

VoIP Peering
ENUM Day
Sydney, Australia

Peering – An overview

- Common relationship customer/provider
 - Customer buys a service from the provider
 - Provider selling access to “the Internet”
- Peering is different
 - Peers share access to their networks and the networks of their customers only
 - Generally without the exchange of money
 - Although the costs for each party are their own individual responsibilities
 - Can be via an “Internet Exchange” or via a private interconnect

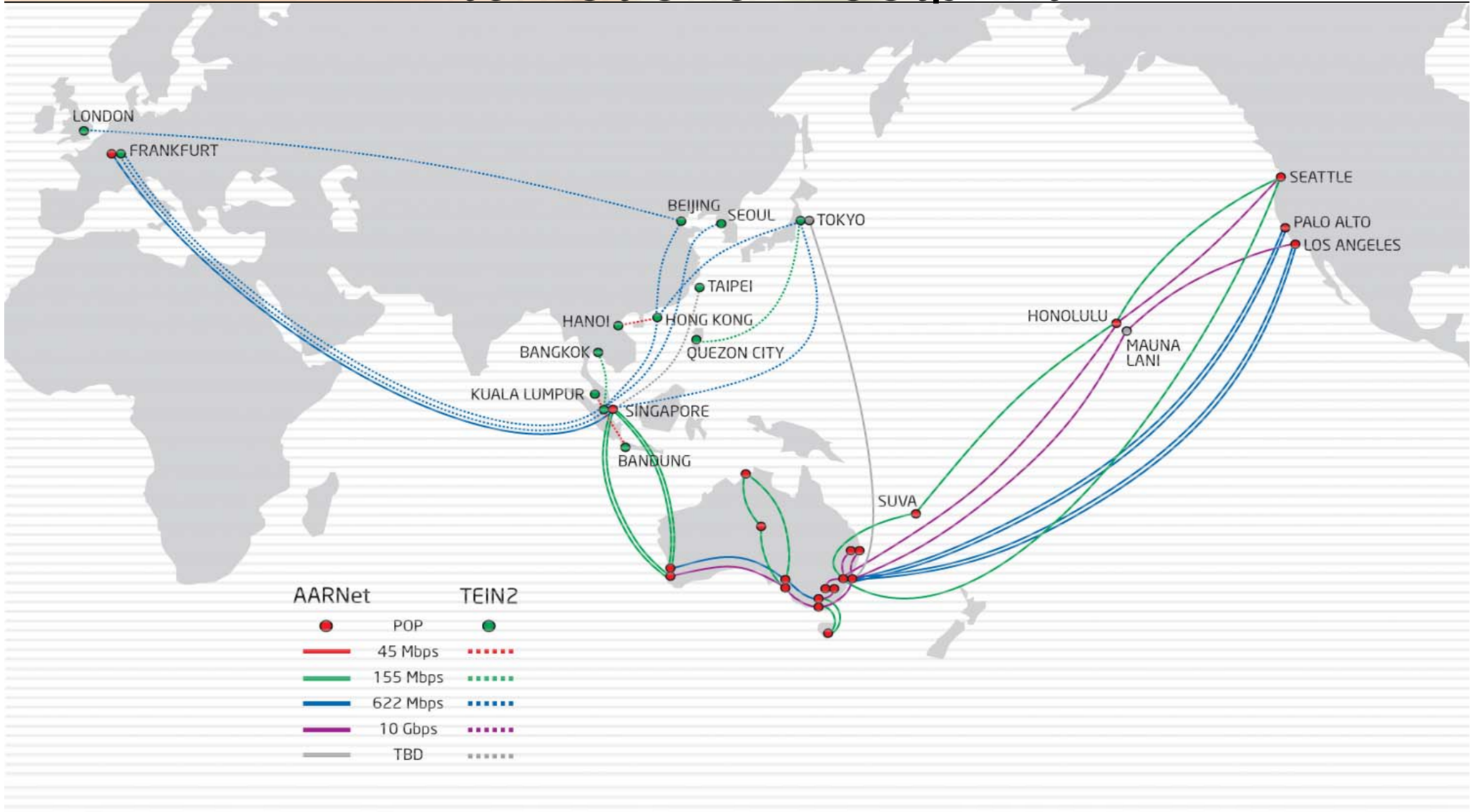
Peering is not free

- Each party has costs
 - Transmission costs
 - Equipment costs
 - Colo costs
- These need to be taken into account to determine the effective rate
- In some cases this might be more than the cost of transit! So be careful.

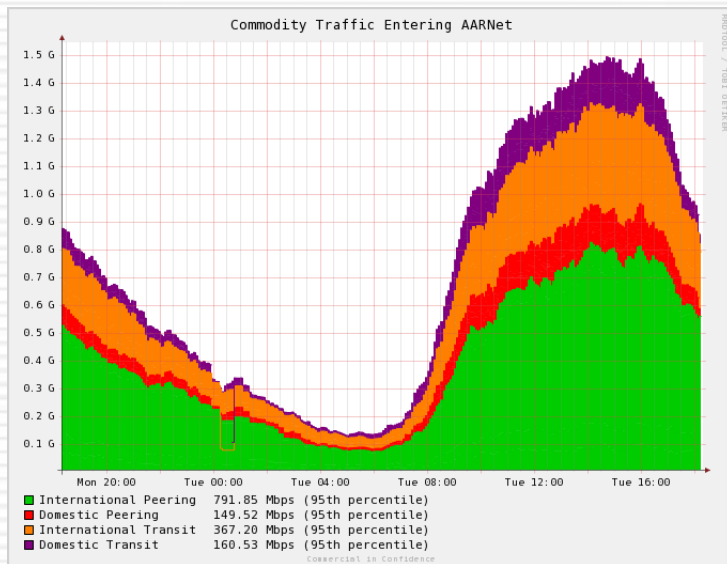
Why peer?

- Can “fix” costs to a bandwidth model rather than a byte charge
 - Transmission is for a committed rate
 - If using an Internet Exchange you buy access to a port at some speed
 - The greater the traffic level the lower the per byte cost
- Enable “advanced” services
 - VoIP!
 - IPv6, multicast
- Improve performance, lower RTT

International Footprint



Peering in AARNet



- AARNet has > 200 peers
- 66% of AARNet's international commodity traffic is received via peering
- 50% of AARNet's domestic commodity traffic is received via peering
- >60% of total commodity via peering
- Currently only doing IP peering

Some Interesting Peers

- ABC, BBC - media companies
- YouTube - DIY media
- Internode, Pacific Internet - National ISP
- Akamai, Google, LimeLight Networks, Microsoft - Content
- China Telecom, KDDI, Singapore Telecom, Telecom NZ - AsiaPac Telcos
- Cogent, Flag Telecom, Telecom Italia - Global Telcos
- Internet2, Géant2 - R&E networks

Is VoIP Peering any different?

- Probably not...
- Transit probably only exists via SS7
- Peering can provide a better performing path for VoIP players
- It avoids the transition through PSTN and resulting recoding issues
- Settlement might be an issue

VoIP Peering today

- Why do we need VoIP Peering, and ultimately ENUM?
- Static routing tables
- SRV records
- Global Dialing Scheme (GDS)
- Trip
- ISN/ITAD
- ENUM

Why do we need VoIP Peering?

	PSTN	H.323	SIP	IM	Email	www	...
PSTN	PSTN	ENUM	ENUM	??	??	??	
H.323	GW	GDS	ENUM+ GW	...	...	...
SIP	GW	ENUM	SRV, Trip, ISN/ITA D	...	...	...
IM	SMS?	ENUM	SRV	...	...	...
Email	SMS?	ENUM	SRV	...	...	...
www	Wap, iMode,...	...	...	...	...	...
...							

Each of the above n x n combinations can be ENUM!

VoIP Peering today

- Static routing tables
 - “Hardcore”/“Worst case” routing
 - Static list entries such as:
 - 02 1234 xxxx -> CCM Org A
 - 02 1244 xxxx -> CCM Org A
 - 02 1334 xxxx -> CCM Org A
 - ...
 - What happens if suddenly 02 1234 10xx is CCM₁ Org A, 02 1234 20xx is CCM₂ Org A, ... ?
We have Universities with > 40 different number block ranges
 - It is obvious that this doesn't scale!
 - For n partner n(n-1) actions required (eg. Change)

VoIP Peering today

- SRV records
 - RFC2782
 - Defines the use of multiple services/server over a single domain
 - $SRV_{SIP} \approx MX_{Email}$
 - Multiple domains can be bound to one server
 - Assume (VoIP) server: 10.10.1.1 answering to:
 - sam@sample.com
 - ted@tester.com
 - ...
 - Record looks like:

```
_sip._udp    SRV    0      5060   sample.com
_sip._udp    SRV    0      5060   tester.com
...
```

VoIP Peering today

- SRV
 - Calling party uses DNS to resolve domain
 - SIP Server then checks SRV
 - Problems:
 - Works only for <user>@<domain>
 - No number dialing!!

VoIP Peering today

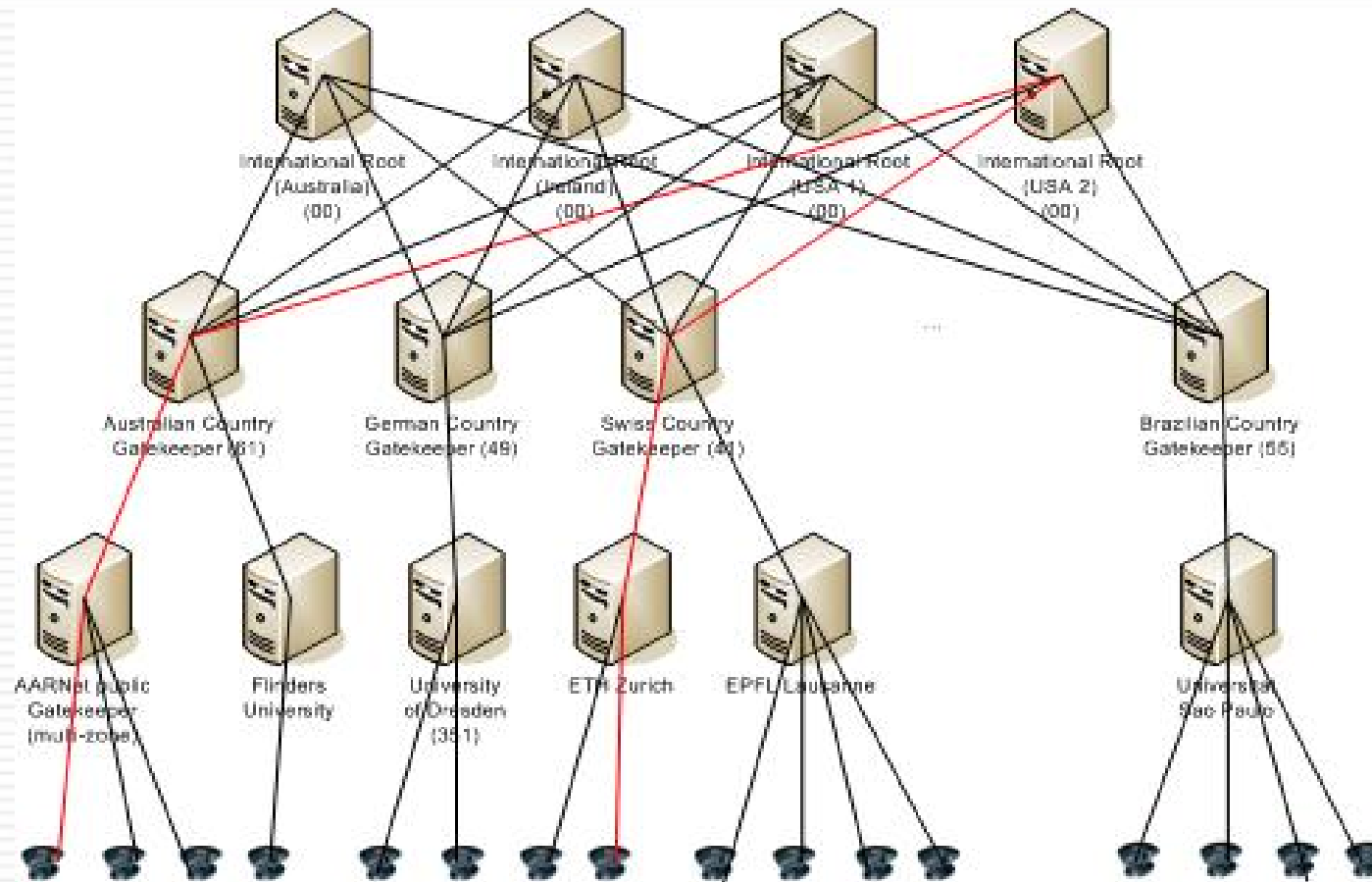
- Global Dialing Scheme (GDS)
 - International dialing plan for H.323 based systems
 - Similar to telephone numbering scheme (E.164)
 - IAC (International access code) : 00
 - CC (Country code): 1, 61, 44, 49,...
 - OP (Organizational prefix): variable
 - EN (Endpoint number): variable
 - **Only** IAC, CC are fixed
 - **Not** limited to 15 digits only
 - Established in 1999 by SURFNet Ukerna, HEANet and UNC
 - Implemented by ViDe, Internet2 and several NRENs
 - Open to everyone!

VoIP Peering today

- Global Dialing Scheme (GDS)
 - Infrastructure: Hierarchical Gatekeeper
 - Each Gatekeeper represents a zone
 - Tier-0 (World, 00): 4 Gatekeeper
 - 2 in the US (OSU), 1 in the UK (HEANet), 1 in Australia (AARNet)
 - Tier-1 (Country, eg. 1, 61, 44, 49,...): ~ 30 countries
 - Tier-2 (Organizational, xxxxx): Several hundred
 - Tier-n (Sub-Organizational): ???
 - Scales very well (so far!)
 - Problems:
 - Was not designed as production level service (was not supposed to be around that long ☺)
 - H.323 based (no SIP/Jingle implementation.... and no, we don't want SIP-GDS)

VoIP Peering today

- Global Dialing Scheme (GDS)



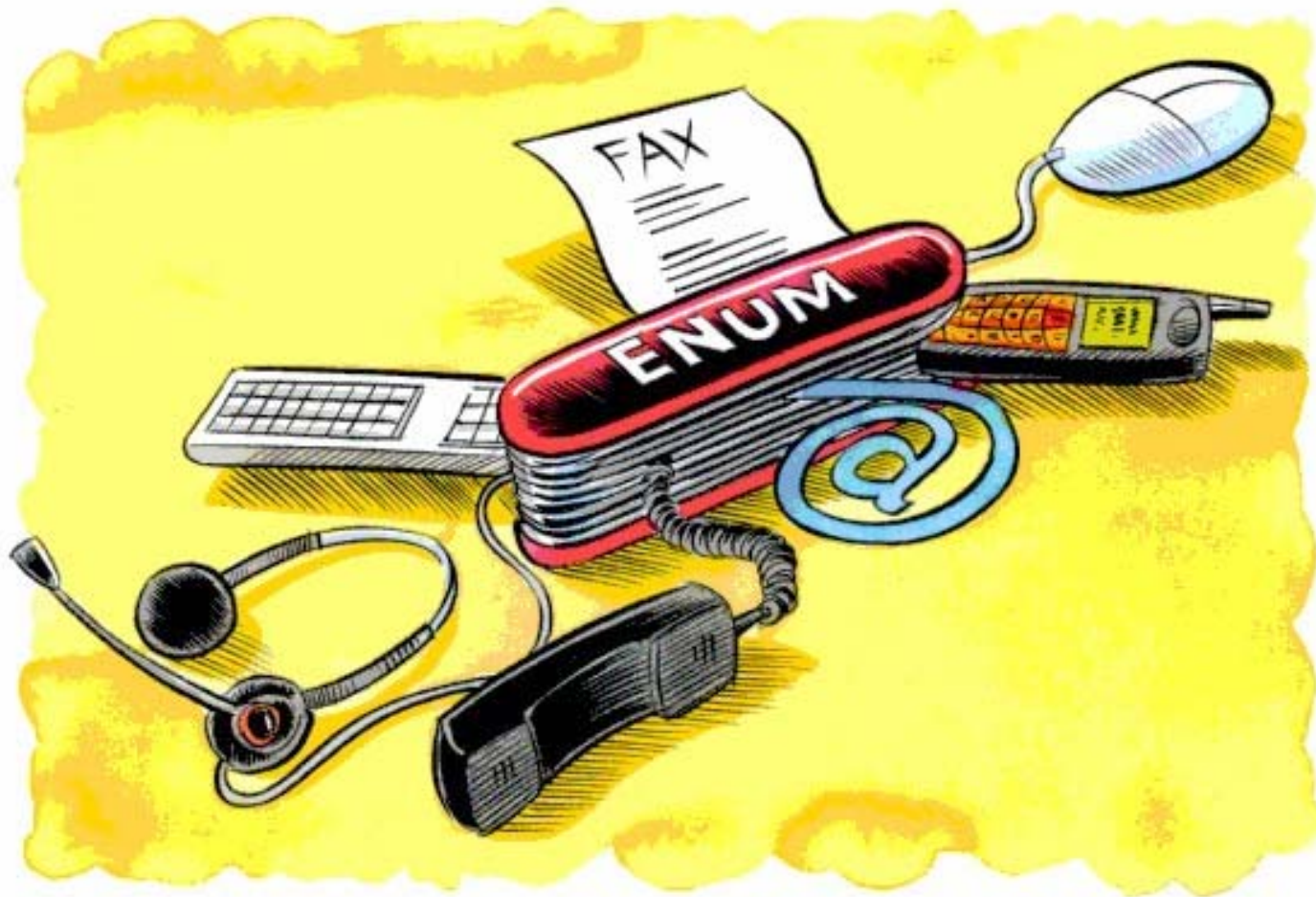
VoIP Peering today

- Trip
 - RFC3219 (never passed the IETF standardization process)
 - Recent attempt to pick it up again was friendly ignored 😊
 - BGP similar
 - Dynamic routing by advertisement
 - Problems:
 - No one really likes BGP in the first place (too complicated)
 - Considered to be deprecated (even on IETF level)

VoIP Peering today

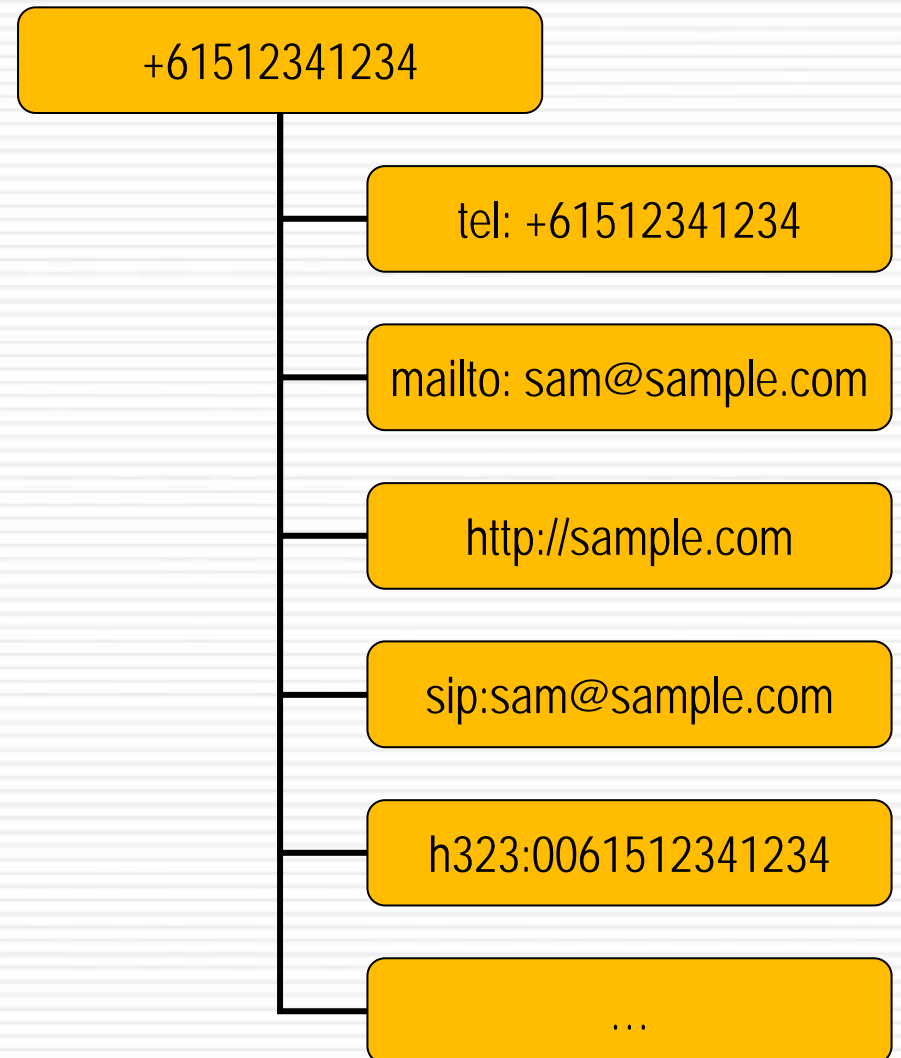
- ISN/ITAD
 - Based on ITAD numbers (-> IANA)
 - Institutions/Organizations/etc. can apply for an ITAD number at IANA
 - Simple: "We rewrite the domain to a number"
 - Format: <ISN>*<ITAD>, eg. 123*25
 - Numeric scheme to <user>@<domain>
 - Implemented by sip.edu
 - Problems:
 - Another work-around
 - Works only on SER/OpenSER/Asterisk so far (could be good thing thou 😊)
 - SIP only

VoIP Peering today



VoIP Peering today

- ENUM
 - E.164 Number Mapping
 - IETF Protocol (RFC3761)
 - The “Common denominator”: Numbers
 - A single number for several service
 - PSTN
 - VoIP (SIP/H.323)
 - Web
 - Email



VoIP Peering today

- ENUM

- DNS based (we all understand how DNS works) (just another zone in your DNS)
- Use of zone entries

```
*.4.3.2.1.5.1.6.e164.arpa. NAPTR 10 10 "u"  
"E2U+sip" "!^\\+6151234(.*)$!sip:6151234\\1@sample.com!" .
```

DNS auto-completes lookups automatically

```
➤ host -t NAPTR 4.3.2.1.4.3.2.1.5.1.6.e164.arpa  
➤ 4.3.2.1.4.3.2.1.5.1.6.e164.arpa has NAPTR record 10 10 "u" "E2U+sip"  
"!^.*$!sip:61512341234@sample.com
```

VoIP Peering today

- ENUM
 - VoIP Peering using ENUM/DNS wildcards is easy to maintain
 - Redundancy as it is based on DNS
 - Primary/Secondary's DNS
 - Sample:
 - Only the few lines below are required to ENUM enable AARNet's number range for SIP & TEL -> fairly simple

```
*.6.2.1.1.2.6.2.1.6.e164.arpa. NAPTR 10 10 "E2U+sip" ...
*.5.7.1.1.2.6.2.1.6.e164.arpa. NAPTR 10 10 "E2U+sip" ...
*.5.3.2.2.2.6.2.1.6.e164.arpa. NAPTR 10 10 "E2U+sip" ...
...
*.6.2.1.1.2.6.2.1.6.e164.arpa. NAPTR 20 10 "E2U+tel" ...
*.5.7.1.1.2.6.2.1.6.e164.arpa. NAPTR 20 10 "E2U+tel" ...
*.5.3.2.2.2.6.2.1.6.e164.arpa. NAPTR 20 10 "E2U+tel" ...
```

Summary

- Multiple VoIP Peering opportunities
- ENUM the only way forward as it not:
 - Only focused on VoIP
 - Ensures a smooth transition to ENUM off various other VoIP Peering techniques
 - NAPTR can be a H.323 (GDS) address
 - NAPTR can be a SIP (ISN/ITAD) number (would require an ENUM service type)
 - Can be use for “block”-routing
 - Infrastructure ENUM

The background of the slide is a dark, almost black, field filled with a bokeh effect of out-of-focus light spots. These spots are primarily in shades of red and orange, with some brighter, more yellowish-orange spots on the left side. The overall effect is soft and atmospheric.

Thank You