Chapter 6

OPNET Simulation Setup for QoE Based Network Selection

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ABSTRACT

In its most generic sense, the user-centric view in telecommunications considers that the users are free from subscription to any one network operator and can instead dynamically choose the most suitable transport infrastructure from the available network providers for their terminal and application requirements. In this approach, the decision of interface selection is delegated to the mobile terminal enabling end users to exploit the best available characteristics of different network technologies and network providers, with the objective of increased satisfaction. In order to more accurately express the user satisfaction in telecommunications, a more subjective and application-specific measure, namely, the Quality-of-Experience (QoE) is introduced. QoE is the core requirement in future wireless networks and provisions. It is a framework that optimizes the global system of networks and users in terms of efficient resource utilization and meeting user preferences (guaranteeing certain Quality-of-Service [QoS] requirements). A number of solution frameworks to address the mentioned problems using different theoretical approaches are proposed in the research literature. Such scholarly approaches need to be evaluated using simulation platforms (e.g., OPNET, NS2, OMNET++, etc.). This chapter focuses on developing the simulation using a standard discrete event network simulator, OPNET. It outlines the general development procedures of different components in simulation and details the following important aspects: Long Term Evolution (LTE) network component development, impairment entity development, implementing IPv6 flow management, developing an integrated heterogeneous scenario with LTE and WLAN, implementing an example scenario, and generating and analyzing the results.

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INTRODUCTION

The business models of telecommunication operators have traditionally been based on the concept of the so-called closed garden: they operate strictly in closed infrastructures and base their revenue-generating models on their capacity to retain a set of customers and effectively establish technological and economical barriers to prevent or discourage users from being able to utilize services and resources offered by other operators. After the initial monopoly-like era, an increasing number of (real and virtual) network operators have been observed on the market in many countries. Users benefit from the resulting competition by having much wider spectrum choices for more competitive prices. On the other hand, current practices in telecommunication business still tie the users to a single operator even though the number of players in the market has been growing. The users tend to manually combine their subscriptions to multiple operators in order to take simultaneous advantage of their different offers that are suited for a variety of services. For example, a user might hold two SIM cards/phones from two distinct operators, one of which provides a fixed rate national calling plan while the other provides low cost, high quality international calling with pay-as-you-go option. Extending this example to a case where there are a large number of operators with a multitude of service options and offers in future all-IP telecommunication networks, manual handling of such multi-operator service combinations is clearly tedious and impractical for the users.

In its most generic sense, the user-centric view in telecommunications considers that the users are free from subscription to any one network operator and can instead dynamically choose the most suitable transport infrastructure from the available network providers for their terminal and application requirements. In this approach, the decision of interface selection is delegated to the mobile terminal enabling end users to exploit the best available characteristics of different network technologies and network providers, with the objective of increased satisfaction. The generic term satisfaction can be interpreted in different ways, where a natural interpretation would be obtaining a high Quality-of-Service (QoS) for the lowest price. In order to more accurately express the user satisfaction in telecommunications, the term QoS has been extended to include more subjective and also application specific measures beyond traditional technical parameters, giving rise to the Quality-of-Experience (QoE) concept.

These facts dictate that QoE is the core requirement in the future wireless networks and provisions a framework that optimizes the global system of networks and users in terms of efficient resource utilization and meeting user preferences (guaranteeing certain QoS requirements). A number of solution frameworks to address the mentioned problems using different theoretical approaches are proposed in the research literature. Such scholarly approaches need to be evaluated using simulation platforms, e.g., OPNET, NS2, OMNET++, etc. It is expected that the simulation settings are driven by the objective of problem that has to be analyzed; therefore simulation proves to be a very helpful tool in evaluating the proposed approaches in terms of their efficiency, gain, loss, etc.

Given the facts discussed in the preceding paragraphs, this chapter focuses on developing the simulation using standard discrete event network simulator, namely, OPNET (OPNET, 2011). It outlines the general development procedures of different components in simulation and details the following important aspects:

- Long Term Evolution (LTE) network component development.
- Impairment entity development.
- Implementing IPv6 flow management.
- Developing an integrated heterogeneous scenario with LTE and WLAN (OPNET standard model).
- Implement an example scenario.
- Generating and analyzing the results.