

ENUM Tutorial

APTLD Technical Workshop

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Overview

- Background
- ENUM Standards
- ENUM Structure
- ENUM Operation
- ENUM activities in Japan

Background

What is ENUM?

- ENUM is a mechanism for mapping telephone (E.164) number to Internet resource address(es).
- Internet resource address(es) are specified as URI(s).
- Mapping is performed by DNS lookup.
- End users (Applications) can select URI according to their preference.
- Standardization by cooperation of IETF and ITU-T.

Telephone and Internet inter-connection

- Glowing demand for using IP (or Internet) telephone.
 - Deployment of Broad Band Internet access.
 - Cost saving.
- Digits only identifier for Internet resources.
 - For the legacy (telephone) interface.
 - Telephone number is global unique.

Further possibilities

- End users view:
 - Unifications of multiple identifiers into one E.164 number.
 - Tel#, Fax#, Email address, Web address, etc.
 - Increases chance to connect to callee.
 - Can be fall back to another URI(s) if line is busy.
- Operators view:
 - Inter-routing between IP phone carriers.

ENUM Standards

E.164 number and DNS

RFC2916

- Published on Sep, 2000.
- Defines how to map E.164 number to DNS NAPTR resource record.
- Designates “e164.arpa” for ENUM infrastructure in DNS.
- RFC2916 is going to be updated.
 - Working draft is so called RFC2916bis.
 - Re-definition as DDDS (RFC3501-04) application.
 - And clarification of specifications.

E.164 number structure

- Standardized at ITU.
- Format
 - Begin with ‘+’
 - Followed by country code
 - Followed by domestic telephone number
 - Remove prefix 0 if necessary.
 - Consists from 10-15 digits.
- Ex (In case of Japan)
 - Domestic: 03-5297-2571
 - E.164: +81-3-5297-2571

E.164 to domain name conversion

1. Check if E.164 is complete.
 - Ex. +81-3-5297-2571
2. Remove all non-digit except for leading '+'.
 - +81352972571
 - This form is remained as AUS (Application Unique String) for applying regular expression in NAPTR.
3. Remove leading '+'.
 - 81352972571
4. Put dots (“.”) between each digit.
 - 8.1.3.5.2.9.7.2.5.7.1
5. Reverse the order of the digits.
 - 1.7.5.2.7.9.2.5.3.1.8
6. Append the string “.e164.arpa” to the end.
 - 1.7.5.2.7.9.2.5.3.1.8.e164.arpa

Structure of NAPTR RR

- ENUM defines “E2U” for NAPTR service.
 - Actually, NAPTR RR is defined in RFC2915.

- Format of ENUM NAPTR RR

label IN NAPTR *order* *pref* “u” “E2U+enumservice” *regexp* .

- *label*: domain name format of E.164 number
- *order*: 16bit unsigned integer
- *pref*: 16bit unsigned integer (*order* is priority)
- *enumservice*: specifies what type of URI can be used for
- *regexp*: specifies how AUS be replaced

Examples of ENUM NAPTR

In case of telephone number +81352972571

\$ORIGIN 1.7.5.2.7.9.2.5.3.1.8.e164.arpa.

IN NAPTR 100 10 "u" "E2U+sip" "!^+813(.*)\$!sip:¥1 @sipisp.jp!" .

Results in 'sip:52972571@sipisp.jp'

\$ORIGIN 1.7.5.2.7.9.2.5.3.1.8.e164.arpa.

IN NAPTR 100 10 "u" "E2U+sip" "!^.*\$!sip:info@sip.jprs.jp!" .

Results in 'sip:info@sip.jprs.jp'

\$ORIGIN 1.7.5.2.7.9.2.5.3.1.8.e164.arpa.

IN NAPTR 100 10 "u" "E2U+mailto" "!^.*\$!mailto:info@jprs.jp!" .

Results in 'mailto:info@jprs.jp'

ENUM Services

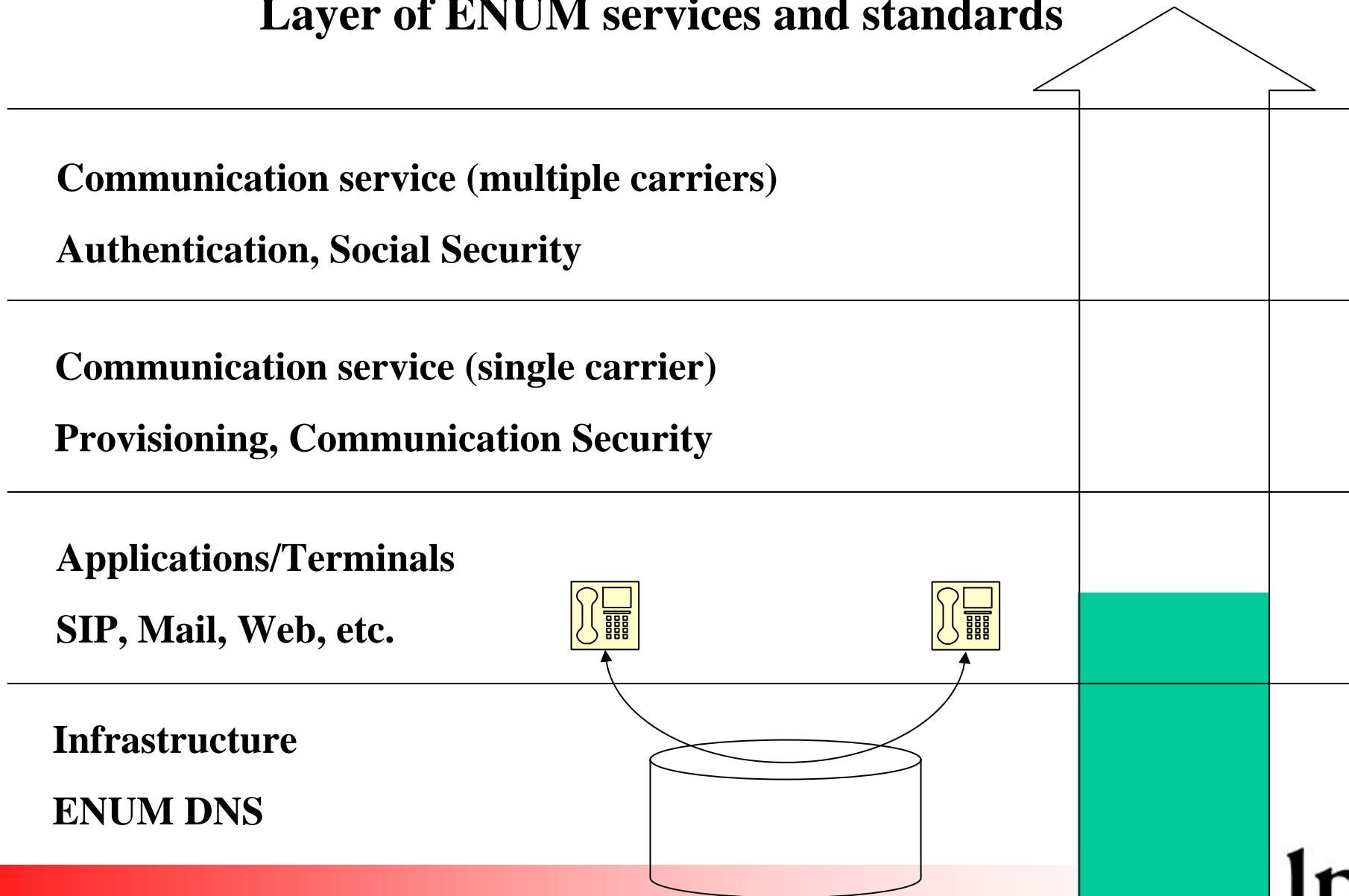
- Must be published as RFC and registered to IANA.
- Expected ENUM services, protocols.

Service/Protocol	service field	URI Scheme (EX)
SIP	E2U+sip	sip:info@sip.jprs.co.jp
H.323	E2U+h323	h323:info@h323.jprs.co.jp
InternetFAX	E2U+ifax	mailto:fax@fax.jprs.co.jp
Telephone	E2U+tel	tel:+81352972571;svc=voice
FAX	E2U+fax:tel	tel:+81352972571;svc=fax
Email	E2U+email:mailto	mailto:info@jprs.co.jp
WEB	E2U+web:http	http://jprs.jp/

Related Standards

- EPP – Extensible Provisioning Protocol
 - For provisioning ENUM NS / NAPTR data between ENUM registries and registrars.
 - Standardization is work in progress at IETF.
- CRISP – Cross Registry Information Sharing Protocol
 - For referring ENUM NS registrant data.
 - Standardization is work in progress at IETF.

Layer of ENUM services and standards



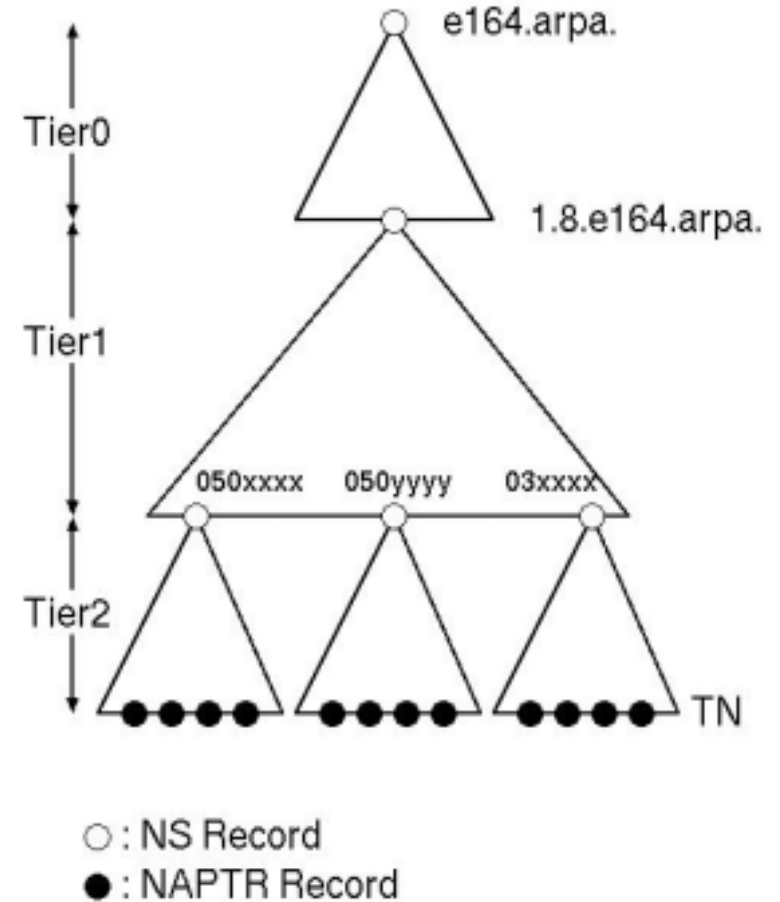
ENUM Structure

Tiered Architecture

- Model of ENUM DNS layer considered at ITU-T.
- Tier0: Top of the ENUM DNS layer.
 - e164.arpa.
 - Managed by ITU-T, Operated by RIPE/NCC.
- Tier1: E.164 country code ENUM DNS layer.
 - 1.8.e164.arpa. (Japan)
 - Management and operation are domestic matter.
- Tier2: Terminal (NAPTR RRs) ENUM DNS layer.
 - 1.7.5.2.7.9.2.5.3.1.8.e164.arpa.
 - Management and operation are domestic matter.

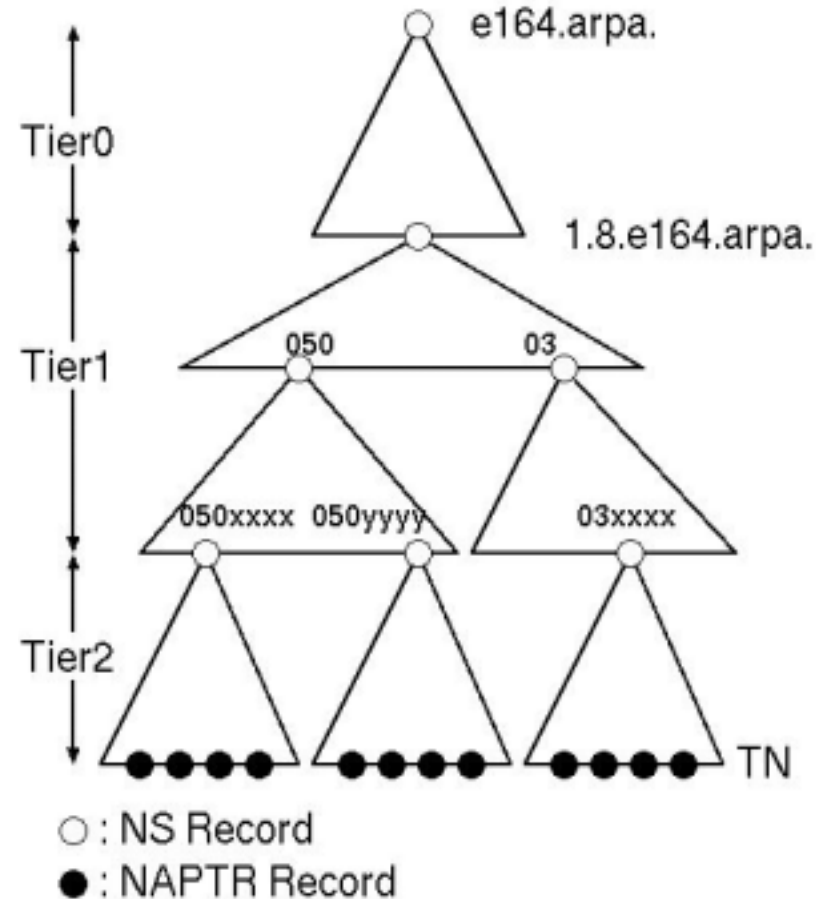
Tier structure: example 1

- Tier1 delegates number block(s) to Tier2.



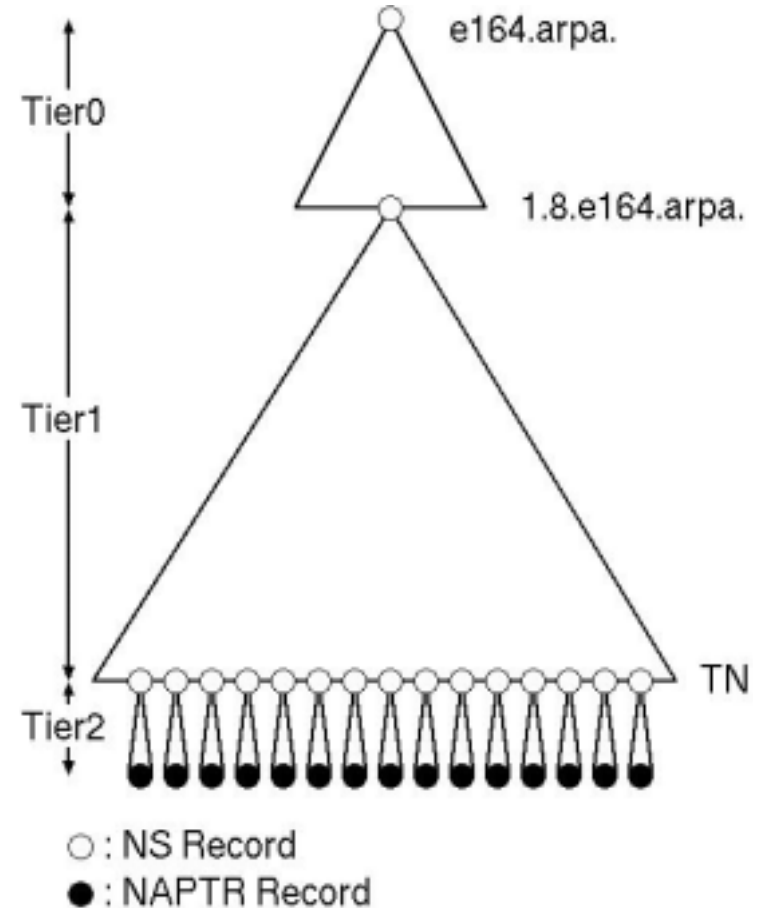
Tier structure: example 2

- Tier1 is layered according to number plan.
- Tier1 delegates number block(s) to Tier2.



Tier structure: example 3

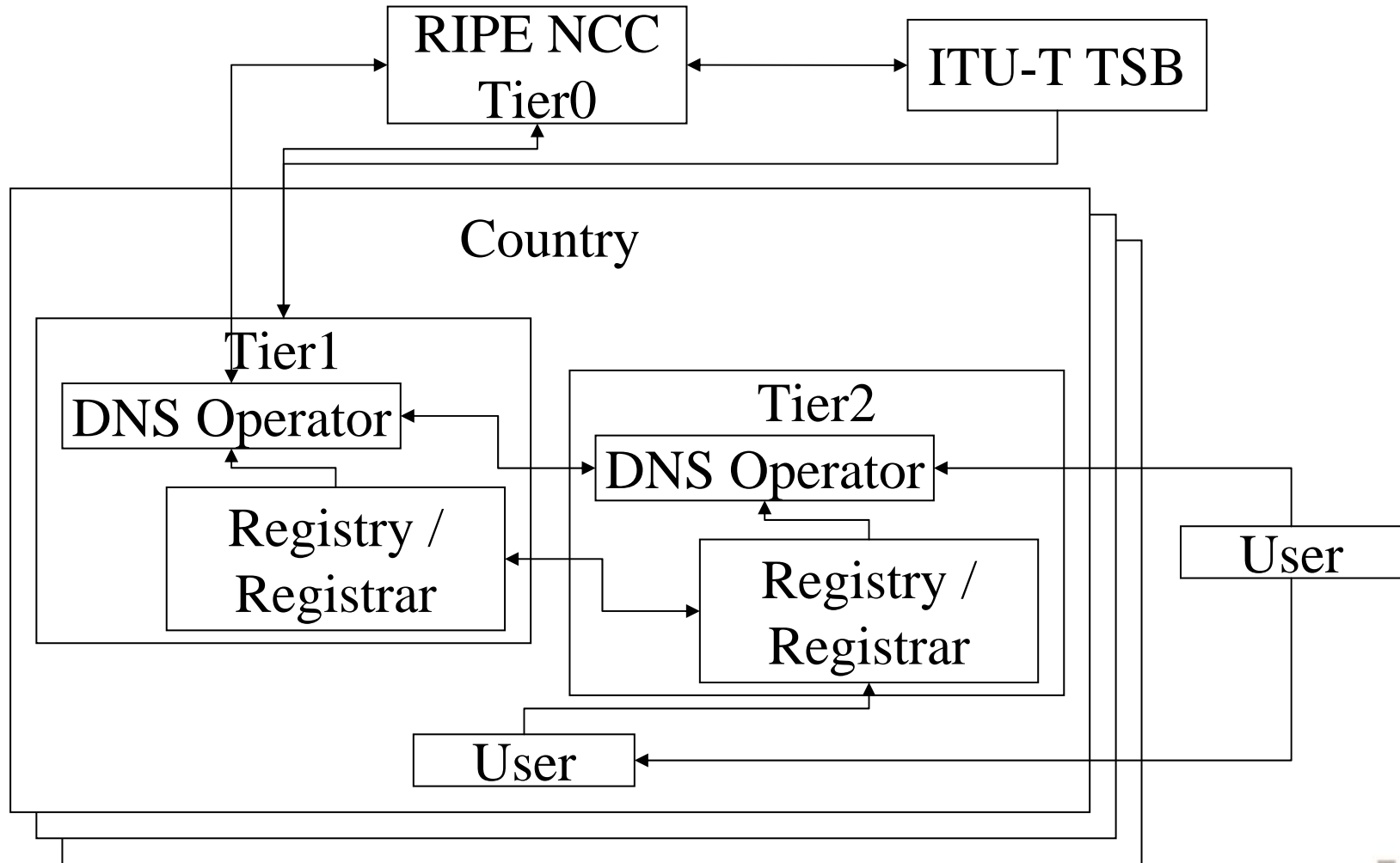
- Tier1 delegates each number to Tier2.
- Easy to provide number portability.
- Suitable for user ENUM.



Operator ENUM / User ENUM

- Operator ENUM
 - Operators (Carriers, ISPs, etc.) set NAPTR to each number they assigned.
 - ENUM services may be limited.
 - Used for inter-routing within operators.
 - ENUM DNS can be internal to the operators.
 - NAPTR RRs can be hidden from users.
- User ENUM
 - Users (E.164 number holders) set NAPTRs according to their demands.
 - Variety of ENUM services can be chosen.
 - User must be verified whether appropriate number holder.
 - Independent number verification authority is required.
- Operation styles are completely different.

ENUM Trial



ENUM trial situation in the World

- Promoted by an organization for the ENUM trial.
 - Members are consist from registry, government, telecom carriers, ISPs, vendors, etc.
 - AT, UK, SE, etc.
 - Most of ENUM trials are this style.
- Promoted by mainly ccTLD registry.
 - Member structure is almost the same as above.
 - DE, KR, etc.
- Promoted by government.
 - ccTLD is a member of the trial.
 - CN, SG, etc.
- Promoted by company authorized by government.
 - AM, Islands.

Why ccTLD?

- ENUM may become critical infrastructure.
- Relationship between government.
- Relationship between carriers/ISPs.
- Stable DNS and Registry/Registrar operation is important.

Delegation status

ITU-T SG2:

E.164 country codes for which TSB has received approvals for ENUM delegations to be performed by RIPE NCC

For more information on the RIPE NCC ENUM activities, please see <http://www.ripe.net/enum/>

E.164 Country Code	Country	Delegee	Date of TSB Approval dd/mm/yy
246	Diego Garcia	Government	12/08/02
247	Ascension	Government	12/08/02
290	Saint Helena	Government	12/08/02
31	Netherlands	Ministry	23/05/02
33	France	DiGITIP (Government)	28/03/03
358	Finland	Finnish Communications Regulatory Authority	26/02/03
36	Hungary	CHIP/ISzT	15/07/02
374	Armenia	Armineo Ltd	11/07/03
40	Romania	MinCom	10/12/02
41	Switzerland	OFCOM	01/10/03
420	Czech Republic	Ministry of Informatics	24/06/03
421	Slovak Republic	Ministry of Transport, Post, and Telecommunications	04/06/03
423	Liechtenstein	SWITCH	21/10/03
43	Austria	Regulator	11/06/02
44	UK	DTI/Nominum	16/05/02
46	Sweden	NPTA	10/12/02
48	Poland	NASK	18/07/02
49	Germany	DENIC	16/05/02
55	Brazil	Brazilian Internet Registry	19/07/02
65	Singapore	IDA (Government)	04/06/03
86	China (c)	CNNIC	02/09/02
878 10	(a)	VISIONng	16/05/02
971	United Arab Emirates	Etisalat	13/01/03
991 001	(b)	NeuStar	02/02/01

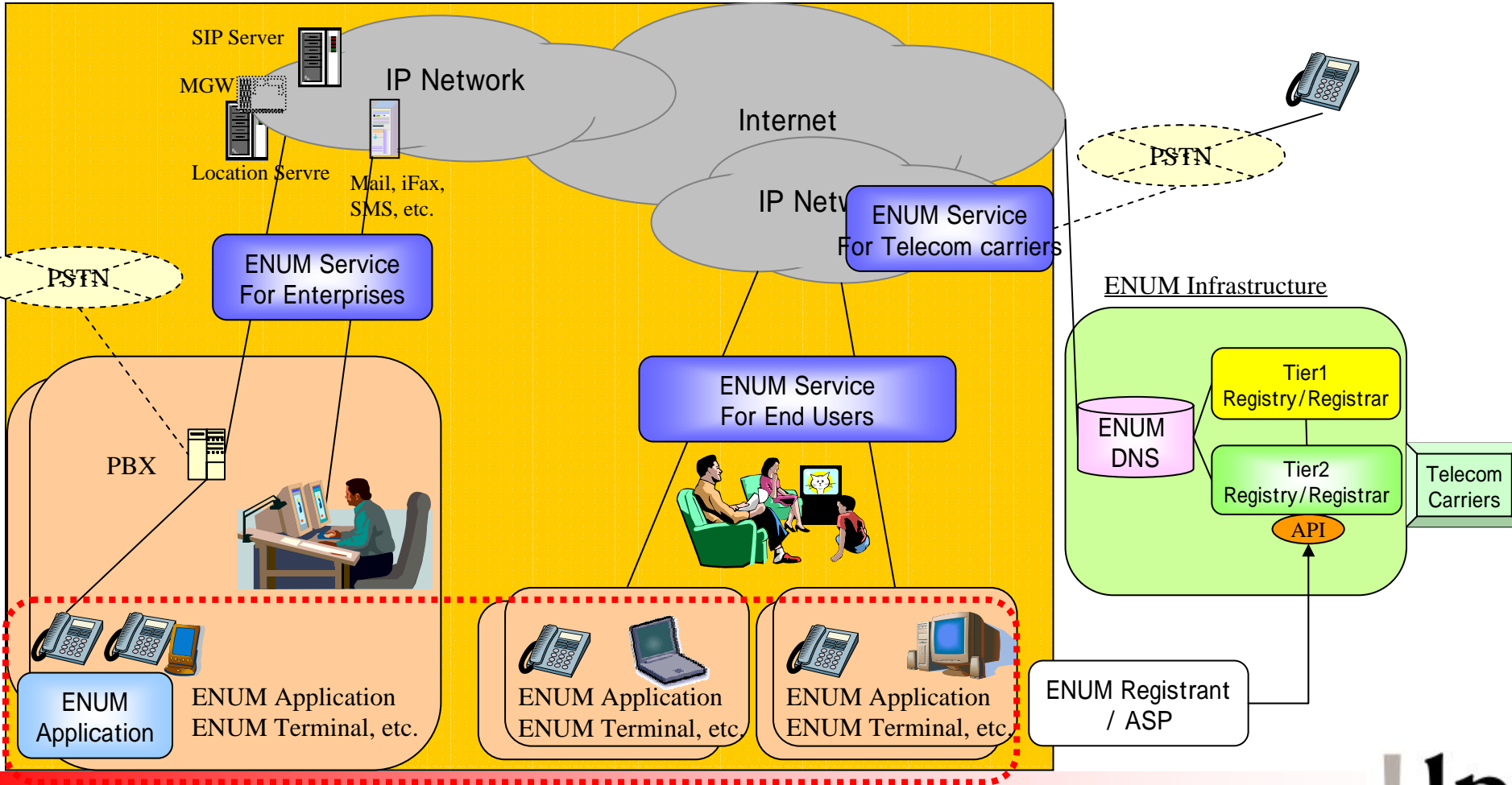
Notes:

- (a) This is a Universal Personal Telephony (UPT) code.
- (b) This is a trial code granted to NeuStar for a limited period. The period expires on 2 November 2003.
- (c) This is a temporary authorization for ENUM global TLD trial and evaluation. This delegation will end on 30 June 2004. If the ITU Interim Procedure is discontinued before then, or if the Recommendation E.A-ENUM is approved before 30 June 2004, the delegation will be turned into an objection.

21-0060

ENUM Operation

Typical ENUM world



DNS structure design

- Depends on which model to select.
- Typical requirements for Tier1 DNS:
 - Handling of large zone (up to 100M entry).
 - Scalability and stability.
 - Performance.
- Typical requirements for Tier2 DNS:
 - Capability for frequent update.
 - Relationship with registry database.
 - EDNS0 support.

Registry DB

- Tier1:
 - Frequency of zone generation.
 - Zone transfer method to primary DNS.
 - Authentication and consistency.
 - Interface for Tier2 Registry (or Tier1 Registrar).
 - EPP?
- Tier2:
 - Partial (dynamic) update.
 - Interface for User (or Tier2 Registrar).
 - Validation of number holder.
 - Interface for Tier1 Registry (or Registrar).
 - EPP?

Consideration for DNS

- Typical ENUM services like Web, Mail, SIP are also lookups DNS.
 - Web: Hyper-links(A).
 - Mail: sending (MX, A), receiving (PTR).
 - SIP: sip domain(A), service protocol (D2U/D2T NAPTR), service location(SRV)
- DNS queries will increase when ENUM deployed.
- Users are nervous to service quality.
 - Users don't care where is the bottle neck.

Issues

- Future vision, business model.
 - Operator ENUM / User ENUM.
 - Management Entity, responsibility.
 - Charge.
- DNS operation.
 - Tier structure.
 - DNS server distribution.
 - Provisioning of NAPTR data.
- Application software development.
 - ENUM client.
 - Relation with other applications, such as Mailer, SIP phone, etc.

Issues (cont.)

- Security.
 - DNS data.
 - ENUM provisioning.
 - User communication (application level).
- Privacy.
 - End user data (whois).
 - Trace of the user behaviour.
- Regulation.
 - ENUM numbering plan.
 - Guarantee of quality of service.

ENUM activities in Japan

ENUM Study Group

- Established
 - September 2002.
- Objectives
 - Understanding the ENUM technology : desk work.
 - Finding political/regulatory issues related to ENUM-based implementation and operation.
 - Studying the implementation and operation of the ENUM–based system, and related matters.
 - Finding technological issues related to ENUM.
 - Clarifying pros and cons in ENUM usage.
- Target of the study
 - ENUM technology.
 - Related technology such as DNS , URI , DDDS.
- Final report
 - Published on May 2003 (English translation coming soon).

ENUM Trial Japan (ETJP)



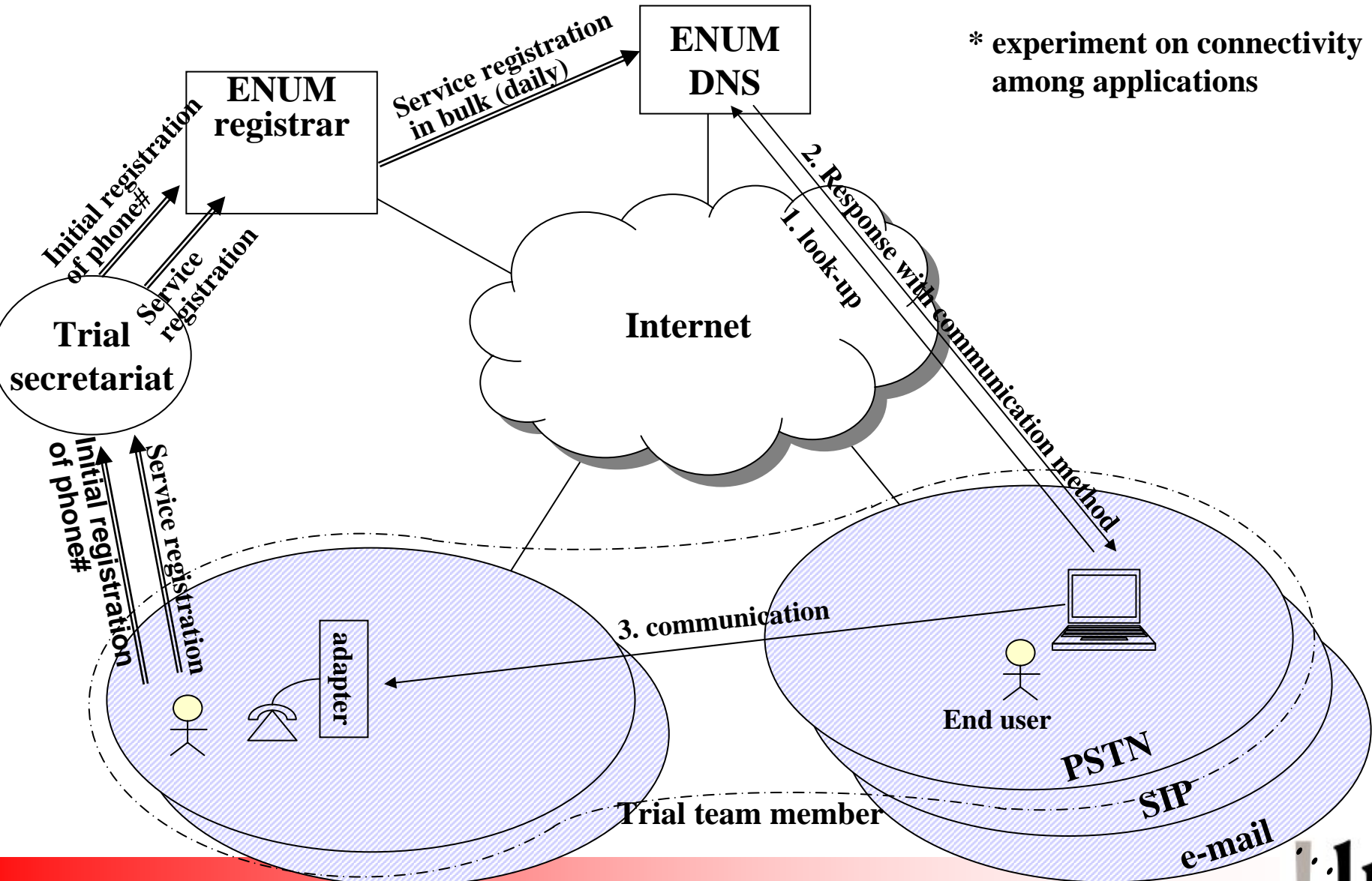
- Established
 - on 17 September 2003 (1 year activity).
- Purpose
 - Perform ENUM trials to ensure functioning and feasibility of basic technical facility.
 - Demonstration of technology for international use.
 - Accumulation of know-how on ENUM and sharing of it among participants.
- Activities
 - DNS operation for ENUM Trial.
 - Feasibility test of communication applications (device, software) using ENUM.
 - Feasibility test of communication services.
- Results
 - Results of technical verification.
 - Communication devices and software provided by participants.
 - Communication services.
 - Clarification and consideration of relevant issues.

ETJP organization

- Participants
 - Companies, organizations, and individuals who hope to contribute to ETJP activities.
 - Number of members: 42 (as of 21 Nov 2003).
- Officers
 - Chairman
 - Shigeki Goto
Japan Network Information Center (JPNIC)/Waseda University
 - Vice chairman
 - Hirofumi Hotta
Japan Registry Service Co., Ltd.(JPRS)
 - Yoshiki Ishida
WIDE Project

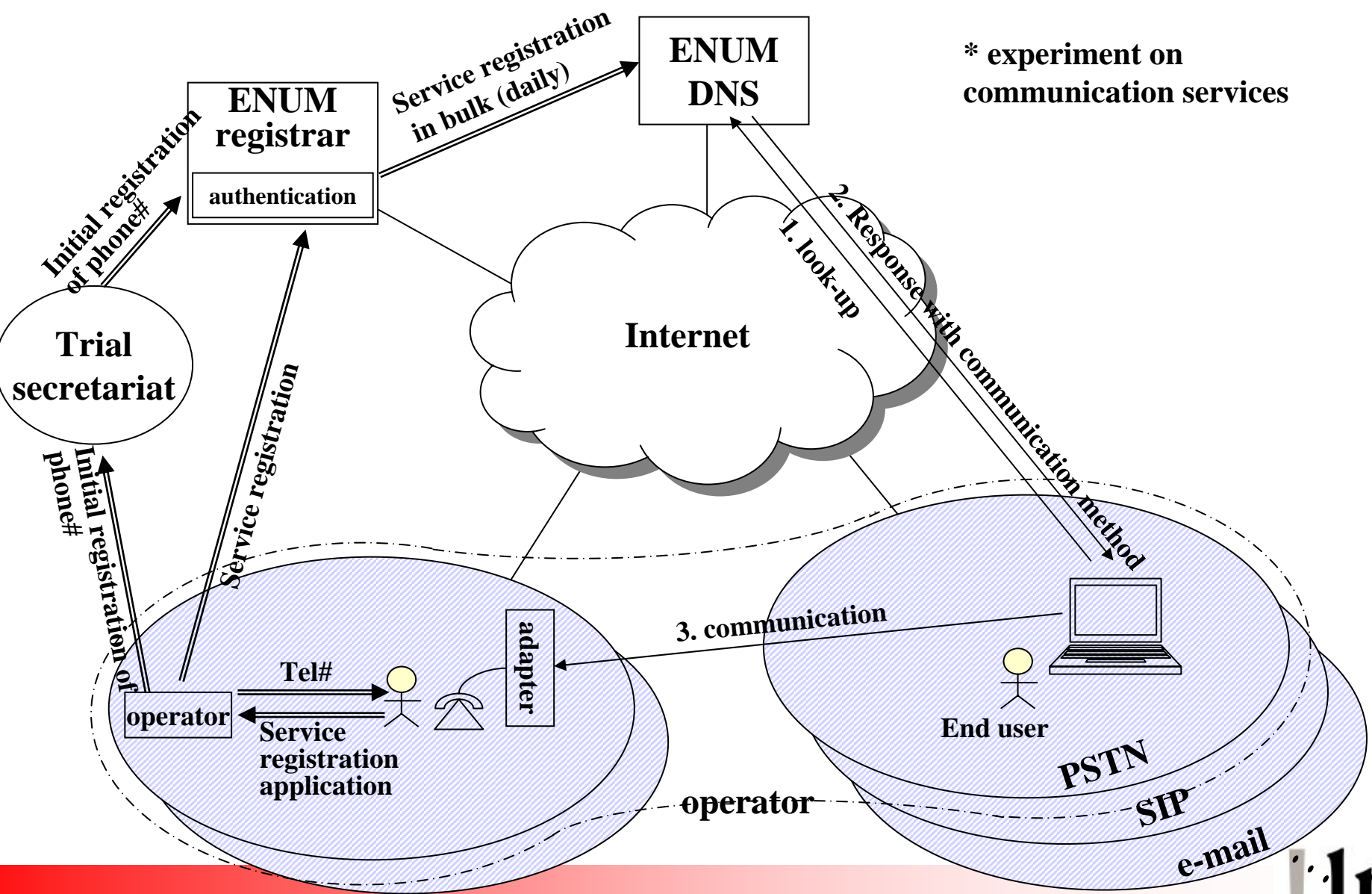
ENUM trial (phase 1)

* experiment on connectivity among applications

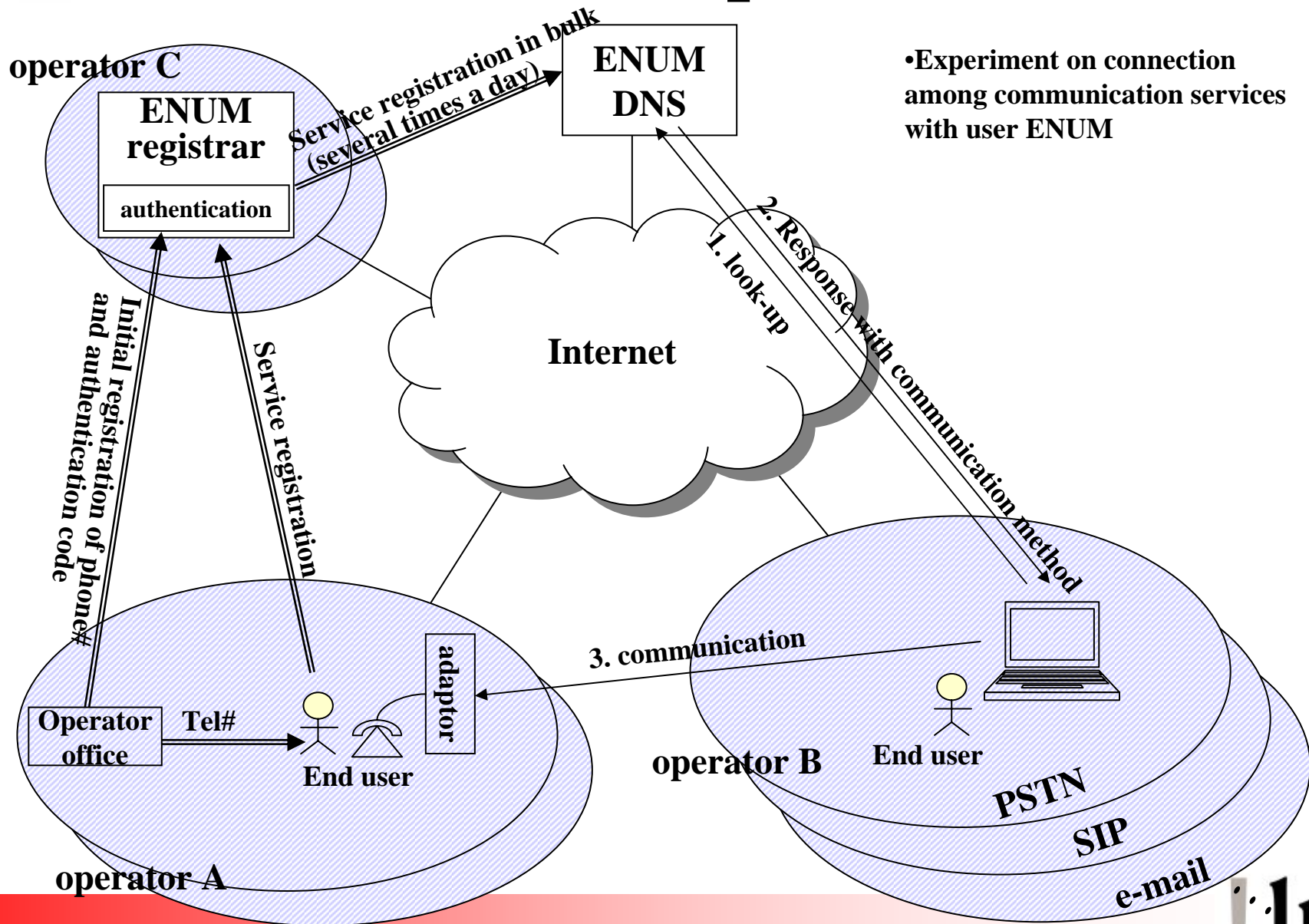


ENUM trial (phase2)

* experiment on communication services



ENUM trial (phase3)



•Experiment on connection among communication services with user ENUM

References

- IETF ENUM WG
 - <http://www.ietf.org/html.charters/enum-charter.html>
- ITU-T
 - <http://www.itu.int/osg/spu/enum/>
- RIPE NCC
 - <http://www.ripe.net/enum/>
- ETJP / ENUM Study Group
 - <http://etjp.jp/>
 - <http://www.nic.ad.jp/en/>

Q & A