Wireless World Research Forum (WWRF)

Title of the Research Item

Flexible and lightweight management architecture for B3G networks

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Subject Area: Network and Services Management

Objectives of the Required Research

As already detailed in the “Network and Services Management” chapter of the Book of Visions [1], it can be anticipated that the wireless world of the future will comprise many Radio Access Technologies (RAT), while the fixed network will be IP-based. The advent of multi-technologies networks offering ubiquitous services over advanced network infrastructure demands an integrated management approach. We address in this paper an integrated management approach for end-to-end service management over heterogeneous networks in a multi-operator environment. We show how to integrate our solution into the larger context of Web-based management, thus allowing the easy integration into already existing management platforms.

State of the Art in the Area

The advent of advanced wireless network allowing high quality multimedia services to mobile users creates an important market for value-added services offered on top of these networks. Such services will be typically offered by service providers to end-users. Service providers will interact with different network operators in order to allow service deployment to be done efficiently over a large geographic area. One important problem that service providers are facing is concerned with the interaction with wireless network operators. The difficulty in this interaction is mainly in service management capabilities offered to the service manager. We address in this contribution the management of services spanning multiple operators over heterogeneous infrastructure. We propose a centralized service management platform for such services which can be loosely integrated within already existing network management platform. Our innovative management framework is based on the combined use of SOAP [5] and COPS [2,3] protocols within the larger context of web-based management [8]. SOAP (Simple Object Access Protocol) is a lightweight distributed object communication protocol allowing to encapsulate self-defined messages over HTTP. The self-definition is obtained by the use of XML [9] (Extensible Markup Language) as an envelope for them.

Possible Approach

We consider an end-to-end service where users are subscribed to service offered by a service provider (SP). Such a service could be for instance to route their call over several networks in

order to achieve a better price or quality of service. For the end users the use of several technologies and/or operators is transparent. They have a SLA (Service Level Agreement) with the SP, and the later is responsible to meet this agreement. The SP will typically have a SLA with each network operator and must establish with them a communication for assuring that the global end-to-end service is working properly. Thus he should be able to request connections set-ups, and particular network configuration to the different network operators. Besides these actions, Service Level Monitoring facilities should be possible in order to allow to the SP to verify that the SLAs existing between him and individual operators are met. Additionally, he is responsible towards his individual clients for the delivered service, thus he must be able to monitor the level of the global service in order to assure that the SLAs existing between him and his clients are met. We are aiming to provide a management architecture capable to be deployed on the service provider side to meet these requirements. There is another important constraint that we must take care of: network operators do already have management architectures in place, and will be not particularly interested in major modifications on these platforms. Thus, a loose and light cooperation mechanism is required. The following figure identifies the main components of today's networks:

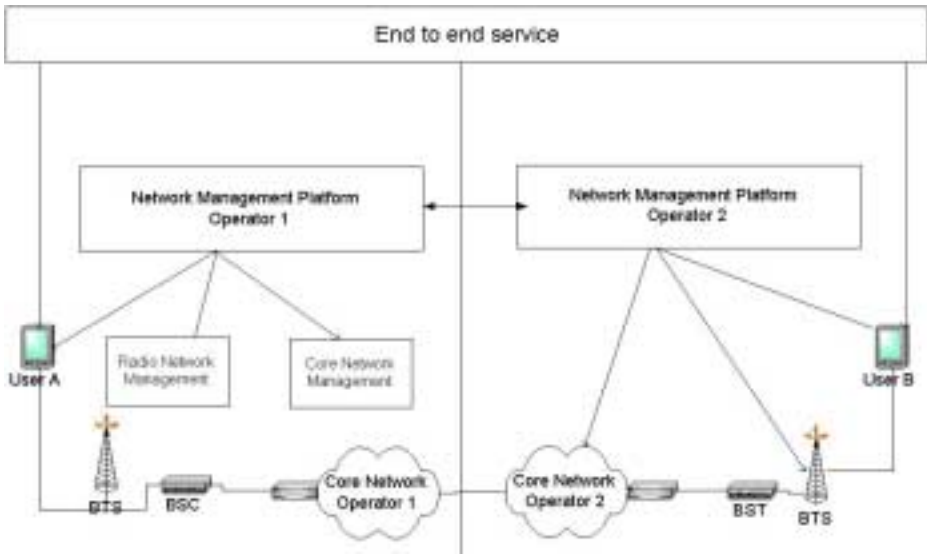

Figure 1

Firstly, the management platform should be able to express requirements in terms of the end-to-end services and map them to network-specific tasks. Next, it should be able to interact with wireless networks that are not under its own administrative control in order to perform the necessary management tasks. This interaction should be as lightweight as possible, but must still enable the platform to monitor and configure the underlying infrastructure.

At the highest level, the management platform should interact with residential users. It should allow the establishments of SLAs, which are stored on a LDAP [4] (Lightweight Directory Access Protocol) server. It provides four major operations. The first one is the monitoring of the individual SLAs in order to verify that they are met. Secondly, it performs the configuration of the underlying network infrastructure. This is done by an optimization module. The later will translate generic SLAs established with individual users to network technology specific SLAs. Finally, a charging module is used for billing purposes. The core component of the management platform is a ***Logical Network MIB***. This is used to represent an abstraction of the real network entities used

over the physical network. It can be considered as a virtual network, that is optimized by the management platform in order to provide the end-to-end service. Since, most network operators will never unveil their real network, such a virtual abstraction of the resources is needed in order to make the service viable. For instance, instead of exposing several network switches, the logical abstraction could be a single switch representing the aggregate connectivity offered by the cloud of switches.
It is based on an integrated network information model which extends the DMTF [6] proposed CIM [7] model. The extension allows to represent the wireless/radio access part of a network. The service management interacts in two manners with the wireless/real network. The general framework for this interaction is given by pairs of SLAs between the service provider and the network operators. The first interaction allows the service manager to directly configure the network. It is called ***COPS gateway***. The optimization module of the service management platform is responsible to generate a set of policies in order to configure the network. These policies are based on a logical/virtual representation of the real networks. A COPS gateway existing between the service management and individual network operators is responsible to map policies expressed on the logical network to real policies. Each gateway is managed by the respective network operators. This is a essential condition in order to guarantee a correct mapping and also to assure network operators that any configuration action is under their control.
The communication for these requests is done over HTTP using the SOAP protocol. Although, we could have selected other paradigms for communication, we considered SOAP as the right choice for the following reasons. On one hand, we need only simple servlet enabled WEB servers for the communication. Thus, no dedicated software infrastructure is needed to be deployed on the network operator side. Secondly, using XML to encapsulate management information allows an easy communication of this data. Even though, different formats might be used on each side, translation to and from XML data, can be done without major changes. Thirdly, SOAP is encapsulated in HTTP, and thus is not affected by firewalls protecting the network and/or the service provider domain. The messages encapsulated over HTTP can contain monitoring information. This information is obtained by the network operator using his network management platform. Typically, it will be done using SNMP (Simple Network Management Protocol). Next, SP-related information is extracted and offered to the later one. Another type of requests is the service requests. These requests contain the necessary information for the individual network operators in order to provide the necessary resource reservation. Such a request is encoded in XML.

Expected results

We have addressed an innovative approach towards joint management of multi-operator and multi-technology networks. The expected result of this work is to provide an integrated management platform that interacts with RAT-specific management platforms. It could provide a building stone for advanced value-added services offered over large and varied infrastructure in future B3G networks. There is still future work ahead of us. We need to investigate the policy mapping from a logical network to the real network: simple policies are now possible, but consistency checking and providing a common and automatic translation for more complex ones must be still done.

List of References

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