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Management Services and Mobility Customer in IP Network

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ABSTRACT

We describe in this article a new approach for IP Network Management: the management of the mobility customer and terminal, based on the management by policy of IETF and benefiting from COPS as the communication protocol and its extensions. First of all we will define the architecture proposed by IETF and its environment. Thereafter we describe a new platform more ameliorated to control the quality of service, and we develop finally a new model named MCMS (Management Services and Mobility Customer), to facilitate the movement of customer while changing the origin network. All this by trying to guarantee the services offered previously in the customer contract.

Keywords **-** Quality of service, SLA, PBM, COPS, IP network

I. INTRODUCTION

Nowadays, the requests of customers on internet are ever increasing in Computing resources than before, and service providers are asked to provide more diverse services as well.
The size of computer networks has grown with time and gotten complicated to manage. While the method BEST EFFORT for the transfer of streams used in the IP network is limited.

The appearance of new type of data over IP such as voice, video and TV demands a guaranteed quality of service QoS. It includes a set of methods which increases the performance of the network, for example A delay of transfers of packets from an application in a real time like the videoconference will result degradation of the image quality even causing the session to end, to correct all those aberrations, the quality of service QoS takes the necessary measures to manage the existing bandwidth either by classification of the circulating streams or by reservation of the available resources in the network . like the reservation of roads and paths for some data streams in a network using the routing instead of the switching. All of this measures stays in many cases insufficient, From where comes the notion of « policy » that includes all the necessary rules for a reliable management of the resources access. This approach takes in charge of other domains in addition to quality of service QoS, like security management or the user mobility

II. POLICY BASED MANAGEMENT

A. Introduction

The management by policy means management of the computer network according to a policy containing a set of rules. this policy is the translation of a contract between the customer and the access provider, either by a negotiation of the customer need, or by an acceptance of rules proposed by the operator to offer these services and grant these privileges to the customer demands . The computer network can be seen as a set of objects supervised by a system administration. this system contains management processes that requires the different local databases while respecting the rules of information system and using a specific communication protocol to exchange this different requests.

Several works define models of information, in our study which is interested to the quality of service QoS. IETF (Internet Engineering Task Force) Standardized the PCIM (Policy Core Information Model
) [6] as far as the core of the model of information of the management by policy and its extensions QPIM(Policy QoS Information Model) [9]or QDDIM (QoS Device Datapath Information Model)[9], and the protocol COPS or LDAP as the communication protocol for this architecture.

B. Architecture

The general architecture of this management, consists to centralize the decisions within an intelligent entity PDP (Policy Decision Point)[4][8], it assures several features, among them we find, the translation of the rules of politics in an understandable size for knots, the communication with the other servers to make a decision, the identification of the policies to be applied to the various PEP (Policy Enforcement Point) [4][8], this last one can be a router, switch or even a firewall, and quite other type of intermediary between the customer and the network, its role consists in applying the decisions taken by the PDP, it can be configurable by SNMP, and by command CLI (Line Interface command).

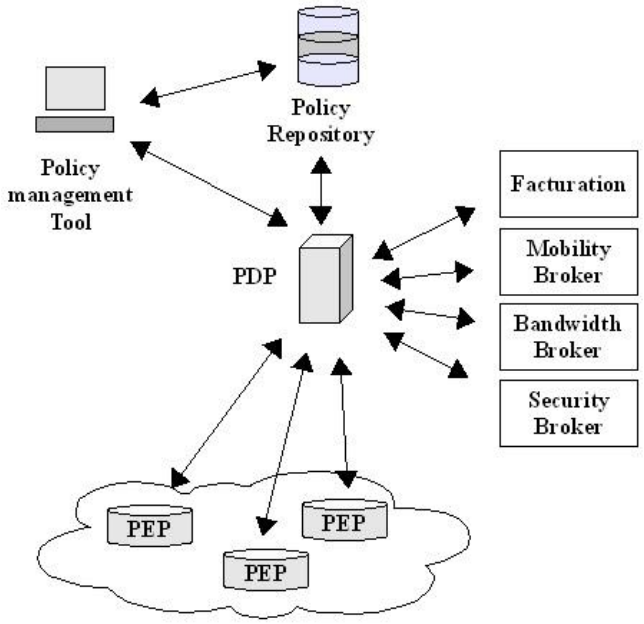

Figure 1.Policy-Based Management Architecture

C. Protocol COPS and its extensions

The protocol COPS (Common Open Policy Service) as the basic communications tool, consists in transporting the demands and turning the policies to be applied, and detecting the conflicts during the installation of policies. COPS also interacts with two main models of the management by policies, the Outsourcing [1][5] and the Provisioning [1][5], the first one is going to delegate the decision to accept or to reject ,although modify a demand of reservation of resource for a new customer to the server of policies PDP, with help of the protocol COPS-RSVP [11][12] extension of COPS, within a network which the customer is not subscribed, in the favorable case, the PDP sends the configuration to be set up in the PEP bound, this last one forwards the configuration to the customer.

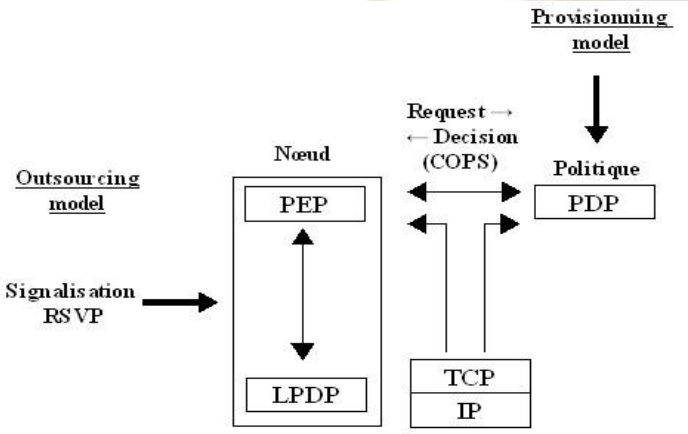

Figure 2. COPS and the Policy Based Management

The second model consists in defining requirements SLA (Level Agreements service)[13] further to a negotiation between the customer and the operator, this service contract defines the responsibilities of the supplier in the availability, degree of stability of networks, and method of calculation, it will be translated into a technical specification SLS (Level Specification service) to memorize in the databases of the operator, which will be requested in the future during the sending of the customer flow in the entrance of the network, this model is often associated with the technique DiffSev[2] in which streams are classified according to many classes, to set up these various configurations of management of the QoS, Provisioning uses the extension COPS-PR [12]for the transfer of the data of policies which take the name of PIB (Policy Information Base).

III. MANAGEMENT OF THE USER MOBILITY AND TERMINAL

A. Management of Services

In the establishment of the customer contract, the provider must ensure the negotiated services previously even during a user movement. So we distinguish basically two types of possible mobility. The first one is about changing the network, where the user keeps the same terminal but changes the cover. The access provider must ensure the connectivity of this user continuously with service and more precisely the same service in this new network.

In the second type, the user stays in the same network but changes the terminal. so he must benefit the same service knowing that he changes the type of terminal .this type of mobility requires user authentication, For this a password or smart card is highly requested even an obligation.

To manage this two type of mobility, we find two extensions of the basic communication COPS protocol: COPS-Mobile User & COPS-Mobile IP

B. COPS-MIP

In this extension of COPS for Mobile IPv4, each network the home network and the foreign network contains a PDP and PEP. In Home Network, we find HPDP (Home Policy Decision Point) equivalent of PDP, and the HPEP (Home Policy Enforcement Point) or HA (Home agent) equivalent of PEP. In the foreign network a FPDP (Home Policy Decision Point) is equivalent of PDP and FPEP (Home Policy Enforcement Point) or FA (Foreign Agent) is equivalent of PEP.

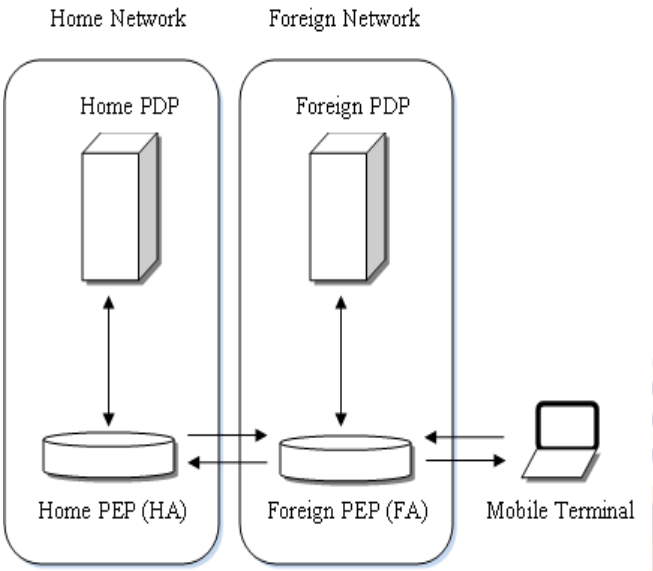

Figure3 : Registration process with **COPS-Mobile IP**

1. The Mobil terminal asks the recording in foreign network through the foreign agent FA
2. A negotiation is established between the FA and the related PDP (FPDP).
3. The FA establishes a connection with the home agent HA and asks the recording of terminal.
4. A negotiation is established between HA and HPDP to decide the policy to be executed.
5. The HA send back the answer to FA.
6. After receiving the answer of recording, the FA and the FPDP decide the policy to execute.
7. The FA allow to the mobile terminal its answer of recording

C. COPS-MU

COPS-Mobile User Offer advantages compared to other protocols. this extension is more adapted not only to the mobility but also to the quality management of service. this is because of Its capacity to insure the portability of the services, by ensuring the previously offered parameters to customer requests, as well as the management of any interruption or blockage caused by changing the network. it should be noted that this extension is applicable to IPv6 networks.

In this version we distinguish two modes. One of the user and the other one of the terminal with symmetric modes of recording.

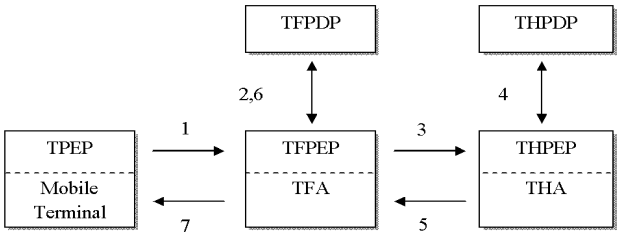

Figure4 :Registration of Terminal (COPS-MU)

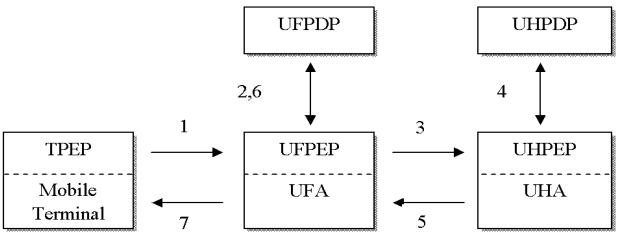

Figure5 :Registration of User (COPS-MU)

1. The terminal asks the recording in foreign network through the terminal foreign agent TFA
2. The launch of a negotiation between TFA and TFPDP to decide the policies to apply
3. The establishment of a connection between TFA and the Terminal Home Agent THA to record the terminal.
4. The negotiation between THA and THPDP to decide the policies to execute.
5. The THA send back the answer to TFA
6. After the reception of return, the TFA and the TFPDP decide the policy to execute further to the answer of recording.
7. The TFA answer the terminal mobile further to its answer of recording.

The mode of terminal recording or that of the user stays the same. The difference is in the mobility of the user which requires always its recording because of changing the used terminal. For recording the terminal, it remains limited only during network change. For these two modes an association is established for every recording. In the terminal mobility, the THA records the connection between the address of terminal and its address in the original network, while in the user mobility; the UHA keeps a connection between the identifier of the user and its address of terminal.

IV. MSMC MODEL (MANAGEMENT SERVICES & MOBILITY CUSTOMER)

A. Network management Objectives

After the microscopic study of the model Centralized Policy-Based Management and the distribution of entities, we tried to improve this model so as to decrease the traffic bound to the centralization of the decisions within the PDP, and to give more flexibility to the customer to manage his

own account, We define at the beginning a new notion LAS (Level of Available Service) and we describe the scenarios possible during the connection of a new customer or already existing in the data base of the operator.

At the first and before any communication with a new customer, the PDP makes a calculation on these databases in functions of existing contract SLA (service-level agreement) defined between operator and customer, with this study we will go establish levels of available service (LAS) which determines the available configuration which the network operator can supply and offer during a next demand. After this determination of LAS, they will be forwarded to all PEP, while benefiting from asynchronous mode of the PDP.

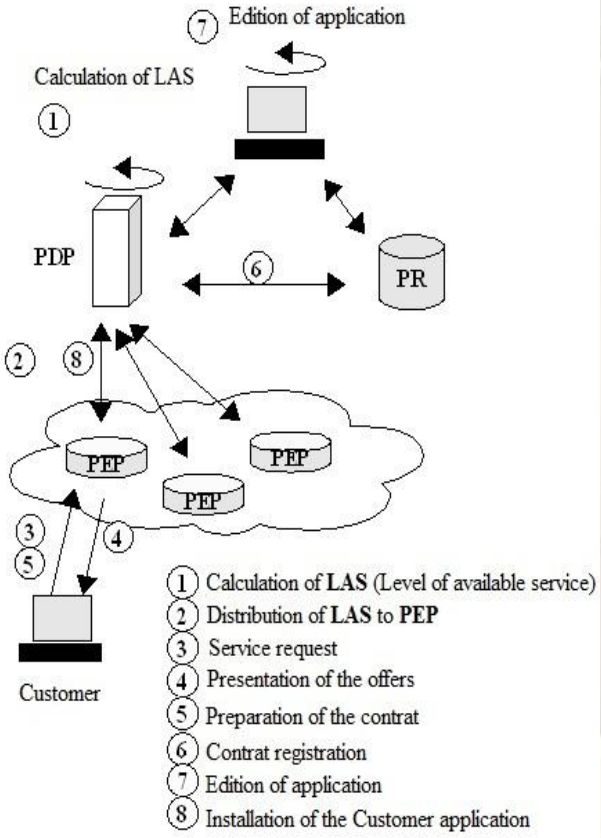

Figure 6: Service contrat for a new customer

In the connection of customer in the network operator, we can distinguish between two modes of connection, the first one is for a new customer who requires quality of service for these demands, a phase of negotiation will be established between the applicant and the PEP only without referring to the PDP, the PEP offers a proposal to the customer by basing itself on the LAS sent previously by the PDP, after the negotiation of both participants, the PEP sends to the PDP the project of the established contract which is the report of negotiation, and asks the recording this new customer in database PR (Policy Repository) [1][8], also the creation of a subscribed account. The PDP converts the rules of politics in an adapted form named PIP(Policy Information Point) which is the source off attribute values, this translation as well as the information of the account and the contract elaborated for this customer will be afterward translated in an adequate mechanism generated by the PDP and sent at the new subscriber.

This shape of management became possible thanks to the improvement of the PEP by the integration of the component LPDP (Local Policy Decision Point) [1][8]who plays a role of local mask of the policies without interacting with the PDP, This last guard always the property to control and oversee the network and all the knots, thanks to its communication with these servers local or distant as the server policy repository in whom the PDP is going to make the search on the rules of policies, or the server of bandwidth who manages the available bandwidth in the network, We notice that the load of negotiation will be decentralized towards the PEP and that a new mechanism is defines in an adaptable format for every customer that we shall explain later.

The addition of every new customer activates the update of the PR database, as well as the calculation of the LAS and the distribution of this information to all the PEP / LPDP. The PEP can appeal at any time to the PDP to react in front of a situation for which it does not arrange adequate rules, it's responsible for the cancellation of any demand become unacceptable further to a customer modification.

This shape of communication requires the use of the basic protocol COPS, this last one uses a model customer / server, to whom the PEP sends messages of decision, the PDP is going to answer as a consequence by messages containing the taken decisions.

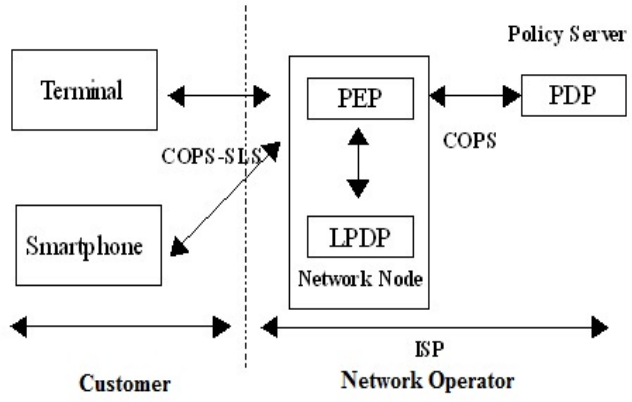

Figure 7: Distribution of Protocol COPS

In this approach the use of COPS will be extended for the negotiation between the customer and the PEP, without needing to refer to the server of policies PDP, the extension COPS-SLS [9][10] proposed in June 2001 by LIP6 and ENST will be requested, We will define the basic protocol and we explain afterward its improvement in our proposal, this protocol purpose the negotiation of the policy between the PEP and the PDP, it can appear as a communications tool inter and intra domain, In the model COPS-SLS proposed previously, the negotiation is dynamic between the customer station and the server of the policies, this automation gives to the customer the possibility to introduce the SLS (Service Level Specification) directly with its ISP (Internet Provider service).

This protocol includes two phases, the phase of configuration which determines the way of negotiating, and the phase of negotiation, which takes care of the exchange of the information necessary for the definition of the SLS between the PEP and the PDP for the establishment of the contract, To succeed this shape of management, we pass by the installation of the way of negotiating the SLS with PEP while benefiting from the provisioning model by the PDP, after this negotiation, the wished SLS will be sent to the PDP, This last one makes its decision to accept or to reject the demand or to propose another contract, the report of customer installation is sent to the PDP, after check of the report, the PDP signs the contract and the customer benefits from the level of service, in the opposite case no contract is established, in our solution the protocol COPS-SLS will be adapted the way that negotiation is made between the customer and the PEP, the authorities of classes PIP, Named ClientSI used for the phase of configuration, and Signaled ClientSI used for the phase of negotiation are encapsulated in the object ClientsSI of the protocol COPS-SLS.

We were able to adapt this protocol for a communication express between the customer and the PEP thanks to its flexibility for the dynamic negotiation of the SLS. After the agreement of the PDP a device which allows identifying the customer as well as its contract will be edited by the operator and to install at the customer terminal.

In the case of a connection of a customer already registered in the database PR using any support(fixed terminal or mobile, Smart phone), the device installed previously at the customer since its first connection is going to allow him to send the flow without negotiation or interrogation of the router to border, This last one as well as everything the knots of the network will be ready to receive these flows of data negotiated previously in the SLA-SLS, the device installed at the customer allow him to be mobile and more flexible for the exchange of streams, with this mechanism the customer will not need to connect in a specific router to emit these data.

Global architecture

The principal objective proposed in this article, it is the redistribution of the roles of the entities that constituting the management by policies, and the decentralization of spots towards the periphery of the network for reasons already evoked several times, the second objective is the decrease of the traffic related to the customer identification and the number of protocols used in the network domain by the use of the protocol COPS-SLS adapted to our architecture.

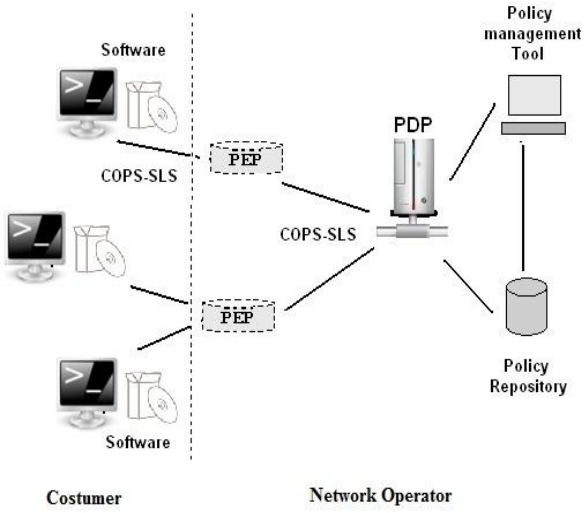

Figure 8: Global Architecture

To complete this architecture, the plan which we quoted previously in the previous section is translated in application for every type of customer equipment, the setting-up of a software which is going to contain the customer identity, by the identification and the authentication of equipments customer, as well as the negotiated contract, this application will be strengthened by algorithms of control, the customer cannot modify them. For the identification of the user, the customer application contains the algorithm of identification which allows verifying the authenticity of this customer in a server radius at the operator, through the protocol COPS-SLS.

B. mobility management :

Components and architecture :

In the two extensions of COPS for the mobility management , we notice a big exchange between the different entities For the terminal recording or of user . the later must be recorded in every connection even if it's in its own network (home network). In the all cases of the figure, we consider that user's mobility depends always on that of terminal. That's why our solution consists to manage this mobility while benefiting from the new architecture proposed previously, all based on the

utilization of the user identifier (software, smart card).

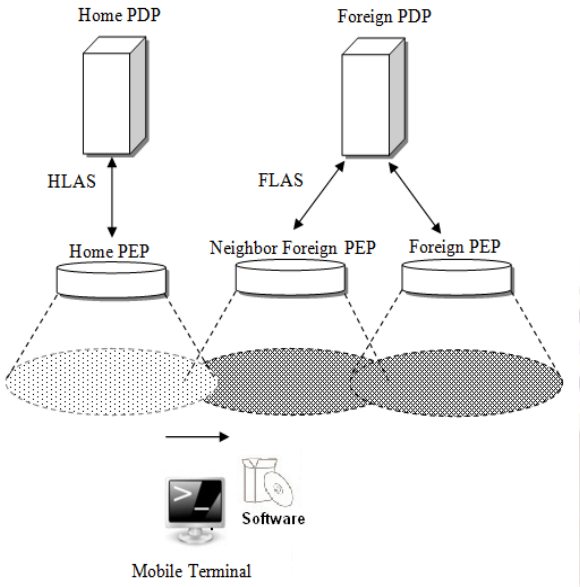

Figure 9: Mobility management of Terminal

HPEP : PEP of the network of origin for the mobile terminal ensuring the function of Home Agent.
HPDP : the policy Server of original terminal network.
HPDP : the policy server of the home network.
HLAS : Level of available service in the home network.
FPDP : the policy server of the foreign network.
NFPEP : The first PEP situated in the foreign network of terminal that ensure the function of Foreign agent.
FLAS: level of service available in the foreign network.
Software (smart card, USB key…) : A physical support containing the application proposed previously for the management by policy with an user identifier .
Mobile Terminal: the user terminal.

Architecture

In the intervention of HPEP and FPEP, the first one keeps always a list of its own issued LAS previously while benefiting from the asynchronous mode guaranteed by HPDP. The latter insure also the state of LAS for the close FPDP, the degree of satisfaction and the availability of every parameter (Bandwidth, deadline, gigue…)

Our solution is to establish a preventive management of any break of costumer connection, through the connection between the HPEP and the NFEP which implies the preliminary knowledge of the levels of service available in the foreign network (FLAS). During the transition of the terminal mobile in its foreign network, the HA records with the NFPEP if the latter has the possibility to satisfy the customer demand and takes his requests. We were able to solve the problem of handoff due to changing network and win time by this preventive reservation.

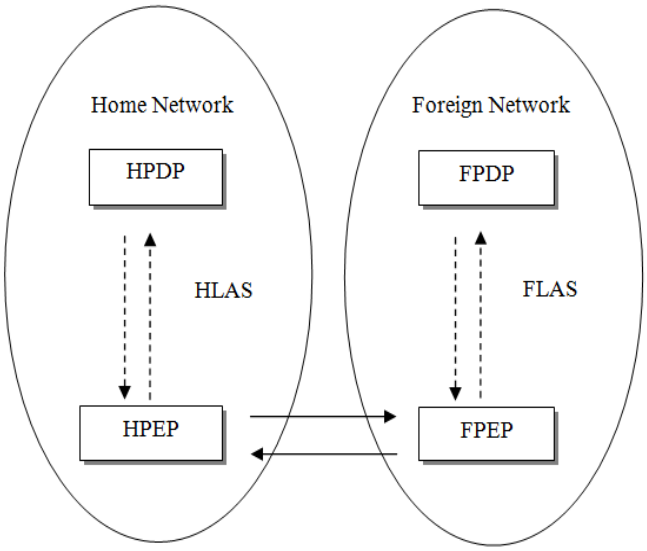

Figure 10: Exchange of Level of Service Available

The customer application allows to him to benefit from these possible LAS negotiated previously in the costumer contract SLA. As we mentioned previously, that the user mobility depends necessarily to the used terminal, the used application by the user, transported on a smartcard or USB key (or any other adaptable device), distinguish the customer and makes his connection of a terminal to a more flexible one and identifies him in the network with a unique way .

V. CONCLUSION

This article introduces new concepts and new notions which allow the change of the classic management, the decentralization of spots and redistribution of the roles as well as the mobility of the customer terminal which are the main profits of our approach, we were able to adapt the protocol COPS-SLS dedicated for the dynamic negotiation of the contract, in our solution the SLA negotiated directly between the customer and the PEP and also the authentication of costumer, wherever he go with the help of the application, The latter transported on a reliable support, makes the mobility customer more flexible, and ensure his movement promoting an important gain of time and a preventive reservation of resources.

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