's Law?
- **Nobody understands ENUM**

- A public SIP URI on the Internet
- Any „IP Telephony or VOIP service“
 - not providing a SIP URI and
 - that cannot be reached via the public Internet,
- **cannot be used in ENUM**
- Vonage, Skype cannot be considered as VoIP
 - Vonage is POTSoIP and
 - Skype is an NGN

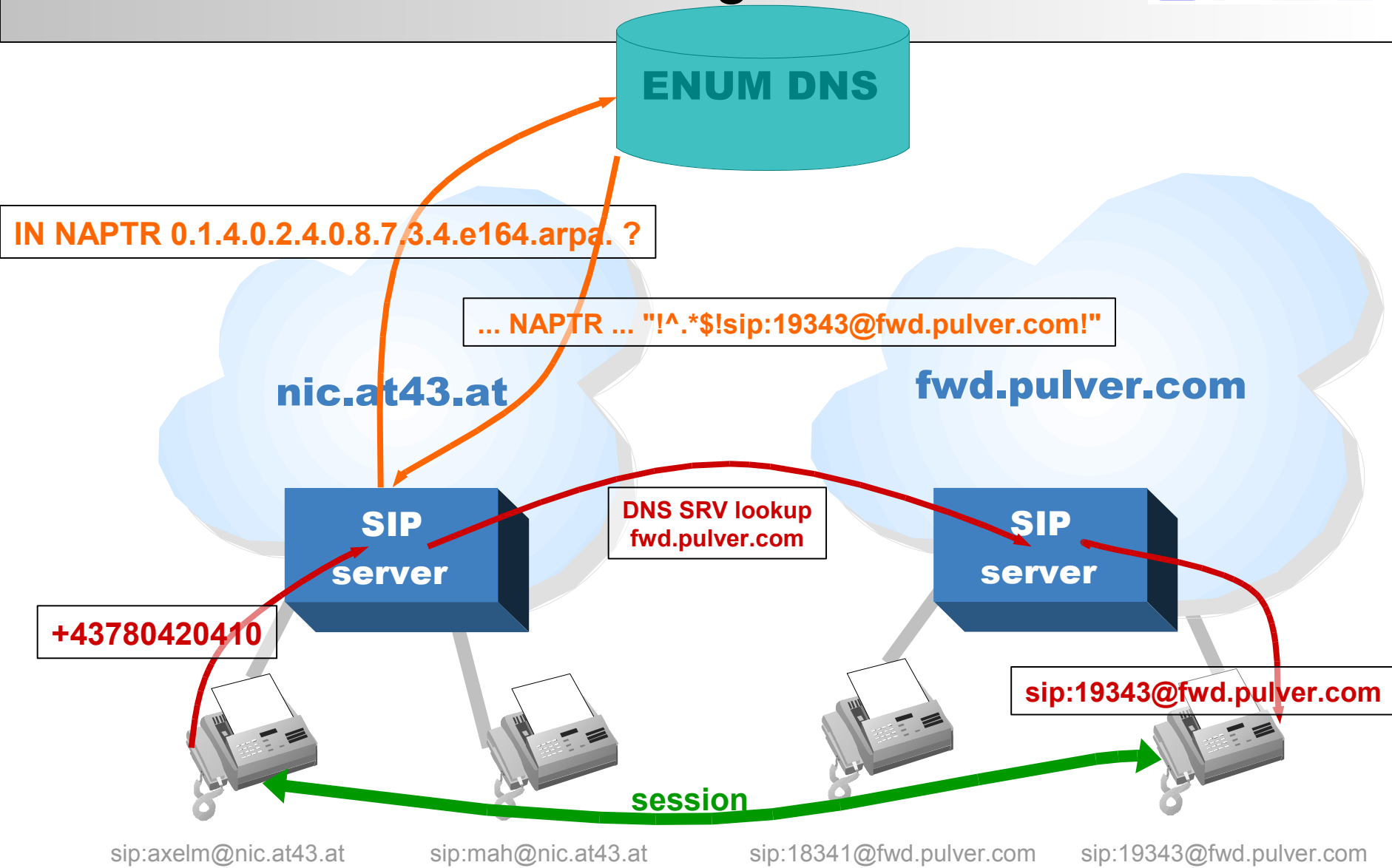
If this does not work, forget ENUM



Overall ETSI TISPAN IMS Architecture – all subsystems



So what is ENUM adding?



- A VoIP provider on the Internet providing you with a SIP URI
- A SIP softclient, a terminal adapter or an IP-phone
- You need to configure them properly
- If you want to use your own domain name, you need a DNS-hosting service providing you with the possibility to host SRV records.
- **You need your national regulator to opt-in to ENUM**
- **Your regulator has not done this yet? - Then there is no-way to use ENUM with your national number**
- You need to find a Registrar in this country
- You have to put all these pieces together by yourself
- Now you have to sit and wait, hoping that somebody will call you with an ENUM enabled device, or using a provider supporting ENUM look-ups
- **BTW, is your provider from above doing ENUM look-ups?**
- Calls from the PSTN will still terminate on your primary line
- Only calls from the Internet terminate on your IP device

... except some well-known nerds

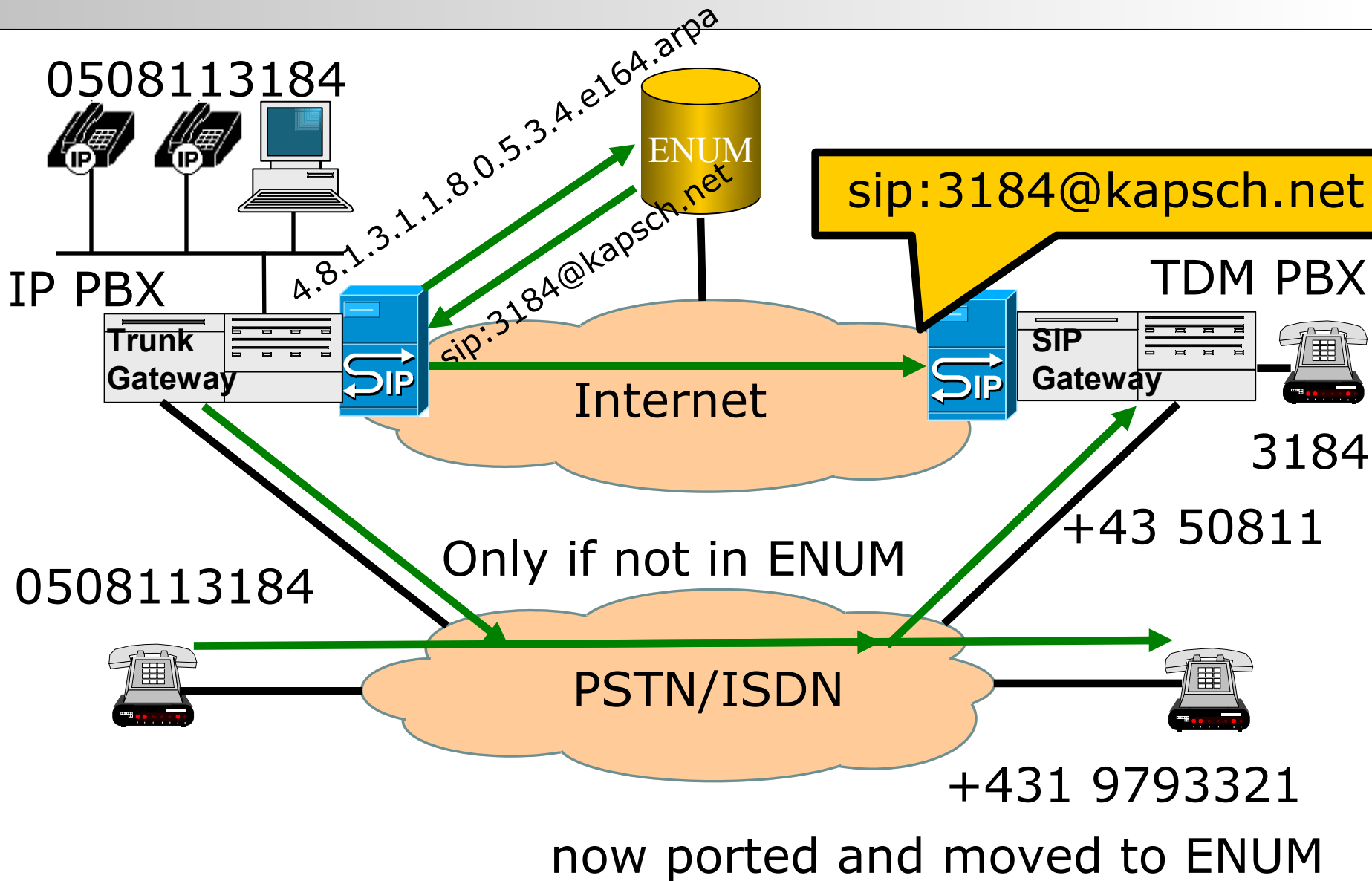
→ So new approaches to ENUM are needed

- Because nobody understands it
 - you can only sell a service or a product a customer understands
- What you **can** sell is:
 - a product to an enterprise (or a nerd)
 - a service to ... – residential users
- You have to bundle ENUM into a product or a service (application)
- e.g. a VoIP (IP Communications) product or service (application)

- ENUM for IP-based private networks ("PBX" and "IP-Centrex") with direct-dial-in (DDI) (product)
- ENUM-enabled number ranges for nomadic users (teleworkers and road-warriors, using laptops, PDAs, WiSIP phones and dual-mode devices)
- mobile numbers with validation via the SIM-Card, to be potentially used with dual-mode devices
→ **Fixed Mobile Convergence**
- Geographic numbers (genuine or ported) for virtual VoIP providers (also for nomadic and/or mobile use)
- residential users with terminal adapters and FXO ports (product for nerds)

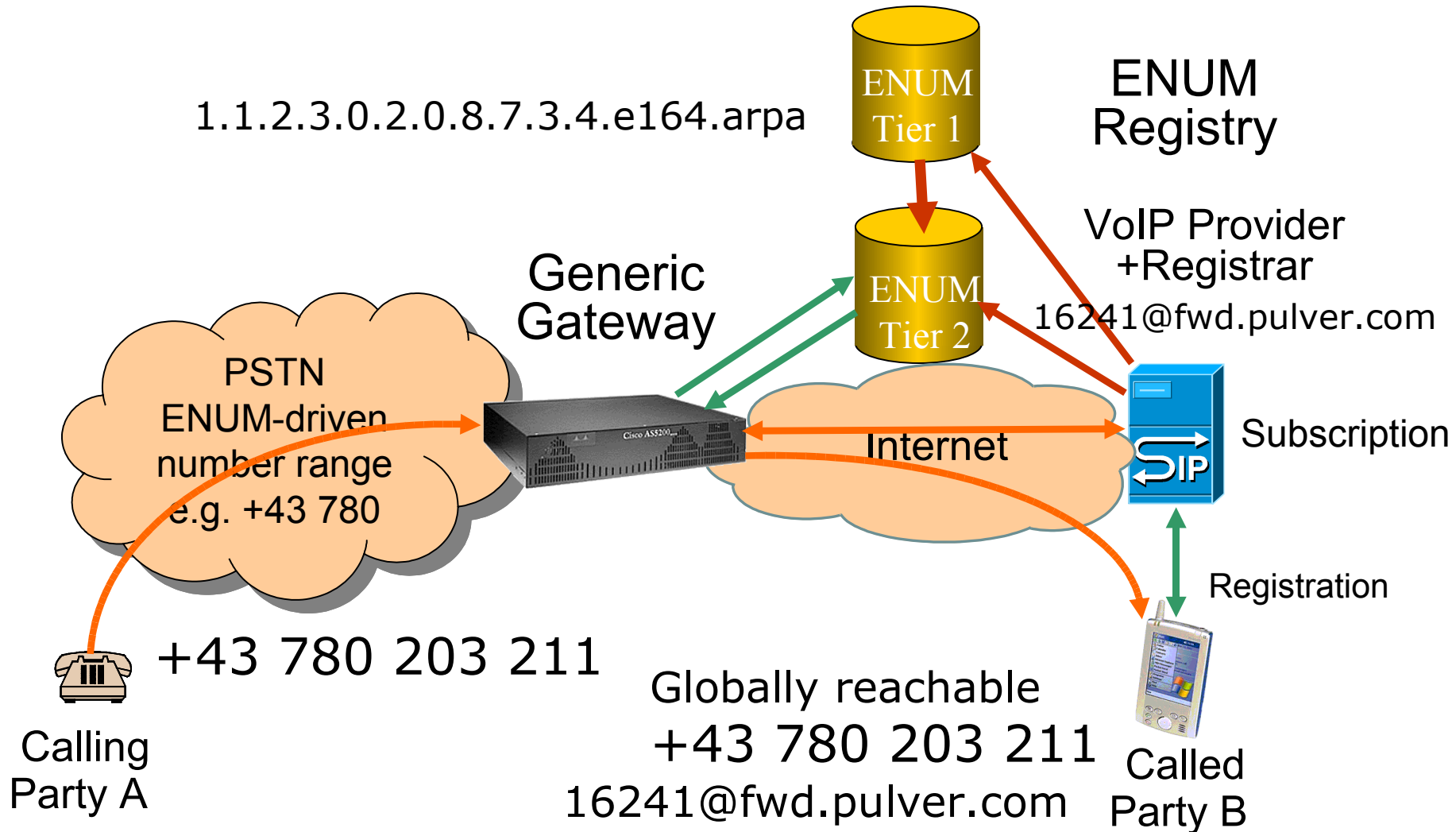
In all these cases the calls are terminated on the same device

One example: ENUM for enterprises



- Format: +43 780 abcdef (ghi)
- the registration of the ENUM domain IS the number assignment
- a cancellation of the ENUM domain will relinquish the number
- easy, cheap, one-step process
- end-user is in control of the ENUM entries
- decoupling of number range allocation and gateway operator
- **any gateway may route the whole number range, just needs to be able to query ENUM**
- any gateway may route similar number ranges (e.g. +87810, +42360, +260510, ...)
- these gateways are called generic gateways (GG)
- **The problem with these numbers is: they are not routed on the PSTN (not immediately)**

Example: +43780 and the Generic Gateway



- Sil.at is providing in one step:
 - A DSL access via an unbundled line
 - A preconfigured Modem, Router, WiFi
 - A preconfigured Sipura to connect your POTS Phone
 - Porting you geo-number to VoIP
 - A SIP URI
 - An ENUM entry for the geo number
 - If you dial an E.164 number, ENUM is checked first
 - Only if no entry is found, the call is forwarded the PSTN
- You get two HW-pieces by mail, connect them and your POTS Phone together and it works
- The only item you need to lookup to get started is the WEP key for WiFi access.

- IP Interconnect (VoIP Peering) required
- User ENUM requires
 - country opt-in
 - end-user opt-in
- Incumbents and other carriers have no say and are not interested
- Is Carrier ENUM a solution?

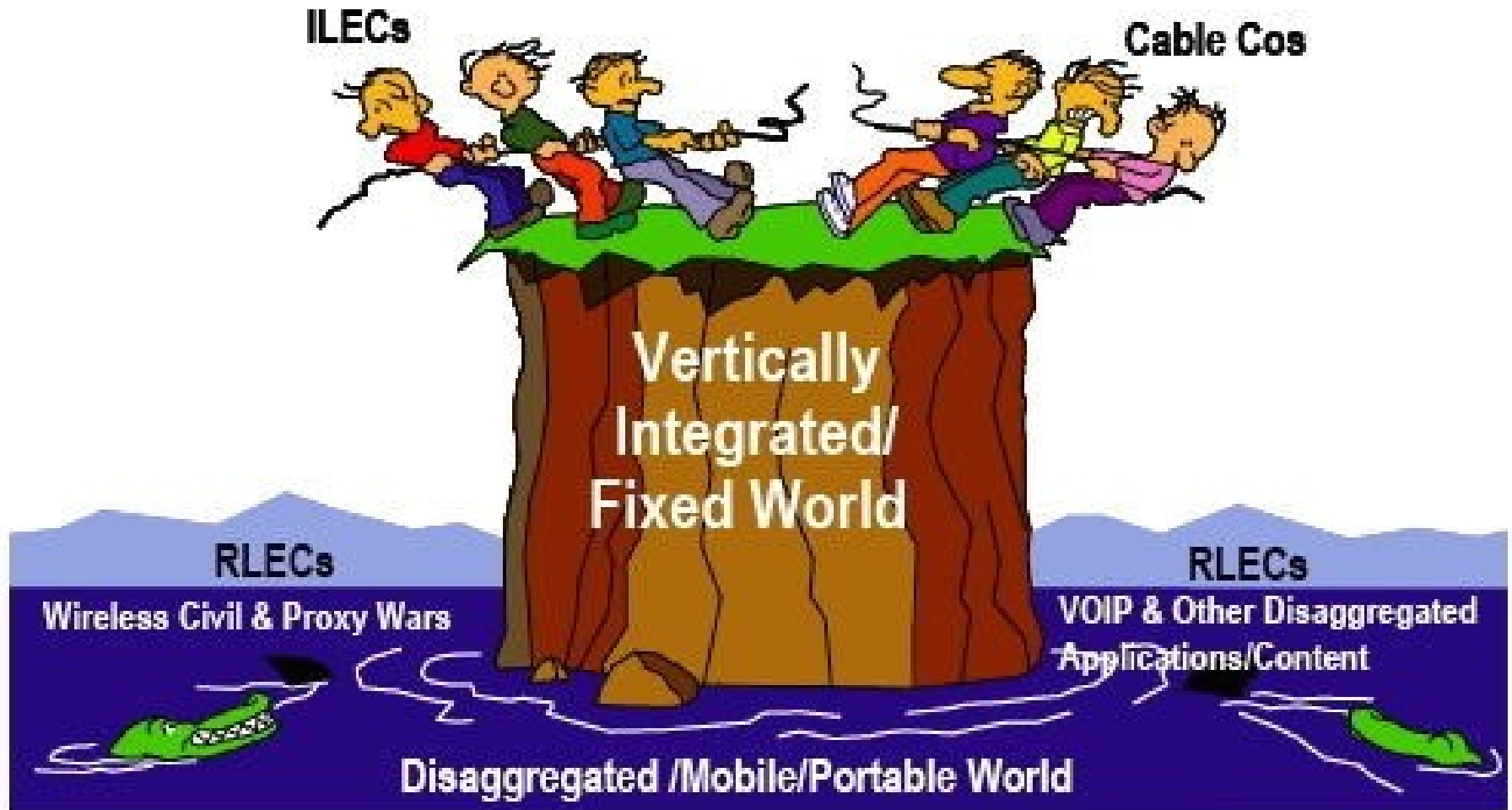
- User ENUM has an additional draw-back: user opt-in
- One basic requirement of user opt-in is that the end-user is understanding what he is doing with ENUM
- Since nobody understands ENUM anyway, you cannot expect the user to understand it.
- In Carrier ENUM there is no user opt-in required, only carrier opt-in
- **And the carriers are knowing what they are doing – or?**

- If we take the All-IP paradigm seriously, we have two basic requirements:
 - Any real-time communication originating on IP and terminating on IP MUST stay on IP end-to-end
 - This implies, it MUST NOT use the PSTN/ISDN to interconnect.
- Benefits are:
 - improved end-to-end functionality (BB codecs, IM, video, conferencing, presence, ...)
 - Improved end-to-end QoS
 - No additional cost beside of IP-access
 - convergence possible at the end-user's device

- VoIP (SIP) is designed to work similar to e-mail
- If you have a SIP URI (an AoR or a public user identity), you may contact the other party.
- The DNS is there to resolve the SIP URI and finally to give you the IP address of the other party
- All protocols are there ...
- So where is the problem?

- There are nice little VoIP islands separated by the rough seas of the Internet (Bermuda Triangle?)
 - They do not trust the Internet
 - They do not trust their users
 - They do not trust each other
 - ...
- Currently they connect via the PSTN with E.164 numbers,
- but now they want also to Interconnect via IP to gain the benefits mentioned

The VoIP Bermuda Triangle



Source: Wachovia Capital Markets, LLC

- they do not want to lose the benefits of the current Interconnect regime
 - trust relationships between carriers
 - control over the media stream
 - bilateral accounting agreements = terminating fees
 - discriminative pricing of the bits in the access and the backbone

- Keep customers in walled gardens („private IP networks“)
- Interconnect only with other walled gardens via direct bilateral links or via another walled garden (extranet)
- But how to route calls between these walled gardens?
- Are “Public User Identities” also accessible by the general public?
- How public is public?

- If Carrier ENUM is intended to allow the mapping of any E.164 number that can be reached on IP to a SIP URI,
- **Carrier ENUM must be in the public DNS.**
- But this is useless, if the resulting SIP URI cannot be reached
- **So for Carrier ENUM also an IP Interconnect (VoIP Peering) regime is required.**
- **ENUM is an applet to VoIP Peering**

1. Non-terminals in Tier 1 of e164.arpa
 - Dead
2. Below e164.arpa
 - c.e164.arpa
 - Requires ITU-T TSB involvement (min 1 year)
 - Definition of rules a national matter -> NRA opt-in (e.g. what is a carrier?)
 - c.3.4.e164.arpa
 - No ITU-T TSN involvement
 - Definition of rules a national matter -> NRA opt-in
 - **Can be implemented today**
3. Other domain – e164c.arpa, e164enum.net,
 - No involvement of regulators
 - Carriers not dependent on NRA opt-in
 - Requires global agreement on domain sponsor and operator = a super GSMA?
 - **Who defines globally what a carrier is?**
 - **Could have been done since 2 years**

- to be reachable via ENUM, an end-user needs a URI resolvable on the Internet (e.g. SIP AoR), provided:
 - by himself (DIY)
 - by his corporation
 - by a virtual VoIP provider
- a carrier hosting a subscriber with an E.164 number within his network MAY provide this subscriber with an URI (or he may not)
- if this is the case, the user may be reachable both via User ENUM and Carrier ENUM
- the carrier may also lookup User ENUM on behalf of his subscriber first, then lookup the Carrier ENUM and finally may route the call via the PSTN
- **so ENUM may co-exist with other routing mechanisms**

- (User) ENUM in e164.arpa is designed according to the end-to-end principle of the Internet to be used by end-user applications
- Infrastructure/Carrier ENUM is intended to be used by providers for offering „services“
- Both implementations will co-exist for some time
- Which flavor of ENUM will finally succeed will be decided somewhere else:
- The end-user will decide if he wants to use applications on his device or services in the network
- The final outcome of the battle between the horizontal layered Internet model and the vertical NGN model is still open, but the trend is going in the direction of horizontal layered Internet model
- **Or ENUM may be completely dead**
=> E.164 is dead
- **=> Skype://richard.stastny**

Thank you

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<http://voipandenum.blogspot.com>