A Next Generation Internet Architecture for Mobility and Multi-homing Support

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ABSTRACT

The current internetworking architecture presents some limitations to naturally support mobility and multi-homing. Among the limitations, the IP semantic overload seems to be a primary issue to be considered. In this paper we present a next generation internetworking architecture to overcome the IP semantic overload by introducing an identification layer located between the network and transport layers. This new layer provides a stable identifier for end-hosts, enabling the natural deployment of new services, such as mobility, multi-homing and security embedded. We implemented a prototype and evaluated it considering the legacy application support in mobility scenarios.

Categories and Subject Descriptors

2.1 [**Computer Communications Networks**]: Wireless Communications

General Terms

Architecture, wireless, measurement

Keywords

Wireless Networks, mobility, multi-homing

1. INTRODUCTION

The current Internet architecture presents some technical barriers to the introduction of new services [1]. Among the mentioned limitations, the IP semantic overload seems to be one of the primary issues that retards the natural deployment of new services, such as mobility and multi-homing. As pointed by Saltzer [3], there is an ambiguity of network objects and their locations. The IP address is both used as object identifier in the transport layer and as topological locator in the network layer, creating an interdependency between the identity of an end-host and its location, resulting in a lack of a stable end-host identifier.

In this paper we propose a next generation Internet architecture to naturally support new services by the introduction of an identification layer. This new logical layer is located between the network and transport layers and is an option to solve the IP semantic overload problem as described in [2, 4]. The transport layer relies on the identification layer to provide stable identifiers for legacy applications and the identification layer binds dynamically to the network layer. Thus, services like mobility and multi-homing are transparently supported. The identification layer is a logical layer and is emulated by the architecture as shown in Fig. 1.

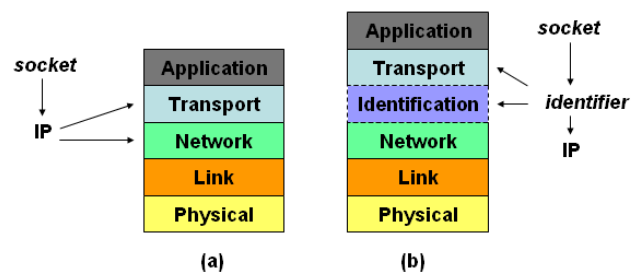

Figure 1: (a) Protocol stack. (b) Protocol stack with the identification layer.

The organization of this paper is as follows. Section 2 presents the architecture proposal. Section 3 describes the prototype implementation and evaluation. Finally, Section 4 summarizes this paper and discusses future works.

2. ARCHITECTURE PROPOSAL

This section presents the architecture proposal for the mobility and multi-homing support. Figure 2 shows the modules of the architecture.

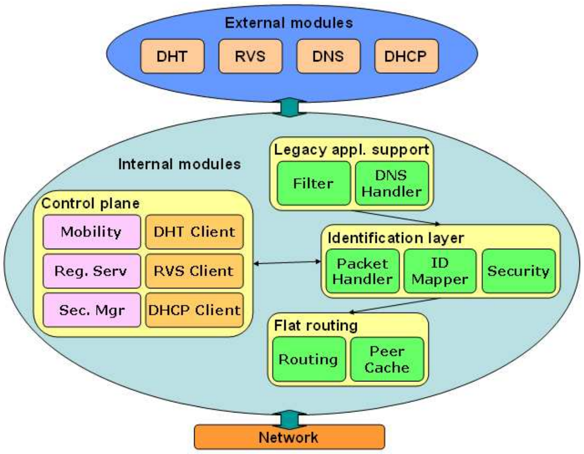

Figure 2: Architecture proposal.

The external modules are components of the architecture that provide services for the end-hosts. The internal modules are components that provide services within each end-host and are divided in data and control planes. Data plane modules are involved in the legacy applications support, identification layer management and flat routing. The control plane is responsible for signaling messages exchanged between components of the architecture, such as registration, flow redirection and security parameters exchange messages. The modules will not be described due to the space limitation.

3. IMPLEMENTATION & EVALUATION

This section presents the prototype implementation and evaluation considering the overhead of the prototype and legacy application support in mobility scenarios. Figure 3 shows the overhead of 17.4% in wired scenarios and 9.3% in wireless scenarios. The overhead is mainly due to the user space implementation of the prototype. The overhead of the prototype is higher in wired scenarios than wireless due to the higher transmission rate of the former one.

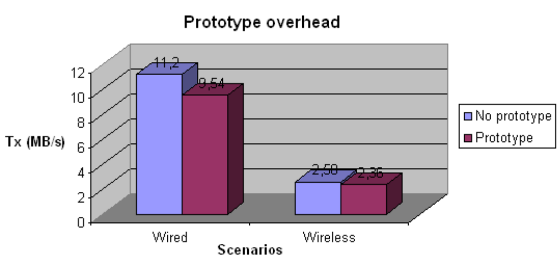

Figure 3: Prototype overhead.

The prototype was evaluated considering the legacy application support in mobility scenarios. We transferred a 224 MB file over a 54 Mb/s wireless link using the SCP tool and measured the transfer time in three different mobility scenarios. Scenario I considers an intra-domain mobility. Scenario II considers an inter-domain mobility, where one node moves to another domain. Scenario III considers a simultaneous node mobility, where both nodes simultaneously move to different domains. Table 1 summarizes the scenarios and presents the average values of 10 measurements.

Table 1: File transfer time in mobility scenarios.

Scen	rate (Mb/s)	Stdev	time (s)	Stdev
I	17.44	0.32	101.46	1.69
II	17.44	0.32	102.42	1.94
III	12.48	1.21	144.72	13.9

Scenario I shows a better performance compared to scenario II due to the faster arrival of the control message indicating the mobility event. Scenario III has a poorer performance due to the lose of the control messages. As both nodes move, the control message indicating the mobility event is lost and both nodes wait for the timeout mechanism to resolve the peer's new locator. The evaluation of the multi-homing feature is not shown due to the space limitation.

4. CONCLUSION AND FUTURE WORK

In this paper we presented a next generation Internet architecture for mobility and multi-homing support. The architecture introduces an identification layer to identify end-hosts over the Internet. This new layer provides a stable end-point to which legacy applications can bind, resulting in natural support of the mobility and multi-homing features.

As future work, we are currently performing some evaluations with other architectures including Mobile IP (MIP) and Host Identity Protocol (HIP) in order to compare with our proposal. We are also working on heterogeneous networks integration, end-host multi-homing and security mechanisms integrated to the identification layer.

5. REFERENCES

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