RESEARCH AND ACADEMIC COMPUTER NETWORK

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Cost optimization based on ENUM entries – research project

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Cost optimization based on Enterprise-ENUM

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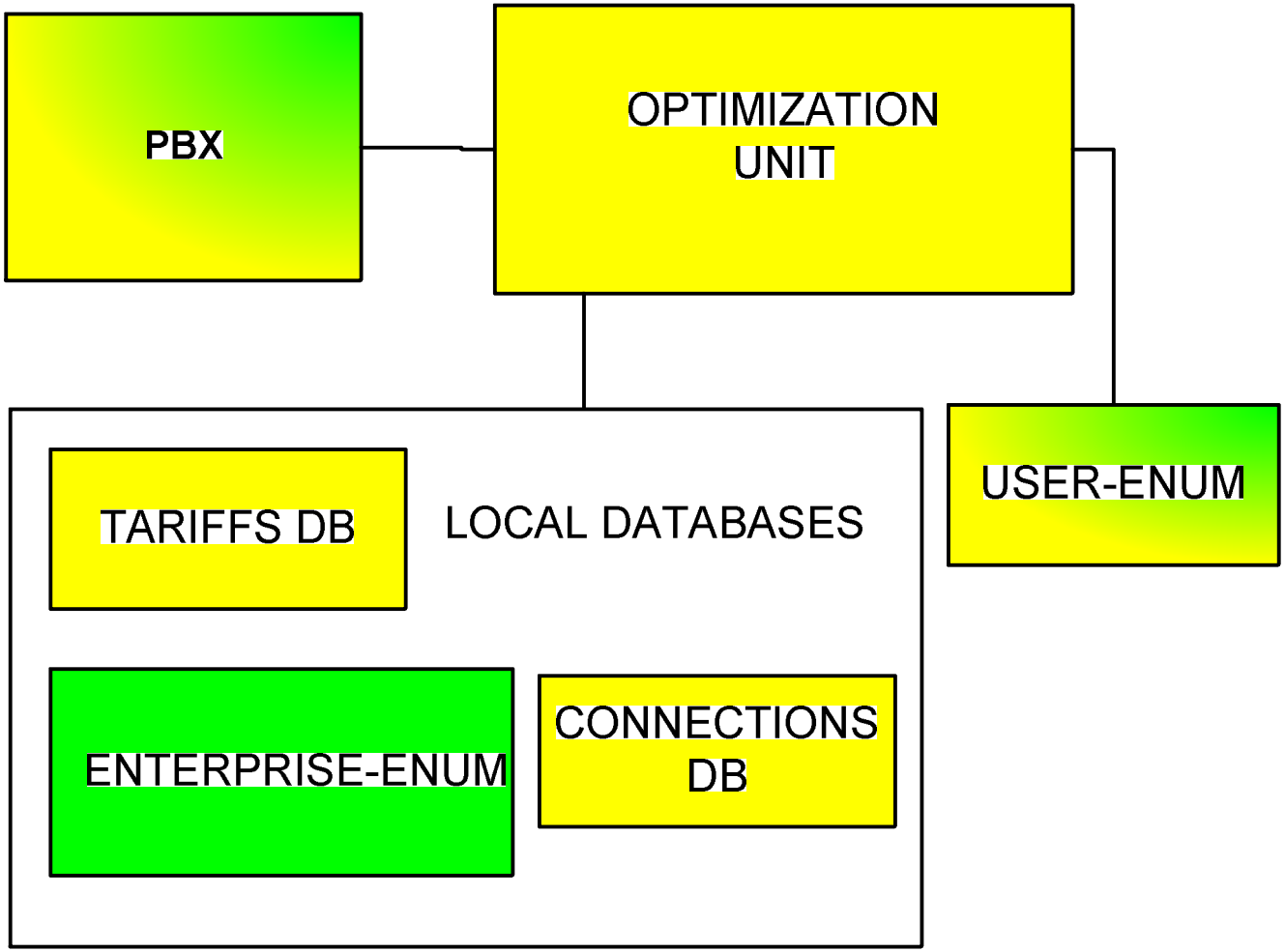
Cost optimization based on Enterprise-ENUM

conception

Cost optimization based on Enterprise-ENUM



Cost optimization based on Enterprise-ENUM

Parts of the solution

- **PBX (i.e. ASTERISK)**
- **Optimization unit**
- **DNS interface**
- **User-ENUM (public DNS tree)**
- **Enterprise ENUM (private/local DNS tree)**
- **Tariffs' database (up-to-date, valid telecom. rates)**
- **Connections' database (history of the user's connections)**

Cost optimization based on Enterprise-ENUM

Assumptions

- **In order to make an optimal choice of the way of connection, the user (subscriber) can use information included in DNS in form of ENUM domains and NAPTR records.**
- **The public available ENUM base (User-ENUM) includes information regarding accessible for the subscriber forms of contact as well as information about preferred forms of contact. Unfortunately, the information regarding preferred forms of contact shows only preferences of the called person, not preferences of a person who initiated a connection. That is why this information could be not adequate for The Caller.**
- **On the basis of the history of established connections as well as information about actual and obligatory telecommunications rates, a switchboard (or external to it module) will analyze data and the results (preferences regarding contacts) will be saved in the local DNS. In case when the subscriber (The Caller) initiating a connection, would inquire the ENUM database about available forms of contact (and this inquiry will be transferred to Enterprise -ENUM instead to User -ENUM database), The Caller will get an information, which will let him to choose the cheapest form of telecommunication connection.**

NAPTR’s extensions

Cost optimization based on Enterprise-ENUM

NAPTR extensions

- **[ORDER] Preferences of the calling party**
  - It's NOT the preference of the called party stored in user-ENUM
  - It is based on the analyses of data stored in the CONNECTIONS DATABASE & TARIFFS DATABASE
- **[PREFERENCE] Probability of the connection**
  - the probability value is based on the analyses of the data stored in the CONNECTIONS DATABASE
  - [PREFERENCE] = 100 – probabilty(connection)
- **Additional flag: [QUALITY]**
  - Quality of the connection (for details see next slide)
- **Additional FLAG: „O"**
  - Indicates that NAPTRs are including the additional information (mentioned above)

[QUALITY] flag

- **[QUALITY] Overal quality indicator from the point of view of the Caller.**
  - Mentioned above indicator will be marked with a flag having value from 0 to 9 (range limited by RFC 3403), where "0" indicates not acceptable quality of connection, and "9" indicates an "ideal" connection (it means with a constant and acceptable delay, without lost of packets etc.).
  - The quality of connection can be determined on the basis of any parameter identifying the quality of connection; in particular for VoiP it could be the parameter MOS-LQ (Mean Opinion Score Listening Quality) or MOS-CQ (Mean Opinion Score Conversional-Quality). Parameters MOS-LQ and MOS-CQ are in the range from 1 to 5. For MOS-LQ and MOS-CQ the value [QUALITY] will be defined with following formula:
  - [QUALITY]=MOS-LQ *2-1 or [QUALITY]=MOS-CQ *2-1

Cost optimization based on Enterprise-ENUM

Downgrade compatibility

- **PBX "standard" extensions using the ENUM database, can use the modified INFRASTRUCTURE-ENUM database without problems.**

examples

Cost optimization based on Enterprise-ENUM

Example of the User-ENUM

- ***0.0.2.1.3.2.5.2.2.e164.arpa NAPTR 100 10 "up" "tel+E2U" "!^.*$!tel:+48225231200!"***
- ***0.0.2.1.3.2.5.2.2.e164.arpa NAPTR 200 10 "up" "tel+E2U" "!^.*$!tel:+48225231204!"***
- ***0.0.2.1.3.2.5.2.2.e164.arpa NAPTR 300 10 "up" "sip+E2U" "!^.*$!sip:204@obelix.nask.waw.pl!".***
- ***0.0.2.1.3.2.5.2.2.e164.arpa NAPTR 300 20 "up" "mailto+E2U" "!^.*$!email: info@nask.biz!".***
- ***0.0.2.1.3.2.5.2.2.e164.arpa NAPTR 300 30 "up" "tel+E2U" "!^.*$!tel:+48225231395!".***

Cost optimization based on Enterprise-ENUM

Example of the Enterprise-ENUM (part 1)

- *0.0.2.1.3.2.5.2.2.e164.arpa NAPTR 100 50 “5oup" "sip+E2U" "!^.*$!sip:204@obelix.nask.waw.pl!“.*
- *0.0.2.1.3.2.5.2.2.e164.arpa NAPTR 200 10 "9oup" "tel+E2U" "!^.*$!tel:+48225231200!“*
- *0.0.2.1.3.2.5.2.2.e164.arpa NAPTR 200 10 "9oup" "tel+E2U" "!^.*$!tel:+48225231204!"*
- *0.0.2.1.3.2.5.2.2.e164.arpa NAPTR 200 100 “oup" "tel+E2U" "!^.*$!tel:+48225231395!“.*
- *4.0.2.1.3.2.5.2.2.e164.arpa NAPTR 100 50 “5oup" "sip+E2U" "!^.*$!sip:204@obelix.nask.waw.pl!“.*
- *4.0.2.1.3.2.5.2.2.e164.arpa NAPTR 200 10 "9oup" "tel+E2U" "!^.*$!tel:+48225231200!“*

Cost optimization based on Enterprise-ENUM

Example of the Enterprise-ENUM (part 2)

- *4.0.2.1.3.2.5.2.2.e164.arpa NAPTR 200 10 "9oup" "tel+E2U" "!^.*$!tel:+48225231204!"*
- *4.0.2.1.3.2.5.2.2.e164.arpa NAPTR 200 100 “oup" "tel+E2U" "!^.*$!tel:+48225231395!“.*
- *0.0.2.1.3.2.5.2.2.e164.arpa NAPTR 100 50 “5oup" "sip+E2U" "!^.*$!sip:204@obelix.nask.waw.pl!“.*
- *5.9.3.1.3.2.5.2.2.e164.arpa NAPTR 200 10 "9oup" "tel+E2U" "!^.*$!tel:+48225231200!“*
- *5.9.3.1.3.2.5.2.2.e164.arpa NAPTR 200 10 "9oup" "tel+E2U" "!^.*$!tel:+48225231204!"*
- *5.9.3.1.3.2.5.2.2.e164.arpa NAPTR 200 100 “oup" "tel+E2U" "!^.*$!tel:+48225231395!“.*

algorithms

Cost optimization based on Enterprise-ENUM

Optimization algorithm using Enterprise-ENUM database

1. **The Switchboard MUST query the "Enterprise-ENUM" database.**
2. **In response a switchboard receives a list of NAPTR records or information about lack of record in DNS.**
3. **The switchboard is trying to establish a connection, considering the sequence of NAPTR records by including parameters saved in fields: ORDER and PREFERENCE. When connection is established, an algorithm is finished.**
4. **If there is a lack of record in Enterprise-ENUM database, the switchboard MUST query User-ENUM database.**
5. **As a response, switchboard receives a list of NAPTR records or information about lack of record in DNS.**
6. **Switchboard is trying to establish a connection, considering the sequence of NAPTR records by including parameters saved in fields: ORDER and PREFERENCE. Enterprise-ENUM database has to be filled in with correct data, before it will be used for optimization.**

Cost optimization based on Enterprise-ENUM

"Enterprise-ENUM" updating algorithm (part 1)

1. **Optimization Module selects first contact from Connections database and retrieves from the contact (history of particular connection), identifier (phone number, SIP address) of subscriber**
2. **For given identifier, Optimization Module retrieves from "User-ENUM" database lists of available NAPTR records.**
3. **Optimization Module retrieves from Connection database all contacts (histories of particular phone connections), performed for particular subscriber, regarding each identifier (phone number, SIP adress) received in step 2 of this algorithm. As the result, there is a list of all contacts (history of calls) realized in every possible way (voice calls for all known numbers - subscriber's identifiers), that were in Connection database.**

Cost optimization based on Enterprise-ENUM

"Enterprise-ENUM" updating algorithm (part 2)

4. **On the basis of data stored in Connection database and Rates database, sequence of contacts to particular subscriber is being determined (from cheapest to most expensive). Additionally, for each identifier, there is determination of probability of correcting initiation contact, and evaluation of average connection quality.**
   a. Algorithm may consider those forms of contact, which were not considered in history of connections, determining in advance some values for quality of the connection and probability (i.e. [QUALITY]=5 for all contacts)
5. **All identifiers with determined parameters are saved in zone file in "Enterprise-ENUM" database in accordance with fields description (see subsection "Extensive meaning of NAPTR fields in Enterprise-ENUM")**
   a. For every identifier , internet domain is created and for this domain NAPTR records are created, related with all other contacts (e.g. for 3 numeric contacts there are 3 domains and totally 9 NAPTR records being created)

Cost optimization based on Enterprise-ENUM

"Enterprise-ENUM" updating algorithm (part 3)

6. **Optimization Module marks all contacts (calls) stored in Connection Database that has been completed with given subscriber, in order to omit these records within next loop of the algorithm.**
7. **Optimization Module searches another possible contact from Connection Database and goes to the step 2 of this algorithm.**
   a. If there are no records to be retrieved from Connection Database, algorithm ends, saving the results as a file of "Enterprise-ENUM" database.

More info...

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