Softswitch Requirements

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Softswitch Requirements: Summary

- Introduction: Background
- Requirements Listing
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  - Routing Functions
- Trial Architecture
- Switch Processing
  - Prefix Routing Table Algorithm
  - ENUM Routing Algorithm
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Introduction: Background

- Korean Industry and Government are working to develop and support new technologies
- Korean Government has a programme to support new addressing schemes - including ENUM
  - the +82 delegated ENUM apex is assigned to NIDA
- Korean Companies are starting to provide VoIP
- Korean Government has developed a regulatory environment for these services:
  - Allocation of Numbering resources for VoIP Providers
  - Performance and Quality rules for VoIP services
- NIDA is working with industry to test and develop ENUM for Korea

Requirements - Operational/Regulatory

- Resilient & Secure **and** Low Cost
- Able to restrict access - must allow call charging
- Provide Fast & Consistent Call Setup times
- Dynamic - allow rapid propagation of changes
- Provide clear Provisioning Responsibility & Control
- Able to handle foreign numbers (not in system)
- Allow good Problem Handling:
  - Early Detection (client knows when there's a problem)
  - Problem Isolation (your problem is not my problem)
    - Limiting destabilization of different carrier systems
    - Limiting error propagation
- Flexible - adapt to changes in service/regulation

Requirements - Softswitch Routing Functions

- Able to route call request to appropriate host
- Provide Fast & Consistent lookup times
- Provide clear chain of authority for published data
- Provide rapid update and propagation of data
- Provide deterministic lookup results:
  - Need to know what kind of number, which host handles calls, and how to process call (SIP, PSTN, …)
- Able to migrate from today to future market:
  - Able to support/reflect Number Portability
  - VoIP-only number range:
    must be able to indicate service status for each number

Korean ENUM Trial Architecture

- NIDA
  - Combined Tier1/Tier2 Authoritative ENUM Servers
  - Centralised ENUM Provisioning using EPP
  - NIDA used DNS Update to reflect changes to ENUM entries onto Authoritative DNS servers
- Each Service Operator (there were two)
  - Carrier used EPP Client to provision ENUM
    - Note: these EPP Clients were decoupled from their Customer provisioning systems
  - Carrier's Softswitches had configurable Prefix Table or ENUM sub-system to select call route
  - Softswitch ENUM sub-system was connected to carrier's own "Internet-visible" Recursive Resolver

Prefix Routing Table Algorithm

- Examine first few digits of Destination Number
- Look up this prefix in “hard-coded” internal table
- If found, process call according to table entry:
  - Process using another Table to select gateway host
    or
  - Process using appropriate/specific PSTN gateway
- Else…
  - Process using generic PSTN gateway

ENUM Routing Algorithm - 1

- Phase 1 - ENUM DNS Query
  - Convert Destination Number to ENUM domain
  - Send DNS query to ENUM domain for NAPTR RRset
  - Get DNS Response and check RCODE
  - If RCODE<>0 .or. N.answers == 0, exit to [PSTN]
  - Else…
    - strip all but E2U NAPTRs that have supported Enumservices
    - If none left, exit to [PSTN]
    - sort remaining NAPTRs on ORDER/PREFERENCE value
    - Pick “top” one

  Note: A common Phase 2 scheme was considered but not implemented in the trial - each Carrier used its own method to process SIP URIs

- [PSTN] - (use existing gateway processing to deliver call onwards to destination via PSTN)

Background: ENUM Routing Algorithm - 2A(i)

- Phase 2 - Finding destination SIP Proxy/B2BUA
  - Extract domainpart from selected ENUM NAPTR
  - Send DNS query to *domainpart* of selected NAPTR
  - Get DNS Response and check RCODE
  - If RCODE<>0, exit to [PSTN]
  - If N.answers == 0
    - Send DNS query to _sip._udp.<*domainpart*> for SRV
  - Else…
    - Select appropriate entry in RRset (D2U or D2T or …)
    - Extract target domain from D2x NAPTR
    - Send DNS query to D2x NAPTR target domain for SRV
  - Get DNS Response and check RCODE
  - If RCODE <> 0 .or. N.answers == 0, exit to [PSTN]
  - Else…

Background: ENUM Routing Algorithm - 2A(ii)

- (at this point, client has SRV for this SIP domain)
  - Extract Target Hostname and port

- *Scan internal host table for pre-arranged Security Associations, or select default connection type*

Background: ENUM Routing Algorithm - 2B

- Phase 2 bis - Finding SIP Proxy/B2BUA in table
  - Scan internal table for this SIP *domainpart*, looking for gateway (hostname and port)
  - If not found, exit to [PSTN]
  - Else…
- *Scan internal host table for pre-arranged Security Associations, or select default connection type*

Note: Common Phase 2 method was considered but not implemented in the trial - each Carrier used its own method to process SIP URIs

Trial Performance Results

Call Type	ENUM Processing	Prefix Table
CarrierA->CarrierA	2.33 seconds	2.28 seconds
CarrierA->CarrierB	2.23 seconds	2.25 seconds
CarrierA->PSTN	4.11 seconds	3.79 seconds
CarrierB->CarrierB	**2.18** seconds	**2.05** seconds
CarrierB->CarrierA	2.19 seconds	2.19 seconds
CarrierB->PSTN	3.95 seconds	3.41 seconds

Note: these are correct average performance figures for the trial.

I-D will be updated to correct **my** transcription errors (apologies).

Trial Lessons

- Carriers **know** that call setup with ENUM works
- Centralised Provisioning System with EPP was OK for this trial, but not appropriate for full commercial service
- Combined Tier1/Tier2 avoided Carrier concerns:
  - Not relying on another carrier to meet their performance requirements, and had defined responsibility for problems
  - RFC 3263 provisioning and publication is an issue; how does this fit with centralised T1/T2 ENUM service?
- Trial did not cover:
  - Number Portability: process for transfer of responsibility for ENUM domain from one carrier to another is considered in future work
  - VoIP-only numbers - trial always passed unknown destination number to PSTN for processing. This needs further work
  - Multi-entry ENUM domains - trial supported EDNS0, but some DNS servers do not do this yet (=> RCODE 5 responses)

Migration Issues - 1

- Centralised T1/T2 was not an issue. Ensuring resilience may be in the long term.
  … Both may be issues for other Countries and regulatory regimes
- Provisioning every number in ENUM will be a scaling challenge
- ENUM provisioning should be integrated with each carrier's customer provisioning system
- Globally accessible DNS entries are a security and privacy concern - why have public access?

Migration Issues - 2

- ENUM is a mission-critical system, and problems must be isolated:
  - How to ensure that timeouts do not push up call setup times?
  - How to ensure that excessive queries do not degrade authoritative server performance?
  - How to publish and propagate changes quickly, whilst limiting query traffic?
- With full commercial service and many carriers, number portability **is** already an issue
- Special processing for VoIP-only numbers may need a way to indicate unused numbers so that PSTN processing is not tried
  - provisioning “unused” ENUM entries may be a solution
  - but… this risks exposing carrier-sensitive information

Current Work

- As mentioned, Number Portability was not covered in this first performance trial. However…
  - This year there are two expanded & interconnected trials covering NP in Korea and China - one managed by NIDA and one by CNNIC
  - These use ENUM entries for NP (i.e. to port a telephone number, the corrected entry **must** be in ENUM or there must be **no** ENUM entry at all)
  - Both systems still uses a common T1/T2 scheme
  - The ported-to carrier requests provisioning of a new SIP URI into the appropriate ENUM domain
  - ENUM provisioning authority with NP is treated similarly to a registration transfer for a .kr or .cn domain.

Your Experiences Needed

- This is a summary of the first Korean ENUM trial. There are other trials and commercial markets "out there" so WE NEED YOUR HELP

- Your trial (or commercial) experiences are sought:
  - We would like to add these to the draft as guidance for others before the final version is published
  - This is scheduled for completion by the next IETF70 meeting in December so comments are welcome ASAP
  - Please contact me (or the other authors) and we will try to capture these experiences in the final version.

Thanks! Questions?