Proposition de recherche doctorale

Vers un Contrôle Programmable pour le Futur Internet et le Cloud Computing

Mots clés :
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Résumé du projet de recherche (Langue 1)
Context of the study and state of the art The control plane and its associated architecture are key elements for an operator to provide carrier-grade services of high quality, with a trouble-free service integration and timely delivery. 3GPP specifies an architecture called IMS (IP Multimedia Sub-System) as a solution for controlling IP-multimedia services. It is a centralized control plane solution that is separate from the user plane and the application plane. As a result, service integration is easier when it is IMS-based and flexible in transporting the service in the user plane. In particular, the introduction of an Application Service that centralizes service-specific features facilitates service deployment of new services within the existing access networks. IMS is the control solution for Orange group; it is considered as strategic for deploying multi-service control for multi-accesses. At the moment, however IMS is only commercially deployed for fixed voice over IP service. Since its first deployment, the IMS architecture has been recognized as relevant for conversational services, in particular, VoIP services, but it has been more debated for other services like content-based services (which remain to be tested on a large scale). Besides, being the first operator deploying IMS based services commercially often generates extra costs. This issue of cost is regularly raised as one of the constraints that hinder the deployment of non conversational services like RCS (Rich Communication Suite). In this respect mid-term solutions that would reduce the cost of deploying IMS such as virtualization could offer an operator the opportunity to leverage the existing IMS architectures for conversational services. Some academic organizations and operators have started considering virtualization of IMS for such purpose but much more research is required to determine whether this truly provides a viable way forward for the industry. Currently, some research bodies are working towards providing the same functionality as a centralized IMS within a virtualized system or ‘cloud’ in order to optimize/reuse the existing resources with a virtualized system. One of the expected benefits is that such virtualization can be made transparent for the users/customers since the service ‘experience’ remains the same as in a centralized architecture. In practice, ‘virtualising’ a standard IMS architecture must be studied at all levels: - the data base and user profile level (eg HSS), - the control point level (i.e. CSCFs) and/or - the service level (Application Servers) and also to what extent such new mechanisms would be backward-compatible with the current centralized IMS architecture (or even whether such backward-compatibility is desirable). For this, one of the options to investigate is to identify the functionalities in each node and re-arrange them in a different manner in order to mutualize the common functionality and then offer it as one single “interface” to the outside world e.g. the applications. This approach is generally referred to as “infrastructure as a service” and is now quite widespread in cloud computing but whether this is truly applicable to the evolution of the IMS control plane as a whole remains to be studied in detail. A number of essential aspects must be considered in making these entities ‘virtual’: the optimized distribution algorithm, the security aspects, the QoS control etc. Recent concepts, which will have to be taken into account in this approach include: - P2P IMS: a model of network architecture which is based on the equivalence of the all devices, including terminals and network elements, so that all the nodes in the network are equal to each other and support the same functionalities. There is no fixed hierarchy or central server. All the elements can act indifferently as a server or a client. The users are identified and the architecture provides mechanisms for locating users or resources within the P2P SIP overlay using the Uniform Resource Identifier (URI) of a user agent. Routing in such architecture is unconventional in the sense that it requires a resolution mechanism to map the identifier with a particular device in real time. - The Advanced Multimedia Systems (AMS): also known as H.325, AMS is the third-generation multimedia system currently under development in ITU-T SG16 (the first generation was H.320 (ISDN), the second generation was H.323 and SIP (VoIP)). H.325 can be considered as a distributed architecture compared to IMS so that the virtualization of IMS architectures may be inspired by the H.325 concept. Although none of these architectures have led to concrete deployments yet, the area of distributed SIP architectures and control plane evolution/virtualization is clearly getting significant interest from the research community. In parallel, the virtualization of control plane can prove very interesting to reduce the control plane cost which is important for Orange. The proposal is to determine whether and how these new techniques can change the current control plane in order to have a virtualized and open control plane architecture. One of the objectives, in particular, is to identify new command protocols for making such evolutions possible and integrate them in the network. Position of the subject with respect to Orange strategy Defining new architectures and mechanisms that will allow in the future a deep and transparent collaboration between the communication infrastructure (access, core, services platforms and SI …) and the virtualization of control plan is one of the main key strategic issues to be studied within the scope of the Research Object NAE “Network Architecture Evolution” in the next years. Therefore, the proposal is perfectly in line with the strategy of the NAE Research Object. Goals of the PhD/ expected results / technical and scientific challenges The objectives of the PhD are the following: 1) Analyze the different existing IMS mechanisms to propose a virtualization method/algorithim the control plane. 2) Identify the requirements for this virtualized architecture have to meet to be a carrier-grade solution for conversational and non conversational services 3) Identify the method which is more efficient and cost-efficient for an operator in general and for Orange in particular. 4) Identify the impact if any of this virtualization with the external systems (eg IS, third party networks) with which IMS is interconnected, 5) More generally, identify the impact on the upper and lower layers of such virtualization 6) Define the architecture and requirements for protocol evolutions to allow the integration and use of these new mechanisms in the network. The expected results are the definition of a ‘cloud’ IMS architecture and the identification of protocol evolution (or definition) to support such an architecture.