Chapter 1 Introduction

1.1 Background

Today's mobile device supports a variety of multimedia applications such as live video, radio or online gaming. People spend their time on their devices for personal entertainment more and more. There are statistics which show that on average, people are spending 2.7 hours per day on the internet via smart phone [1].

The smart phones are characterized by small screens, limited CPU power and memory. Due to the requirements of multimedia applications over wireless communication those applications require a huge amount of bandwidth from the network to support them, which creates problems for the network provider and also affects to QoE (Quality of Experience) of end user for multimedia services.

However, one pattern that is appropriate for the efficient delivery of multimedia messages is multicast. For instance, transmitting live video data from a media server using multicast allows for a single data stream to be simultaneously sent to several users thereby offering a considerable bandwidth saving over sending multiple separate data streams.

Multicast services do, however, introduce challenges within the network when the recipients of the service are moving. Current multicast routing protocol standards are designed for static client IP addresses. Not only does mobile node movement introduce the problem of access network handover, but also, when considering devices could result in them switching between access network hotspots. Support for this requires an efficient solution to be found for managing multicast services where mobile devices have the capability of operating over several different networks.

Therefore, this research is investigating multicast mobility handover within WiFi networks. The aim of this PhD research is to propose a new method and framework that tries to provide smooth mobility in homogeneous networks such as within WiFi zones.

1.2 Research Aim

The research has the aim to propose a new technique that provides efficient mobility for multicast services in WiFi networks. This research is focused on techniques to reduce handover latency, multicast address management and provide a connection when a user moves between networks.

This research is focused on techniques to reduce handover latency, which comprises multicast handover delay, end-to-end delivery delay and to minimize packet loss. For multicast routing, the research will focus on how to maintain the multicast session for mobile nodes and manage multicast group memberships thereby also minimising packet delay.

1.3 Research Objectives

To achieve this research aim, four objectives have been acknowledged. These research objectives are:

1.   To understand, analyse and identify major issues in multicast mobility and focus on issues, which are related to the handover process.
2.   To propose the technique that can support multicast mobility when a mobile node changes the zone within WiFi network environments.
3.   Implement and evaluate, within a simulation environment, that part of the framework that handles WiFi zone handover.
4.   To publish the results of the research and write up a PhD thesis.

1.4 Research Questions

During the research process, the following key research questions will be addressed:

1.   How can we reduce latency time in a multicast stream when handover occurs?
2.   What performance advantages can be gained over existing schemes for mobile multicast delivery?

1.5 Contribution to Knowledge

Designing a new framework for minimizing multicast mobility within WiFi networks by focusing on techniques to reduce handover latency, packet delay and maintain multicast services for mobile nodes. The key protocols that had been modified in the framework are Mobile IP, IGMP, PIM and ICMP protocols. The key novel features of this new framework are that firstly, mobile nodes register with each foreign network that is within range, secondly a Care of Addresses is obtained for each foreign network, thirdly that the associated multicast trees are established but finally, that the chosen foreign network and multicast tree is only activated once handover is confirmed.   In this way, the new framework is able to minimise handover delay and loss of connectivity when handover is taking place.

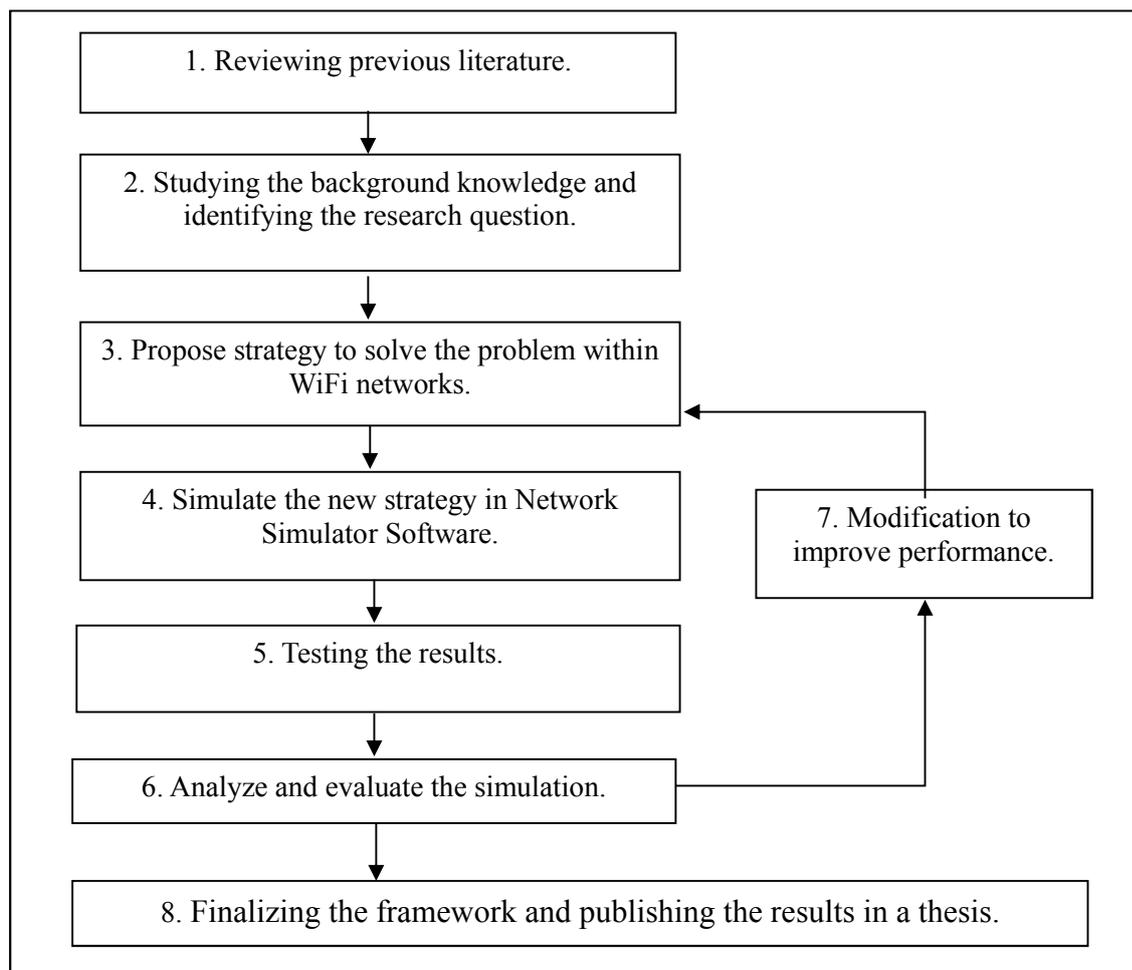# 1.6 Overview of Research Methodology

Figure 1-1 Research Methodology

In order to complete this research, the following research methodology has been adopted as shown in Figure 1-1.

The details of each step are described as follows:

1. *Reviewing previous literature* – More than 150 research articles have been reviewed. At this stage, the researcher has gained more knowledge about the problems in multicast mobility, and the mechanism of handover.

2. *Studying the background knowledge and identifying the research question* – The literature review confirms the importance and relevance of the research field and shows where gaps exist within the knowledge. These gaps then help to formulate the research question for this research.

3. *Propose strategy to solve the problem within WiFi networks* – From the background knowledge, literature review, and research question it is then possible to start to propose and design a new framework for improving the performance and QoS guarantees of multicast mobility.

4. *Simulate the new strategy in network simulator software* – The first stage of the framework will be evaluated for use within WiFi networks only. This allows the basic concepts of the framework to be evaluated and as necessary, modified.

5. *Testing the results* – The detailed simulation results will allow the performance of the framework to be quantified and areas for improvement identified across a broad range of networking scenarios.

6. *Analyze and evaluate the simulation* – The outputs from the simulation will be analysed in detail to assess performance and to compare to standard framework.

7. *Modification to improve performance* – Depending upon the simulation results, further refinement and modification of the scheme will follow as necessary.

8. *Finalizing the framework and publishing the results in a thesis* – The results of all of the simulation studies will allow for a final design to be confirmed and this, together with the contribution to knowledge of the research, will be presented within a PhD thesis.

1.7 Structure of the Thesis

The rest of the thesis is organized in the following chapters.

- ➢ **Chapter 2** presents the literature review concentrating on the concept of the multicast, multicast mobility, multicast handover issues within wireless networks.
- ➢ **Chapter 3** presents the concept and theory idea design of the research, which is to combine network architecture, protocol overview, connection management and modified protocol message.
- ➢ **Chapter 4** consists of framework simulation details which have been implemented within OPNET Modeler.
- ➢ **Chapter 5** will present the network scenario, simulation result from OPNET Modeler software and performance evaluation.
- ➢ **Chapter 6** consists of conclusion and recommendations for further research.