

Lessons Learned

from Trials and Implementations

Future Directions

Denic.de

ENUM Tag

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

- The Future of User ENUM in e164.arpa?
 - The basic idea
 - The problems
 - New approaches are needed
 - The benefits
 - Examples
- Future Directions for Carriers (whatever that is)
 - The Internet Architecture
 - IP Interconnect (VoIP Peering)
 - The Walled Gardens
 - An example from NGN IMS 3GPP
 - Public User Identities?
 - Why Carrier ENUM? What is required by Carriers?
 - The other ENUMs
 - Public Carrier ENUM – the options
 - Is co-existence possible?
- Open issues, discussion

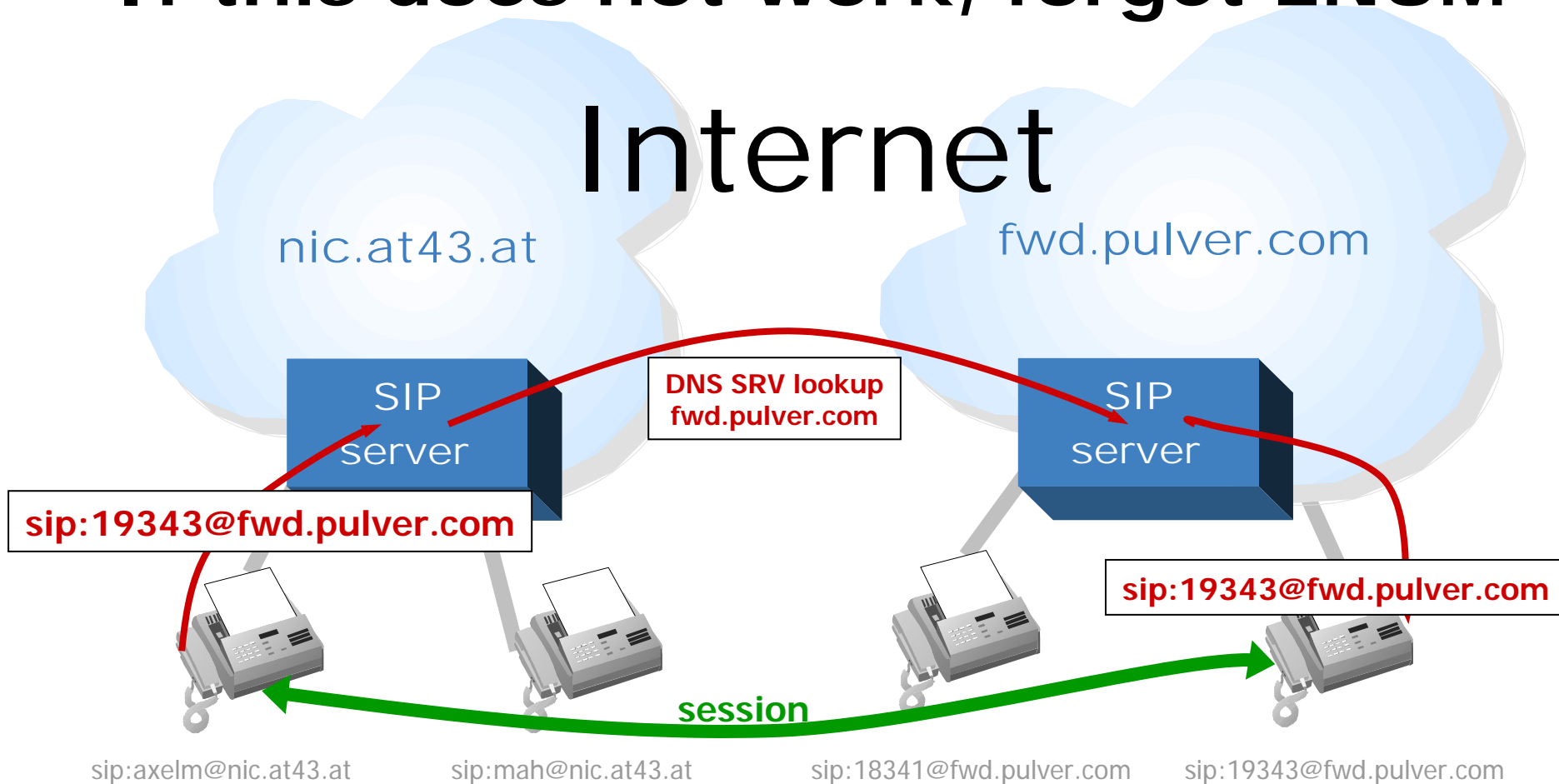
- The basic idea of ENUM has some drawbacks
- Basic Lesson: – you cannot sell ENUM
 - You can only sell a product or
 - a service (application)
- so new approaches are needed

- 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 first user wants to **link** to this **number**
- This approach has some draw-backs

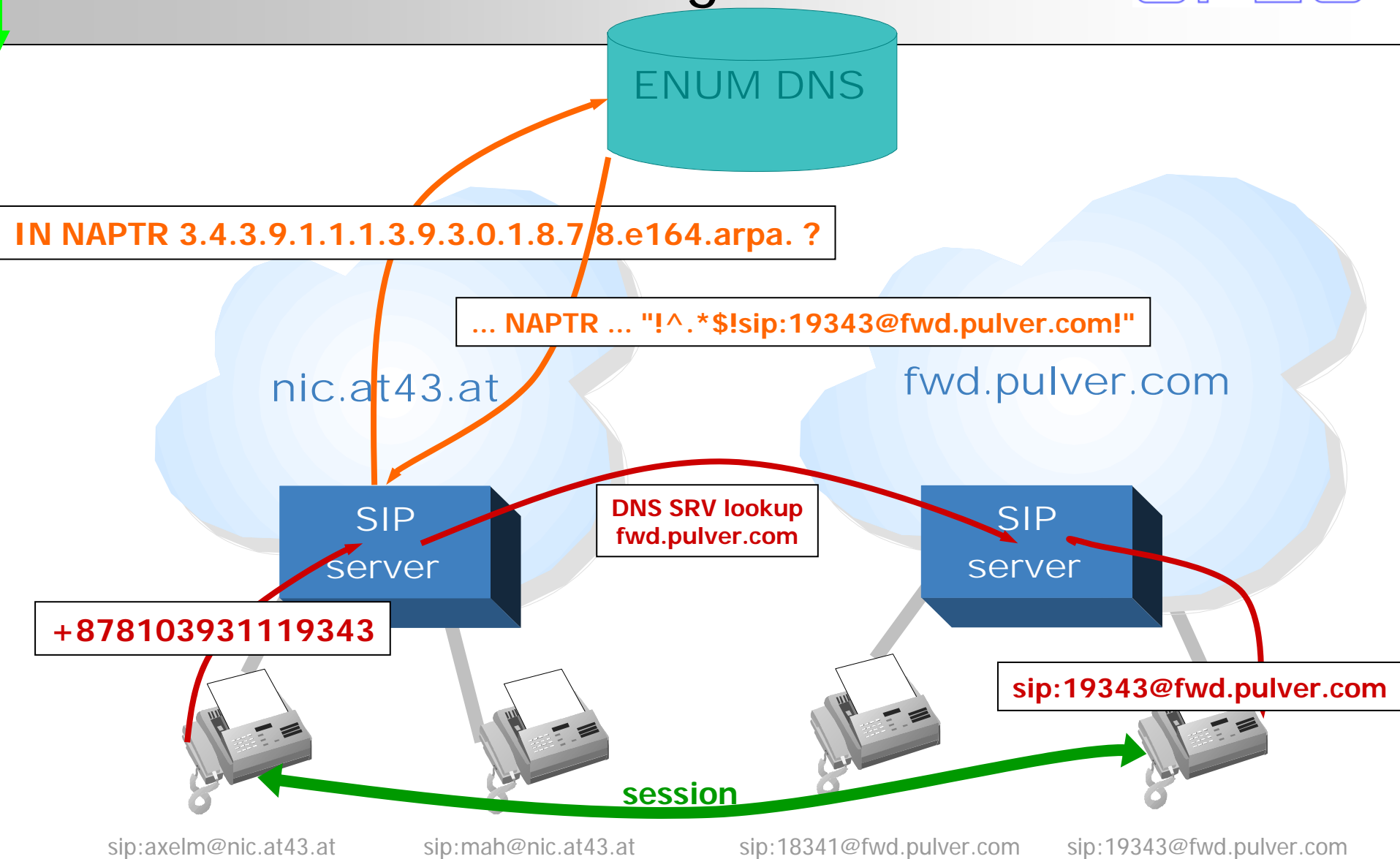
- Privacy concerns reduced the usability of ENUM basically to VoIP,
- **BUT most VoIP providers do not provide end-users with SIP URIs to be reached on the Internet without termination fees**
- Why should an end-user pay for the benefit of other users?
- How to overcome Metcalfe's Law?
- **Nobody understands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

If this does not work, forget ENUM



So what is ENUM adding?



- A virtual VoIP provider on the Internet providing you with a SIP URI
- A SIP Softclient, Terminal Adapter or an IP-phone
- You need to configure it 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

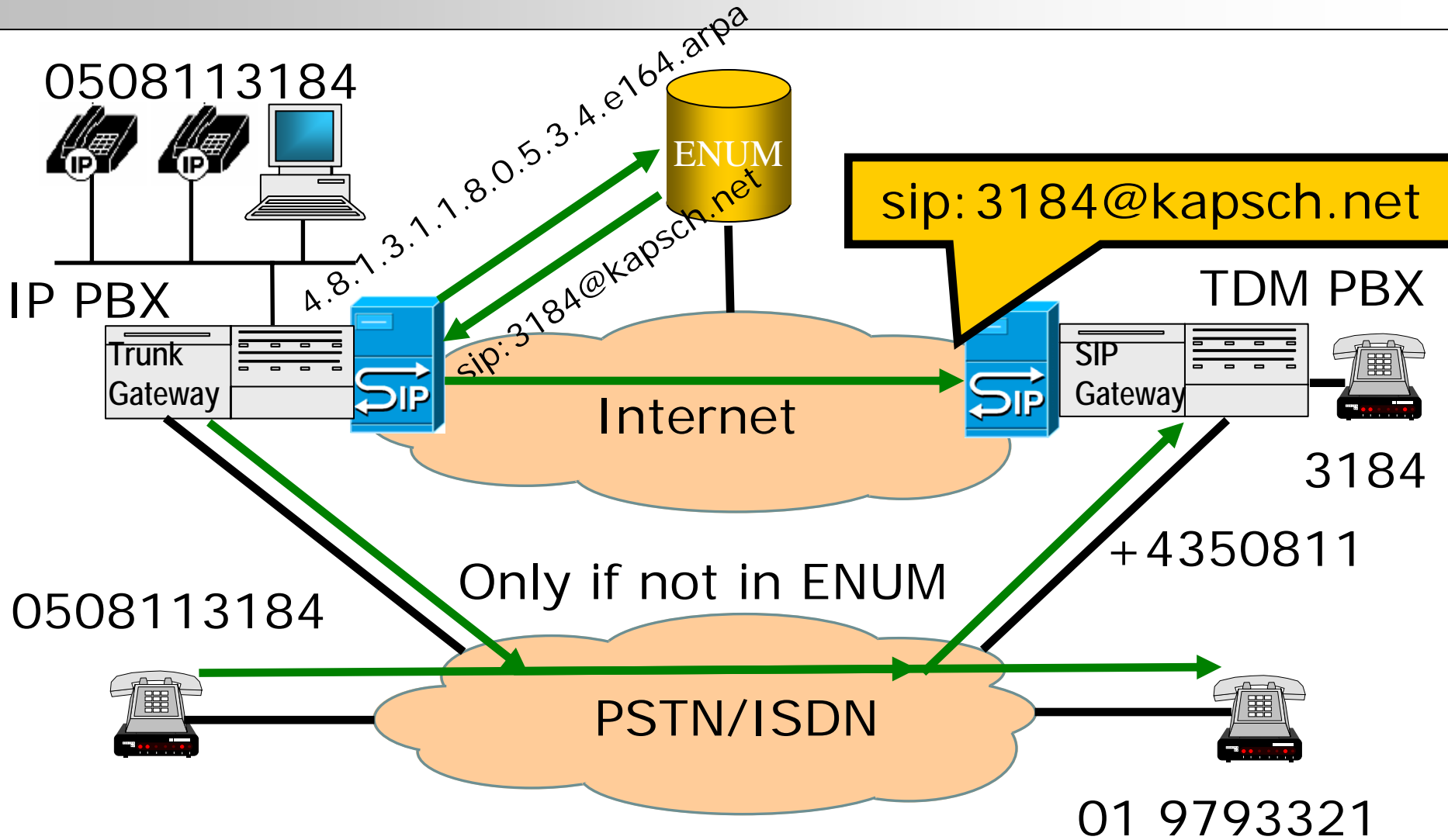
- Because nobody understands it
 - you can only sell a service or a product a customer understands
- What you **can** sell is:
 - a product to an enterprise (or a nerd)
 - a service to idi.. – residential users
- You have to bundle ENUM into a product or a service (application)
- e.g. a VoIP (IP Communications)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

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

- **Any connection that originates on IP and terminates on IP stays on IP end-to-end**
 - No additional cost for PSTN by-pass
 - Improved QoS for native IP connections
 - improved functionality (IM, Video, Conferencing, presence, ...)
- Reachability from the PSTN is either provided via dedicated gateways:
 - for enterprise PBX (example 1)
 - for ported numbers (carrier gateway example 3)
- or via generic gateways
 - for ENUM enabled numbers (example 2)

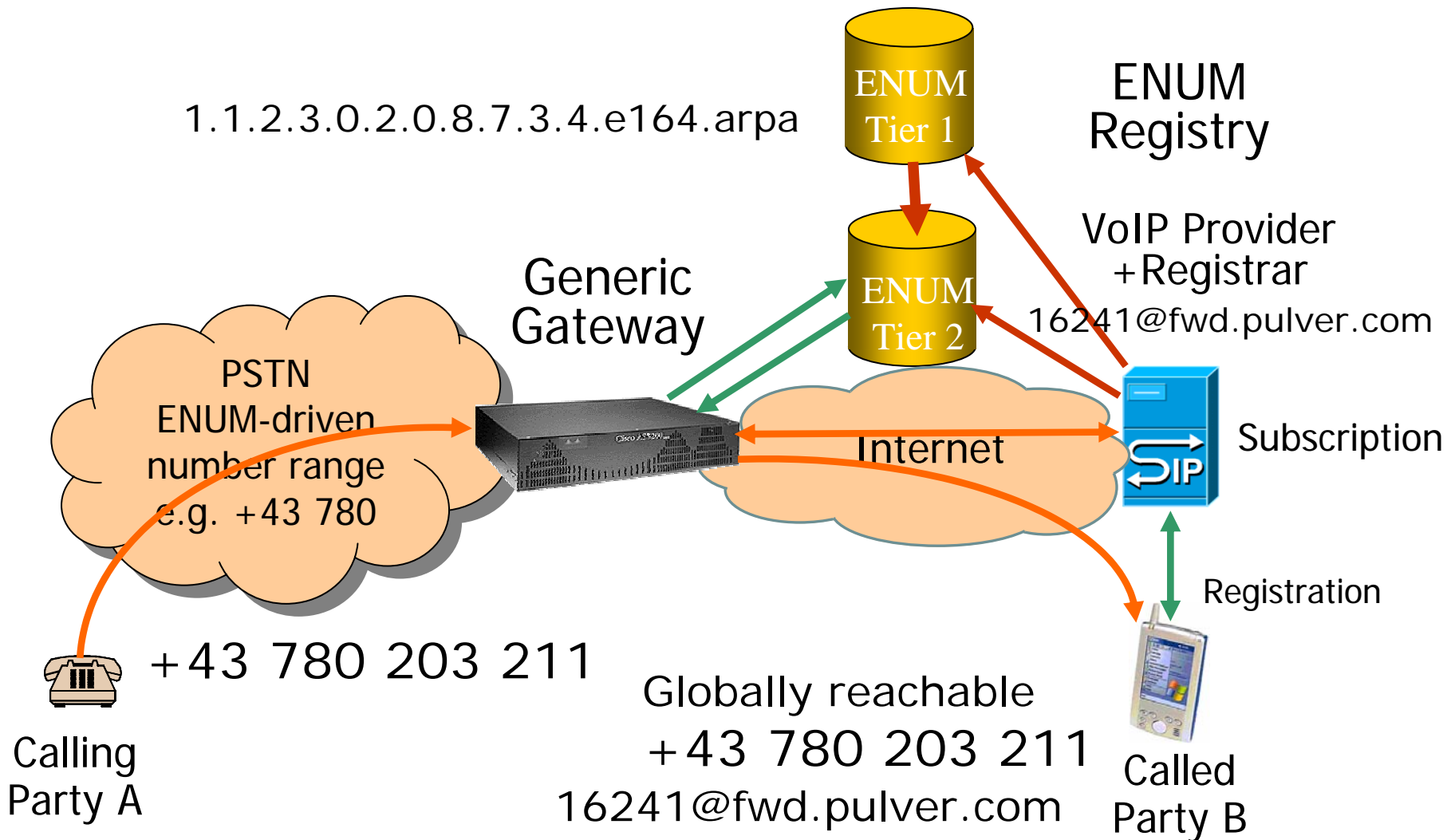
One example: ENUM for enterprises



ENUM-enabled Number Range

- 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
- You get in addition all info to change the configuration, but the only item you need to lookup to get started is the WEP key for WiFi access.

- Future Directions
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- 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 is done with URIs
 - by resolving them via the DNS to IP-addresses
- Routing on the PSTN is done with phone numbers (globally unique E.164 numbers and others)
 - The routing on the PSTN is done by analyzing the structure of the number in different networks e.g. by using transit networks
- E.164 numbers cannot be routed on the Internet natively, they need to be translated first to URIs
- This is done by a mapping database e.g. ENUM

- If we take the All-IP paradigm serious, 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

- 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?

- Some citations from ETSI TS 123.228 V6: IMS Stage 2 Service Description:
 - This document defines the stage-2 service description for the IP Multimedia Core Network Subsystem (IMS), which includes the elements necessary to support IP Multimedia (IM) services.
 - This document identifies the mechanisms to enable support for IP multimedia applications.

- Every IM CN subsystem user shall have one or more Public User Identities.
- The Public User Identity/identities are used by any user for requesting communications to other users.
- **For example, this might be included on a business card.**
- Both telecom numbering and Internet naming schemes can be used to address users depending on the Public User identities that the users have.
- The Public User Identity/identities SHALL take the form of
 - a SIP URI (as defined in RFC 3261 and RFC 2396)
 - or the "tel:" URI format RFC 3966.

- The CSCF, BGCF and MGCF nodes shall be identifiable using a valid SIP URI (Host Domain Name or Network Address) on those interfaces supporting the SIP protocol.
- These SIP URIs would be used when identifying these nodes in header fields of SIP messages.
- **However, this does not require that these URIs will be globally published in DNS.**
- ?

- Routing of SIP signalling within the IMS SHALL use SIP URIs ...
 - E.164 format Public User Identities SHALL NOT be used for routing within the IMS, and
 - session requests based upon E.164 format Public User Identities will require conversion into SIP URI format for internal IMS usage:
- **The S-CSCF shall support the ability to translate the E.164 address contained in a Request-URI in the non-SIP TEL URI format to a SIP routable SIP URI using an ENUM DNS translation mechanism as specified in IETF RFC 3761**

- The actual ENUM/DNS database(s) used to perform address translations are outside the scope of 3GPP and are therefore a matter for the IM operator.
- **There is no requirement that the Universal ENUM service on the internet be used.**
- As such, it is possible that the ENUM/DNS mechanism uses a different top level domain to that of "e164.arpa."

- To resolve a public user identity on my business card in any SIP-server,
 - say sip:richard.stastny@vodafone.com,
- the SIP server first needs to resolve vodafone.com via the DNS using the procedures defined in RFC3263 to find the IP address of the SIP server of Vodafone.
- then this SIP server needs to be able to access the Vodafone SIP server.
- **This implies that general rules for IP Interconnect (or VoIP Peering) are in place**
- One approach may be undertaken in IETF voipeer

- User ENUM as defined in RFC 3761 is designed according to the Internet principles – end-to-end
- It can be used for SIP peering on the Internet
- It works

- But nobody is using it, because the basic resource is missing: only few VoIP provider are providing SIP URIs reachable via the Internet
- **For User ENUM to work you need IP Interconnect (VoIP Peering) to be in place**

- 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 carriers want to interconnect (peer)
 - using IP-based technology
 - and E.164 numbers,
- they have to use something else (e.g. another database)
 - to route calls within their networks
 - or to route calls between networks
- If this other database is using ENUM technology, some name it:
 - Carrier “ENUM”
 - Infrastructure “ENUM”
 - Operator “ENUM”
 - Enterprise “ENUM”
 - Corporate “ENUM”

- Infrastructure ENUM
 - ETSI TR 102 055
- Carrier, Operator ENUM
 - GSM-A GRX, ETSI TISPAN
- Alternate trees
 - e164.info
 - e164.org
 - XConnect
 - etc.
- Private, Corporate, Enterprise ENUM
- Public Carrier ENUM
 - now also in the IETF

- Carriers may use ENUM technology to find within their network
 - the VoIP servers hosting their subscribers
 - Interworking servers (e.g. SIP/H.323)
 - the egress border elements to other IP-based networks
 - the egress gateways to PSTN-based networks
- The ENUM database may also
 - interwork with existing IN (NP) databases
 - may be provisioned from the same administrative database
- The root of the database may be in any domain
- the administration of the database is a carrier internal matter
 - > but it has to be done!**

- Any con-federation of carriers may use ENUM technology to find
 - the ingress border elements of the other IP-based networks
 - not end-to-end, but network-to-network
- the shared DB may either be in a
 - IP-based network shared between carriers (extranet)
 - or on the Internet (e.g. e164.info, e164enum.net, ..)
- The root of the database may be in any domain
- **the administration of the database is a con-federation internal matter (no regulators involved)**
- **Everybody is administrating only his subscribers!**
- **But: how to find others, and how to be found by others? How public is a public identifier?**
- in the rare case that all carriers agree to use a common shared database on the Internet
 - an implementation in .arpa (e.g. .e164c.arpa) is recommended (ETSI) -> **Public Carrier ENUM**

- ETSI TISPAN is in the final stages for Release 1
- The work of WG4 regarding numbering, naming, addressing and routing was ignored up-to-now by the rest of TISPAN (and vice versa)
- GSMA participated in WG4, but is currently playing hide and seek.
- GSMA is planning to use a carrier shared use implementation within the GRX network
- Recently TISPAN detected that they have a serious problem here

- Public Internet
 - this they do not want (sharks out there)
- Private Internet - Share the GSMA backbone
 - this GSMA does not want
- Private Internet - Copy the GSMA backbone
 - there is no fixed operator "GSMA"
- Walled garden/Isolated subnets (PSTN model)
= bilateral peering
 - this does not scale

- 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
 - Definition of rules national matter -> NRA opt-in (e.g. what is a carrier?)
 - c.3.4.e164.arpa
 - No ITU-T TSN involvement
 - Definition of rules national matter -> NRA opt-in
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?**

- 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 ENUM and the carrier database
- the carrier may also lookup ENUM on behalf of his subscriber first, then lookup the carrier database(s) 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>