

Relation between ENUM and NGN

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Dr. Peter Kim, Nokia Siemens Networks, Head of IMS/FMC Systems Engineering.

Relation between ENUM and NGN – Overview

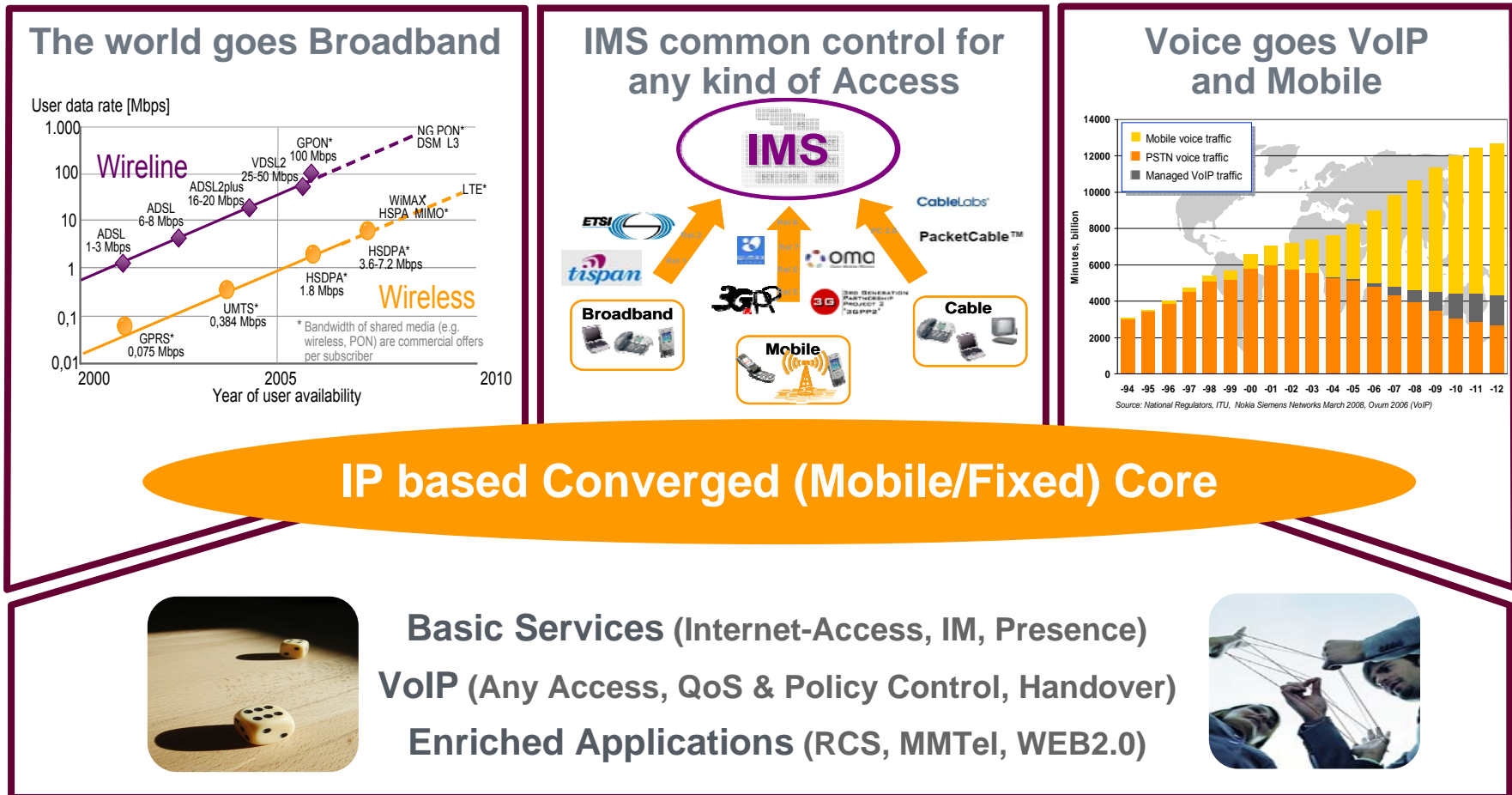
» ENUM and NGN

- ⇒ Core Architecture Vision
- ⇒ ENUM Usage in the NGN
- ⇒ Deployment Experiences
- ⇒ Summary



Relation between ENUM and NGN – Core Architecture Vision

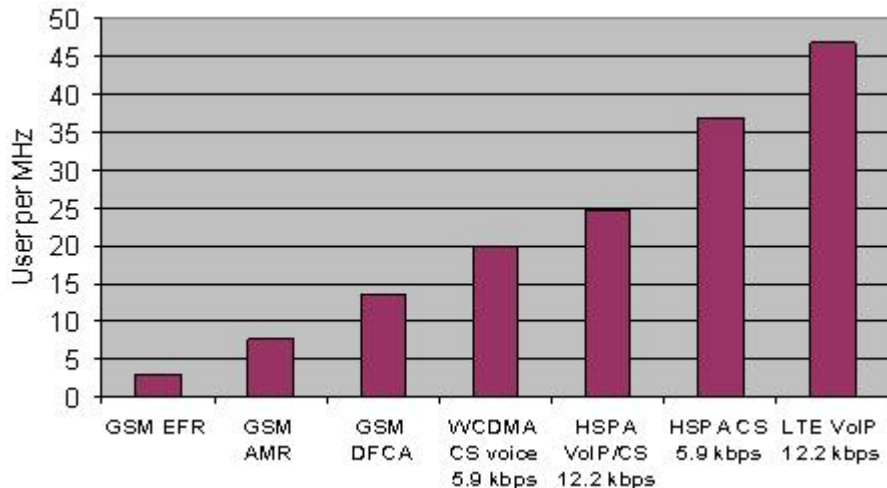
- Convergence of Networks and Applications:



Relation between ENUM and NGN – Core Architecture Vision

• Drivers for Voice over LTE (VoLTE):

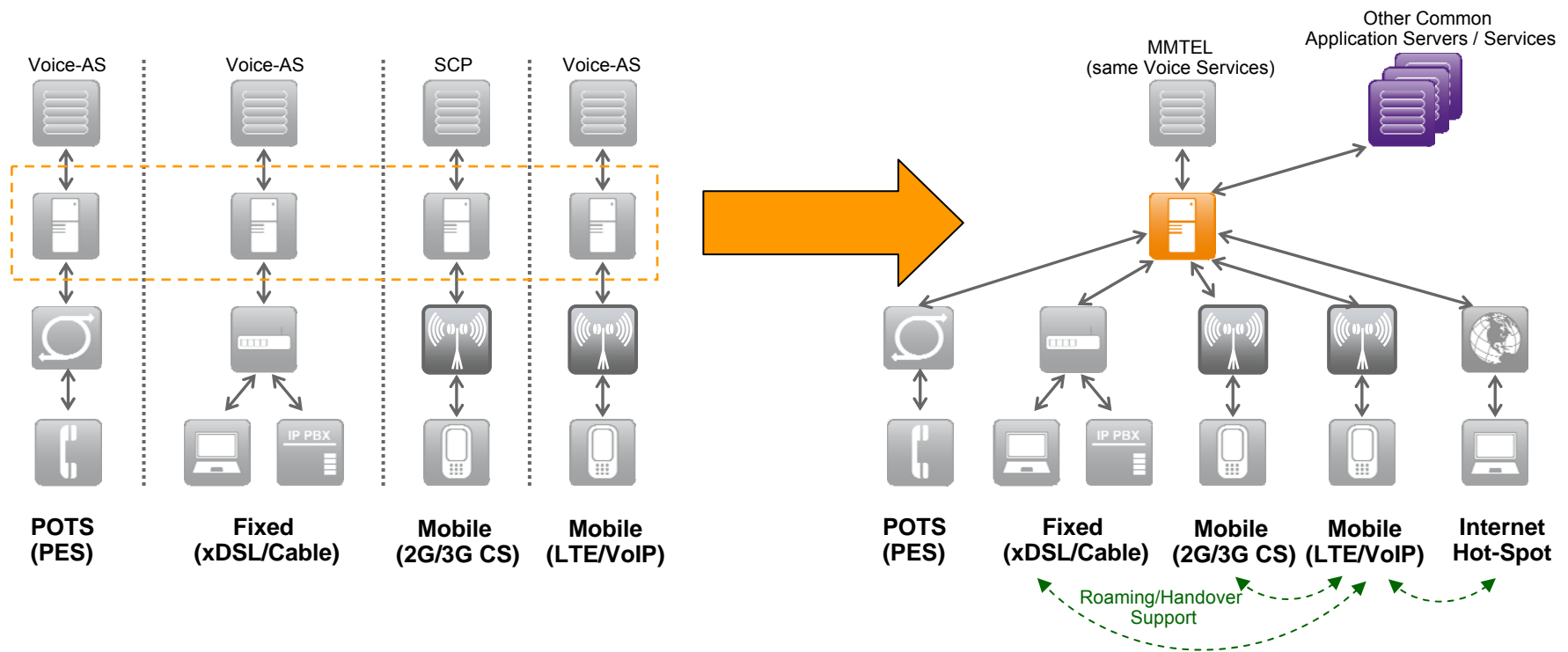
Mobile Network Operator's Strategic Priorities:



- Radio access harmonisation
 - Gradual phase-out of non-LTE radio access
 - OPEX saving by packet-only access technology
- Service core harmonisation
 - Gradual evolution of CS voice core in favour of common VoIP infrastructure
- LTE Evolution from CDMA
 - LTE as evolution path for CDMA operators
 - VoIP as enabler for concurrent voice and data with mobile handheld

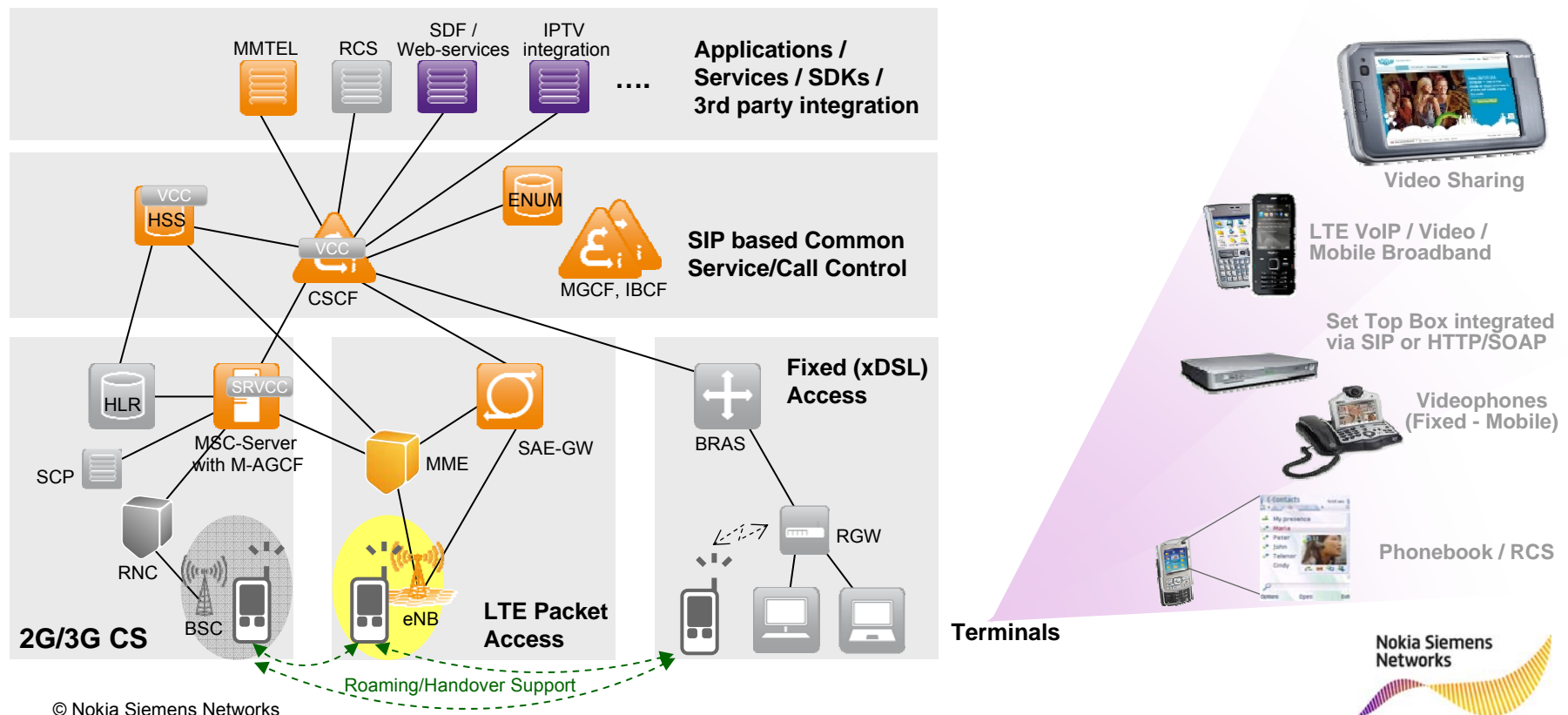
Relation between ENUM and NGN – Core Architecture Vision

- **Common IMS based Service Infrastructure for any access and any device:**
 - clear separation between **infrastructure** (routing, user management, charging, mobility, regulatory services, QoS-, policy control) and the **applications**.

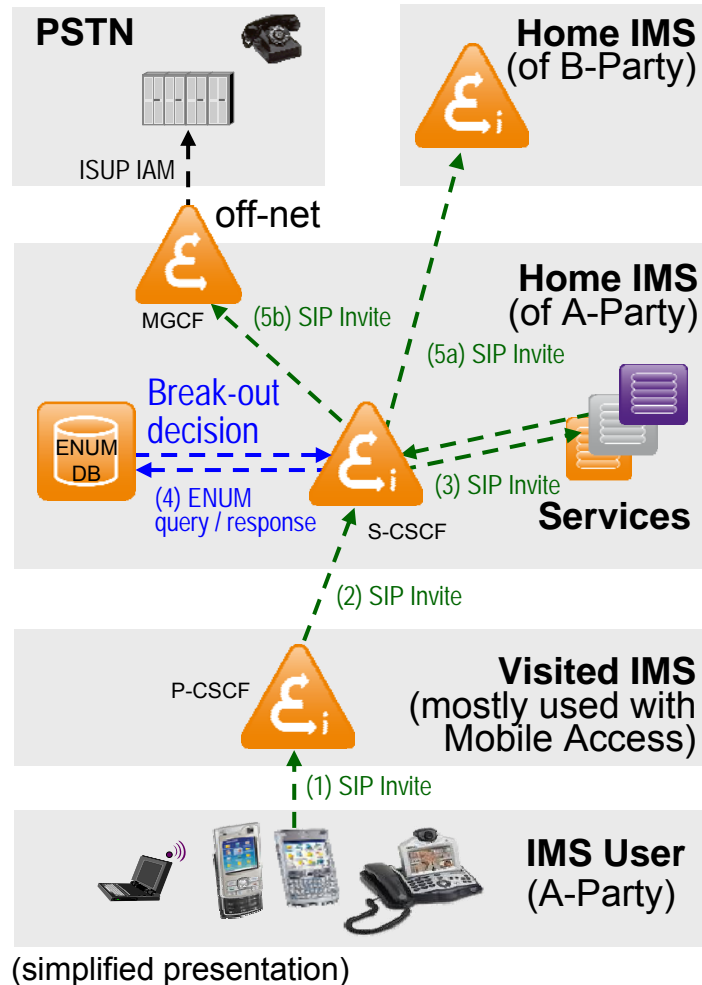


Relation between ENUM and NGN – Core Architecture Vision

- **...continued:**
 - calls/sessions are anchored in the IMS.
 - 2G/3G CS Phones are supported via ICS/M-AGCF in the MSC-Server.
 - Legacy (CAMEL) is supported e.g. via built-in IM-SSF in the MSC-Server.
 - ENUM is used for breakout-, routing- and number-portability support



Relation between ENUM and NGN – ENUM Usage in the IMS



In standard IMS, the ENUM lookup is used:

- to make the basic routing decision between IMS on-net calls and off-net calls (break-out to the PSTN/CS domain), and
- to retrieve the B-Parties (Called-Party) home-network domain in the case of IMS on-net calls.

Optionally, an ENUM lookup may be used:

- to retrieve Number Portability data e.g. to be passed on to the PSTN.

Only Infrastructure ENUM is needed.

IMS does not use ENUM:

- for routing between the Visited IMS Network and the Home IMS Network.
- when the A-Party (Calling-Party) uses an alphanumeric SIP URI, e.g. `sip:peter.kim@operator.com` to address the B-Party (Called-Party).

Relation between ENUM and NGN – ENUM Usage in the IMS



- Destination address sent by the IMS User Agent of the A-Party (Calling-Party):

`sip:08912345678@imsA.net`

- The S-CSCF of the A-Party (or a SIP-AS) performs the conversion to an international number format:

`sip:+498912345678@imsA.net`
`+498912345679`

- The S-CSCF issues an ENUM query for:

- The ENUM service responds:

A) if called user B is an IMS user (on-net):

Enumservice: `E2U+sip`

Substitution: `+498912345678@imsB.net`

B) if called user B is a PSTN user (off-net):

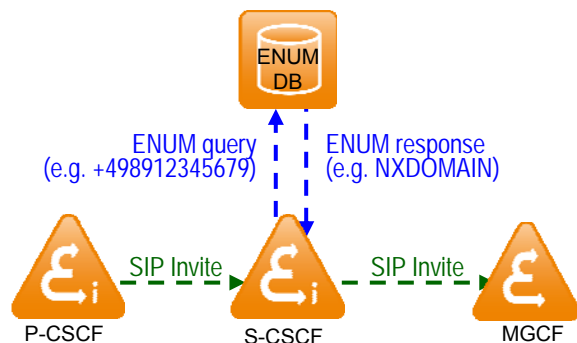
Error: "NXDOMAIN" (domain not existing)

- Or -

Enumservice: `E2U+pstn:sip` or `E2U+pstn:tel`

Substitution (for "E2U+pstn:sip"):

`sip:+498912345678;npdi;`
`rn=+498911223344@gw.net;user=phone`



Note: typical deployments use "NXDOMAIN"; the PSTN Gateway consults an NP database in the PSTN to retrieve the NP data.

Relation between ENUM and NGN – User ENUM versus Infrastructure ENUM

Characteristics:

- **User ENUM (Public ENUM)** is a public, on-line directory service for end-users. The data are populated by end users who choose to participate.
- Uses the public DNS infrastructure on the Internet.
- End-users can publish the URIs of the services they use (VoIP, Email, Web links,...) and link them to their PSTN number.

User ENUM is not an option: for most NGN operators due to:

- **Charging:** costs depend on the call path and the SLA with e.g. the Long Distance Carrier.
- **Security:** the ENUM database, when public, would become vulnerable for DoS, SPIT and other attacks. Calls could easily be re-routed. In contrast, operators want to selectively disclose their ingress points to other operators depending on SLAs, and do not expose them to the public Internet.
- **Control and Stability:** operators want to build-up and interconnect their VoIP networks independent of the current User ENUM registration status.

Characteristics:

- **Infrastructure ENUM (Private ENUM, Carrier ENUM)** is a private service of operators. The data are populated by the operators themselves. This uses a private DNS infrastructure.
- Operators publish their ingress points and link them to the PSTN number blocks that they own.
- Initiatives to establish a global regulated Infrastructure ENUM have not been successful so far.

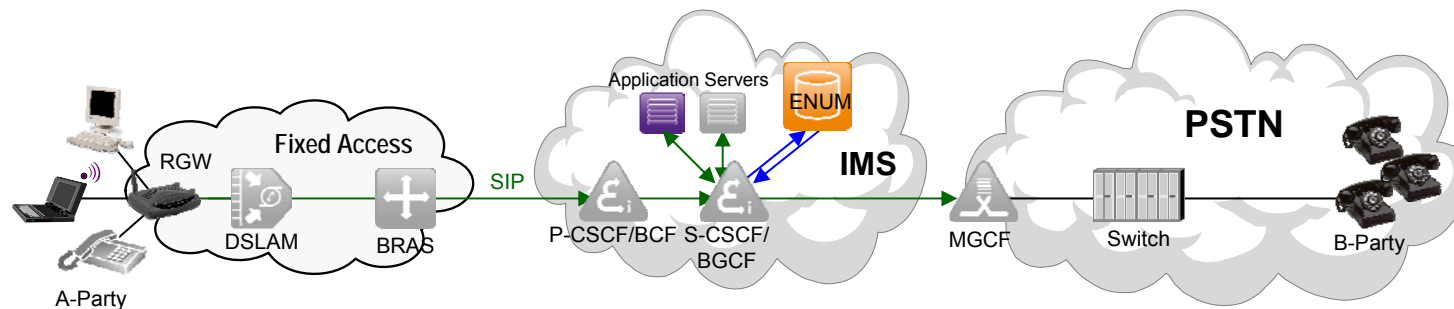
Infrastructure ENUM is generally used as follows:

- Operators deploy their own private ENUM database together with their NGN. If needed, they interconnect their ENUM databases based on bilateral or multilateral agreements.
- Operators may use the ENUM service provided by the GSMA or other organizations.
- Infrastructure ENUM deployments are basically secured because they are not linked to the public Internet.

Relation between ENUM and NGN – Deployment Experiences



- **Example ENUM usage in our existing IMS/Fixed (xDSL, Cable) deployments:**
 - IMS Standard ENUM function is used today (= PSTN Breakout Decision).
 - Isolated operator networks. Operator interworking is performed via the PSTN.
 - Typically, SIP URIs of the format `sip:e164@operator.com` are used (TEL URIs and Alphanumeric SIP URIs are supported; but hardly used).
 - Multi- IMS Service Sites are deployed by the operators.
 - IMS local (combined) DNS/ENUM Servers are often used.
 - In some deployments IMS DNS- and ENUM-Servers are physically separated.



- Typical ENUM entry for an IMS subscriber:

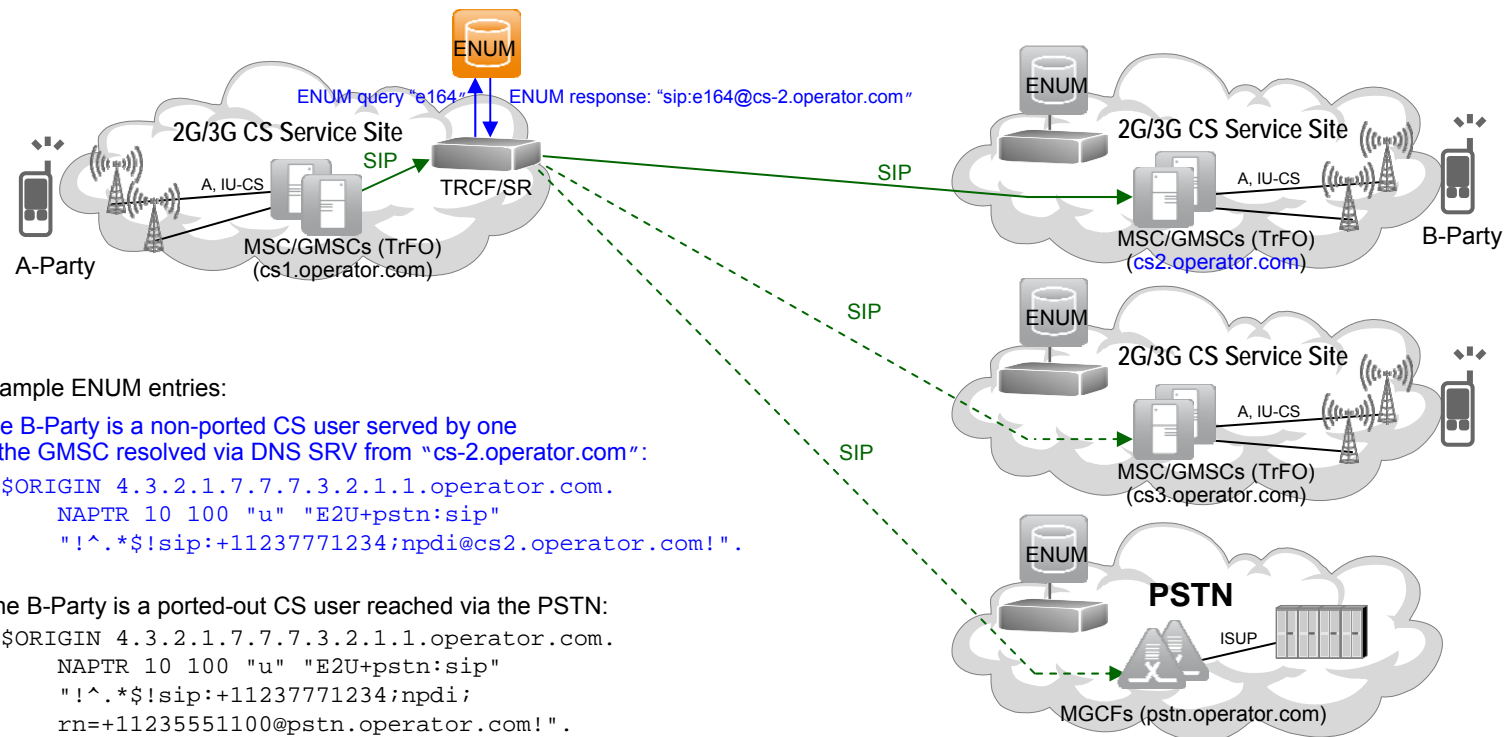
```
$ORIGIN 4.3.2.1.7.7.3.2.1.1.operator.com.  
NAPTR 10 100 "u" "E2U+sip"  
"!^.*$!sip:+11237771234@operator.com!".
```

Relation between ENUM and NGN – Deployment Experiences



- **Example ENUM usage in pre-IMS Mobile networks:**

- Infrastructure/Private ENUM database in large operator network.
- SIP is used to interconnect MSCs in different routing areas.
- ENUM database is queried to find the route to the target area.

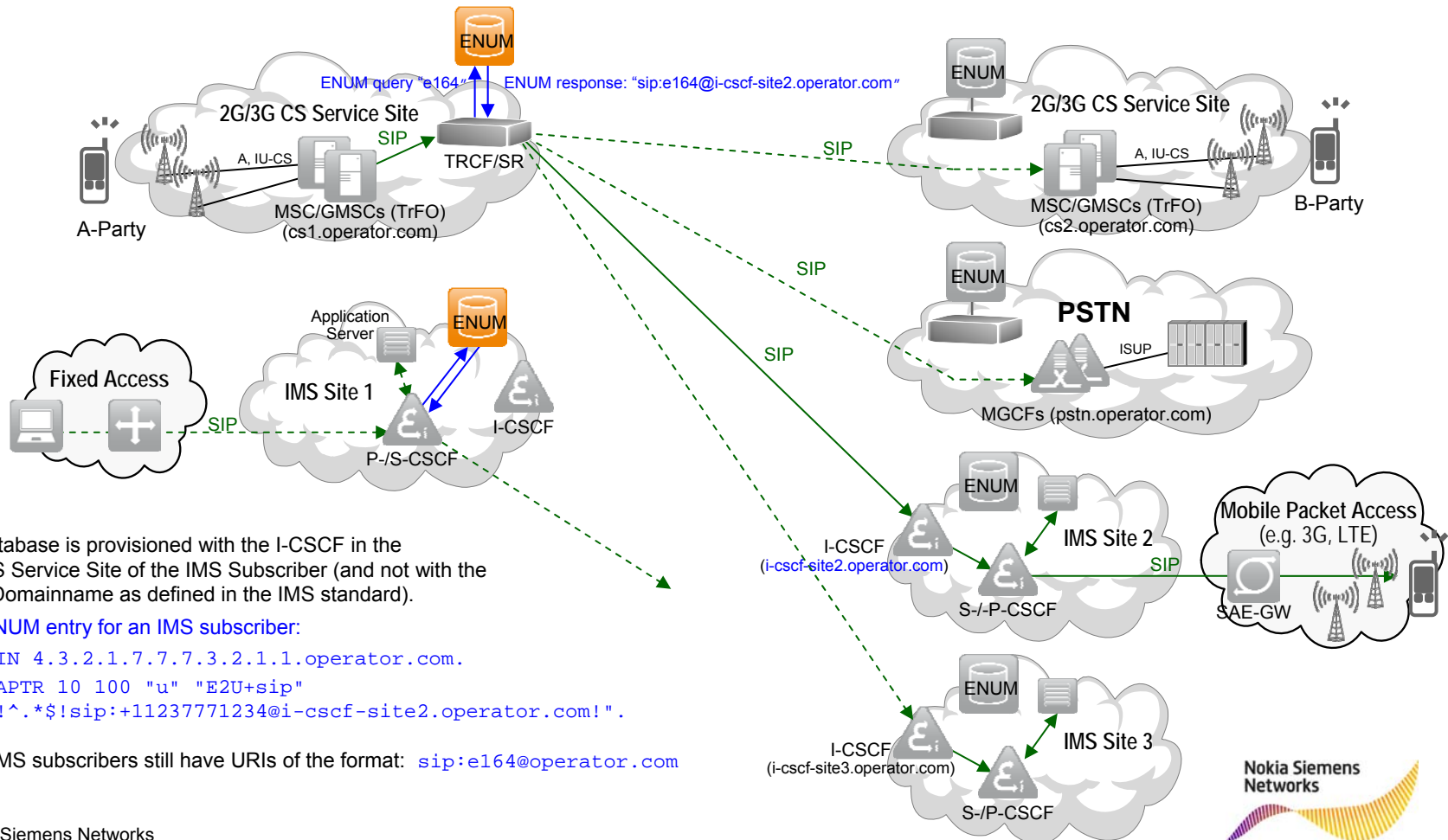


Relation between ENUM and NGN – Deployment Experiences



- **Adding IMS/VoIP (xDSL/FTTH, LTE) to the example:**

- Existing CS (TRCF/SR) and IMS (S-CSCF) share the same ENUM database.
- ENUM helps to find the Home IMS Service Site of the IMS Subscriber.



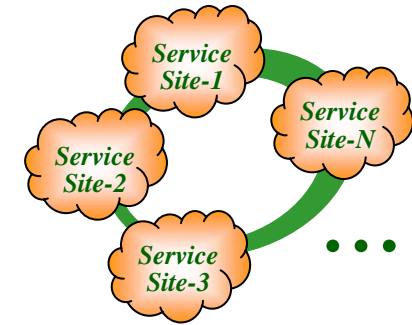
- ENUM database is provisioned with the I-CSCF in the Home IMS Service Site of the IMS Subscriber (and not with the operator Domainname as defined in the IMS standard).
- Typical ENUM entry for an IMS subscriber:


```

$ORIGIN 4.3.2.1.7.7.3.2.1.1.operator.com.
NAPTR 10 100 "u" "E2U+sip"
"!^.*$!sip:+11237771234@i-cscf-site2.operator.com!".
      
```
- Note: all IMS subscribers still have URIs of the format: sip:e164@operator.com

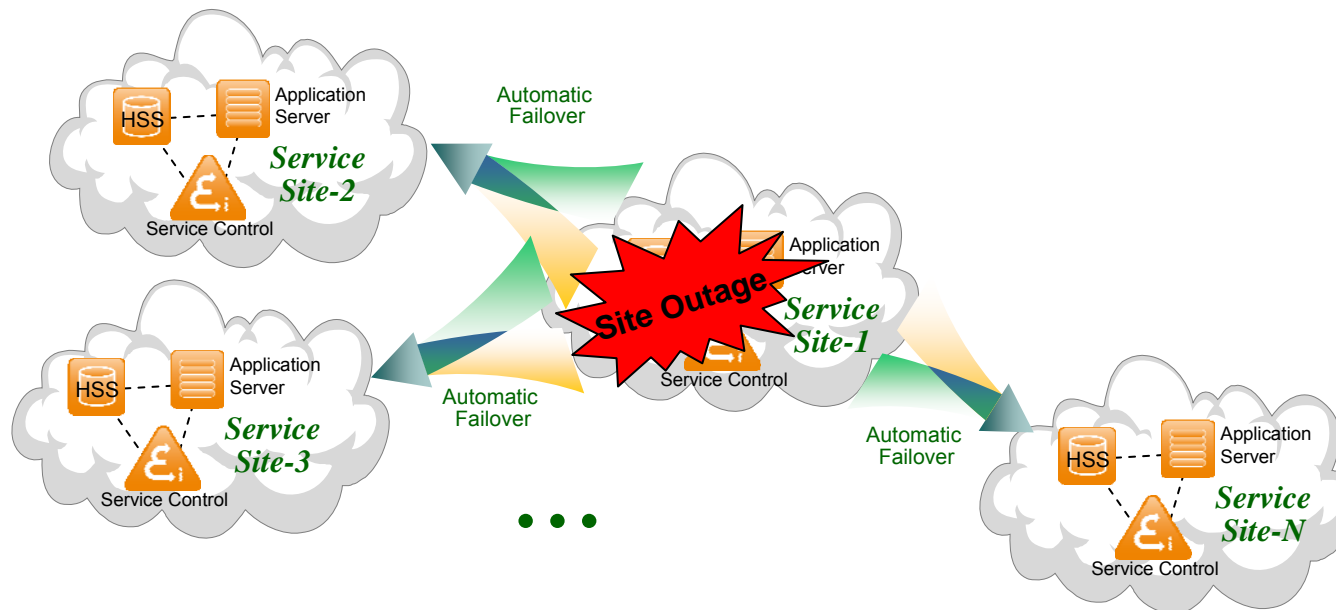


Relation between ENUM and NGN – Deployment Experiences

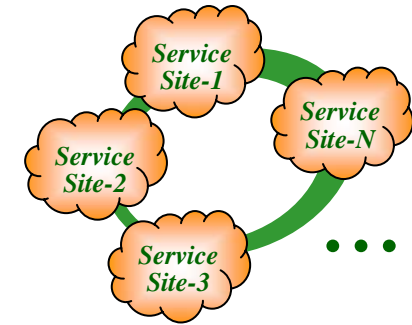


- **Support of IMS Multi-Site Redundancy:**

- **Multi-Site and Service Continuity support:** in case of an IMS site outage, the Service is maintained by one/more alternative sites.
- A **single domain name** for all IMS subscribers independent of the IMS service sites.
- Operators request the support of a **Home Concept** (= preferred IMS service site) for each IMS subscriber.
 - Can be solved via ENUM and/or DNS Views



Relation between ENUM and NGN – Deployment Experiences



- **Details on IMS Multi-Site Redundancy:**

- Based on NSN Multi-Site, distributed-, in-memory Database (One-NDS).
- DNS SRV Priorities can be used for Redundancy/Failover Control:

- for users that have “Site2” as their home site: `i-cscf-site2.operator.com` is configured in ENUM.
- for users that have “Site3” as their home site: `i-cscf-site3.operator.com` is configured in ENUM.

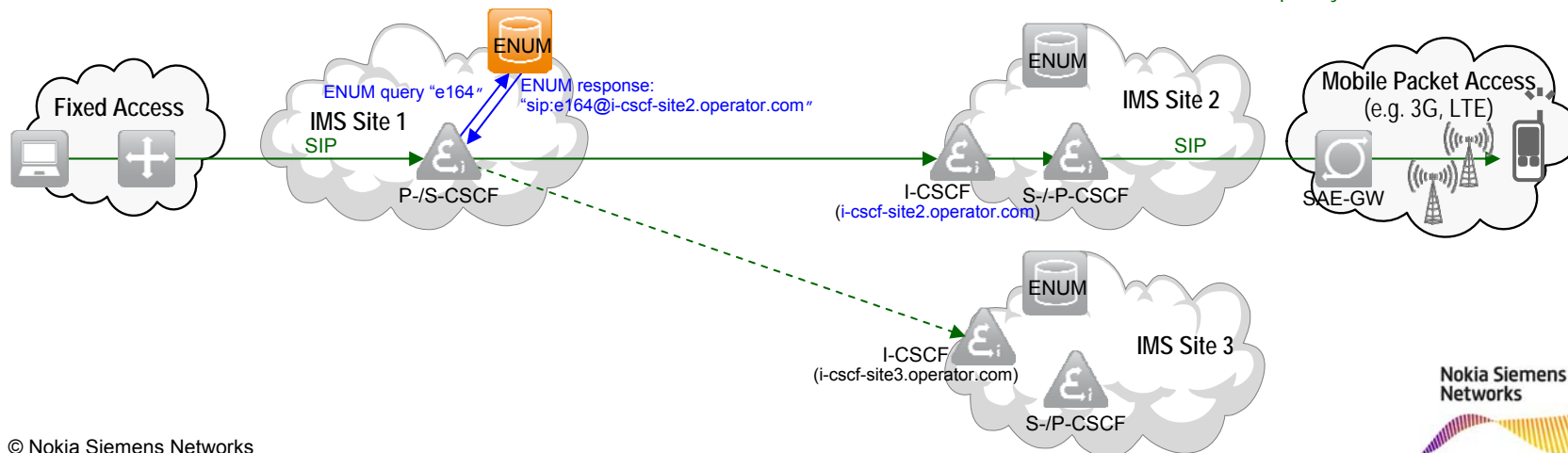
- All IMS sites of the operator have the same IMS Domain Name e.g. “operator.com” .
- Example ENUM entry for an IMS subscriber:

```
$ORIGIN 4.3.2.1.7.7.7.3.2.1.1.operator.com.
NAPTR 10 100 "u" "E2U+sip" "!^.*$!sip:+11237771234@i-cscf-site2.operator.com!".
```

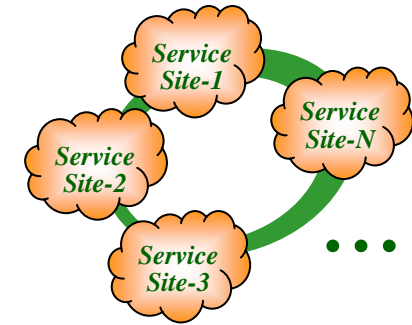
- Example DNS SRV entry:

```
i-cscf-site2      IN NAPTR 50 50 "s" "SIP+D2U" "" _sip._udp.icscf-site2
                  IN NAPTR 50 51 "s" "SIP+D2T" "" _sip._tcp.icscf-site2
```

```
_sip._udp.icscf-site2  IN SRV 10 20 5060 i-cscf-site2-host1 } The I-CSCFs located on “Site2” have higher
                        IN SRV 10 20 5060 i-cscf-site2-host2 } priority for “Site2” IMS Subscribers.
                        IN SRV 20 20 5060 i-cscf-site3-host1 } The I-CSCFs located on “Site3” have
                        IN SRV 20 20 5060 i-cscf-site3-host2 } lower priority for “Site2” IMS Subscribers.
```

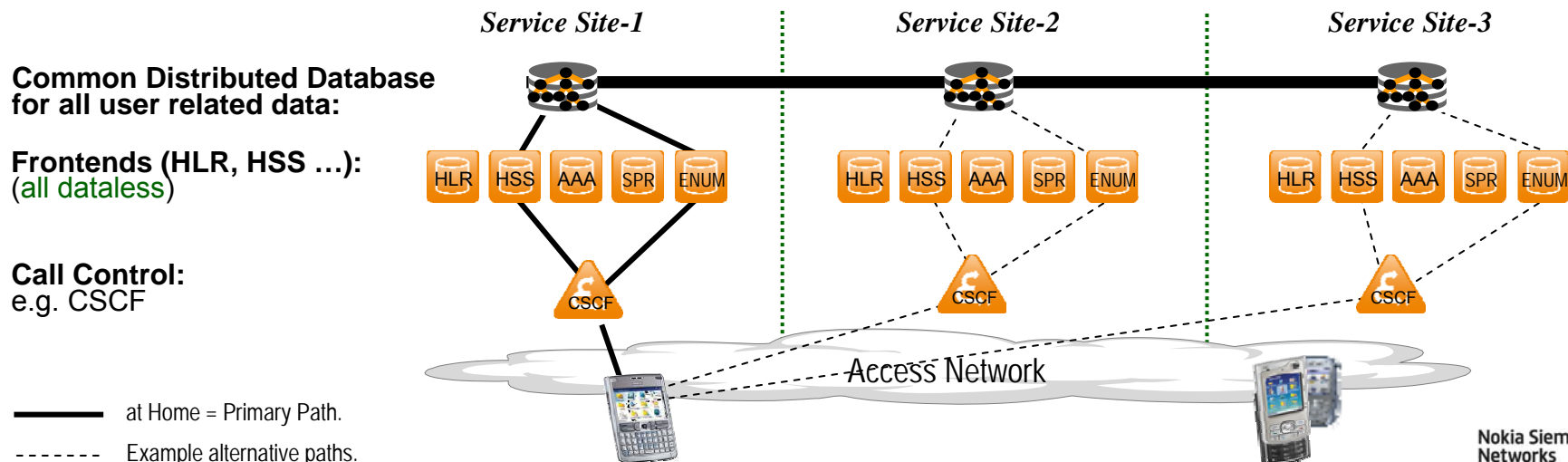


Relation between ENUM and NGN – Deployment Experiences



- **Number Portability Issues:**

- ENUM DB is able to maintain NP data → used today. But this is not yet well integrated with existing NP databases.
- Porting in/out of subscribers was built-in into the standard e.g. done using delegation (NS, DNAME Resource Records).
 - for example: 7.3.8.5.3.6.8.3.0.3.9.4.e164.arpa. IN NS NewServiceProvider.com. ; single, ported-out number
- There is a generic trend to consolidate all subscriber specific data into a single database to save OPEX and to support Geo-Redundancy:
 - Applications: HLR, AAA, HSS, SPR (Policy), some Application Server Data are supported today.
 - in the future, ENUM and NP data (e.g. located today in the STP/MNP-SRFs) might become part of the **Common NGN User Profile**.



Relation between ENUM and NGN – Summary

- **IMS will be the core of the NGN for Fixed/Mobile Converged Networks:**
 - In Fixed Networks, IMS based solutions are used already today.
 - LTE drives VoIP/IMS into Mobile Networks.
 - ENUM is a standard element in the IMS Core.
- **Only Infrastructure ENUM is required for the NGN:**
 - Infrastructure ENUM is used today. ENUM interconnections other operators do not exist widely, and are performed based on bilateral or multilateral SLAs.
 - Infrastructure ENUM is well protected in the operator network e.g. based on physically separate ENUM servers on isolated LANs.
 - User ENUM is not needed for the NGN.
- **Existing deployments need to be integrated:**
 - standard IMS uses ENUM only for the PSTN Breakout Decision. But ENUM is also used for routing and to maintain NP data.
 - Specific Operator requirements need to be considered e.g. Multi-Site Geo-Redundancy or Single Operator IMS Domain Support.

Thank You!

