A Solution for Mobility Protocols Evaluation

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***Abstract*—The motivation of the research project proposed in this article is to show means and results for overcoming the challenges of maintaining an uninterrupted connection on wireless mobile networks, which is becoming more and more necessary for users who increasingly require ubiquity when accessing voice and video services. These services become a critical case when used together, since high transmission rates are needed. A possible option in this scenario is the use of smartphone oriented networks, considering their recent support for packet-switched services evolution. This article presents the implementation of an app for mobile devices, that can be used with the Android or IOS operating systems, which provides a thorough mobility protocol evaluation.**

Keywords–Technology; Mobility; Handover; Latency; Wireless Networks.

I. INTRODUCTION

Due to the increasing demand for services that require strict compliance with network requirements, such as, voice and video applications, along with the ubiquity of these services, the issue of always keeping mobile devices users well connected when moving among networks with different administrative domains, has proved to be a challenge. During the handover period, the user may suffer longer delays than desired or even data loss. This effect ends up decreasing the quality of information, and this situation becomes especially critical when one is dealing with multimedia data in communication.

Effectiveness in the delivery of a service or provision quality assurance in transmission and reception of a flow is related to some variables that can be crucial in a computer network application. They are almost always related to the technology that was used, how the transmission flow was made and, very often, to the functional requirements of the application that will benefit from the network architecture. Analyzing the context of mobility and convergence, the requirements in the control of the limits of each parameter of these variables are even more important, since they can be a determining factor as to whether or not to deliver a particular package. Thus, network technologies need to work in such a way that can promote transparency to the users, from the point of view of utilization of the service, providing full support to mobility and data continuity.

Beside the need that involves the support of connection and continuity of data traffic, there is the additional challenge of integration among wireless services. Interfaces without coupling present additional challenges, because they are very frequently found in networks with many different administrative domains. In such situations, it is noted that one network does not provide a coupling to another, and, as a result, there is management of different IPs addresses, leading to the need for rigorous studies to evaluate the impact of a migration process among heterogeneous networks, as presented in Al-Surmi [1] and Fernandes [2].

The Internet was not originally designed to support device mobility. Considering the existing infrastructure and all the main protocols used in the Transmission Control Protocol/Internet Protocol (TCP/IP), layer model, these have limitations which make it difficult to use them for mobility scenarios. The Mobile Internet Protocol (MIP), described in Perkins [3], has been widely disseminated, studied and used as a solution to the mobility problem in IP networks, leading to some implementation of this protocol. However, in some studies, such as Kodaly [4] and Mohamed [5], its application has become practically unfeasible, since it was based on providing architectures in extremely controlled and poorly functional environments.

This study proposes to implement a mobile app that is able to provide results of certain mobility protocols evaluations. For the next step in future work, it is proposed to measure and evaluate the handover latency values using the Specialized MIP (SMIP) protocol, as presented in Monteiro [6], analyzing the feasibility of mobility in networks. The efficiency of these protocols will be experimentally and numerically evaluated in a given scenario, from the viewpoint of network latency and its involvement in certain types of traffic or applications. The results obtained from the evaluation of the mobility protocols will be available in the created app and disseminated to the scientific community.

This paper is organized into the following sections: after the Introduction, in Section II the work listed presents the research carried out, showing the theoretical references that were used and a brief description of each one. Section III provides the proposal of this article, as well as the materials used for app planning and implementation and the methodology applied to carry out the research. Section IV presents the results obtained with the use of the app. In Section V, we conclude this paper and suggest directions for future work.

II. RELATED WORK

Technology is everywhere today. Studies are pursuing solutions in order to provide ubiquitous information for the most diverse problems. Mobile devices have a crucial role in this information dissemination process.

The largest number of studies found about mobility protocol evaluations show experiences with mobile IP in complex and specific environments. An example can be seen in [7], where authors demonstrate the use and performance of IP protocol in a smart bridge environment. This particular research proposal is to introduce and characterize a protocol architecture based on IP to achieve applications in, for

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example, smart meters and inverters.

In another case, the authors in [8], address and evaluate the mobile IP in a Pay-TV environment, showing its efficiency in that specific scenario. Some weaknesses related to maintenance of user privacy, can be highlighted, such as insider attack and user traceability attack.

In [9], results are presented for the use of IP protocol in a Virtual Private Network (VPN) environment, allowing terminal mobility for the user of that VPN. This was based on aggregation of two or more internet mobile accesses and is able to provide a higher end-to-end available bandwidth due to an adaptive load balancing algorithm. This research also proposes a neural network approach for predicting the main Key Performance Indicators (KPIs) values at a given geographical point.

Thus, with a view to continue pointing in the direction of using mobile apps for troubleshooting in the context of mobility, this research presents the implementation of an app that provides information about the research that will be carried out during the postgraduate course in Telematics.

III. PROPOSAL

When thinking about mobility in networks with different administrative domains, the biggest challenge is the increase in handover latency. Taking this scenario into account, it is possible to adopt certain procedures that enable implementation of mobility under specific circumstances, provided that certain requirements are established. These requirements range from defining which layer mobility will be introduced into, to the most efficient application of the algorithm or protocol that will perform the actual implementation.

The proposal of this research is to create an app that will provide information about the research. The research has the purpose of evaluating and measuring handover latency using specific protocols, seeking solutions that are workable for use on current mobile devices.

In order to find the best way to seek information and present it in a practical, easy-to-read and understandable way for the users, a plan of action was devised for the project. Figure 1 shows the architecture of the solution, as well as the steps and sequence of actions that were executed for implementing the proposal of this research.

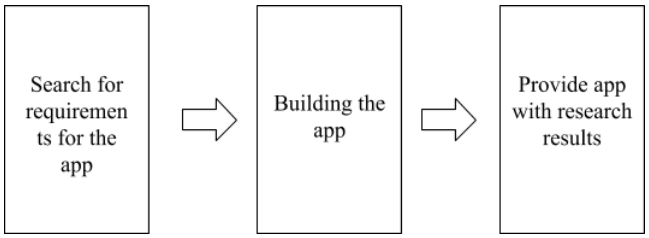

Figure 1. Solution architecture

A. Materials

This research was developed during the postgraduate degree course in Telematics. The research group work was consolidated in meetings held in the laboratory reserved for the postgraduate course of the Federal Institute of Education, Science and Technology of Tocantins (IFTO), and some meetings were also attended by video conference.

The efforts during the first meetings were concentrated on solving problems that have been proposed to groups by professors in the postgraduate course. It involved several debates with the intention of finding ways of how the various parts of the project would be executed. After the presentation of all problems that had been proposed, the other meetings were focused on the search for practical and highly applicable solutions for teaching and learning. Current and easily usable tools such as YouTube [10], Gmail [11], Classroom [12], WhatsApp [13], Google Drive [14] and Google Docs [15] were used for the video conference.

In order to develop the app proposed in this research, the following items that will be described as follows were used: Computers (Desktop and a Dell notebook) using Linux and Windows operating systems, respectively, both with Internet access, a Web platform that enables the creation of mobile apps, the AppSheet, Google Drive for storing required content for the application of the implementation, Google Docs for editing of the files that will be made available in the app and YouTube for sharing videos. The mobile device for testing was a Motorola Moto tt^5 plus smartphone.

B. Methodology

This subsection will present the steps and methodological technologies adopted for implementation of the proposed project in this work. The app was developed for smartphones, tablets or any device with an Android or IOS operating system, with a view to providing information about the research that will be performed.

The first stage of the project was collection of information that deals with mobility among heterogeneous networks. Initially, requirements and functionalities were developed for the system in question: project description, protocol used, testing environment, objectives, problems, advantages, challenges and team work.

Once the requirements were established, part of the implementation of the app started. For this purpose, we used a specific tool, AppSheet, a platform Web site that enables creation of apps for mobile devices without the need for having extensive experience in mobile application development. The AppSheet was created in 2014 and the tool is employed by users in more than 220 countries, making it possible to create apps that meet specific needs from a spreadsheet, simply and quickly.

A spreadsheet was created to show implementation of the app containing information that will be available, as well as images related to the texts, files to help in data interpretation and videos. In order to enter the platform, it was necessary to sign in with a Gmail account and allow the tool to have access to the file saved on the drive. Editing to the app is done in a very simple and practical way.

The AppSheet platform interface is shown in Figure 2, where the functionalities provided by the tool have been displayed. This figure points out the options for app editing, the tables that were used for app construction, the conditions established for proper functioning and a presentation of an app

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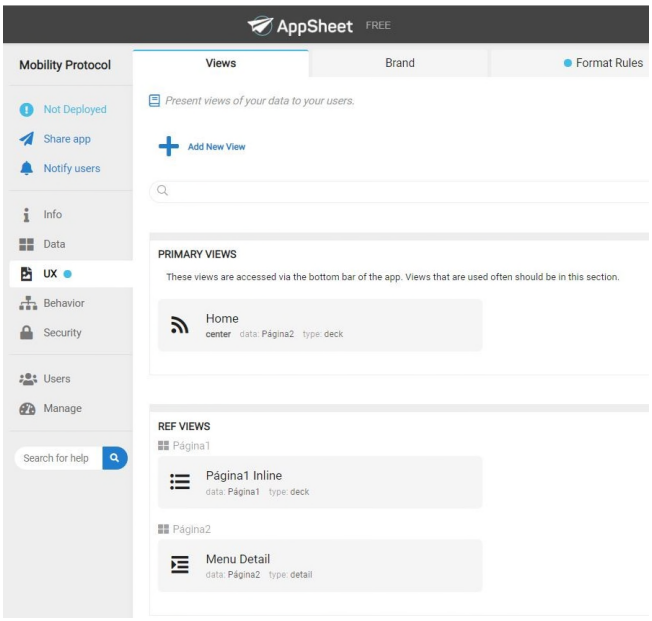


Figure 2. AppSheet

already in operation, in other words, an app simulation on a mobile screen.

After the app began to take shape, final adjustments were made in terms of information presentation and the colors used to make project more visually attractive.

Research on mobility protocol evaluation will be done later on during the postgraduate course. For this first stage the efforts were concentrated on creating the app. The results obtained, the methodology and how the test environment was assembled will be also presented for the app developed in this research.

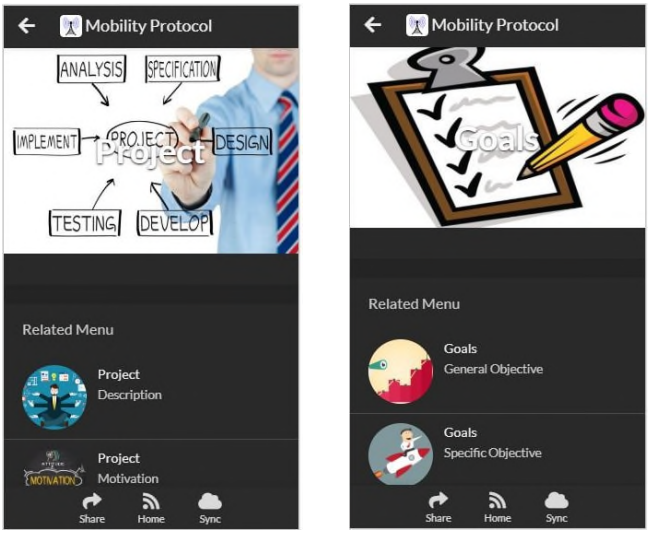
IV. RESULTS

In this section, the results obtained will be presented for implementation of the app using the AppSheet, which was described in the previous section.

In order to optimize the dissemination of information relevant to solutions that address the heterogeneity of wireless networks, an application was created to provide the results of the research that will be carried out during the postgraduate course. The manner in which the information will be provided will provide a very concise and dynamic understanding.

The initial prototype of the app was built from the requirements and features surveyed during the course of the research. A spreadsheet was created in Google Documents and from this, an application was implemented on the AppSheet Web platform. Figure 3 illustrates some of the app screens after it was ready. Figure 3 (a) shows the screen when we press the button named Project, connecting the path to the Project Description part and to the Project Motivation that encourages further research. Figure 3 (b) illustrates the application screen when the Goals button is clicked; it shows the user the General Purpose and Specific Objectives buttons.

The overall goal of protocol evaluation shown in Figure 3 (b) is to try to always keep mobile device users well connected when moving among different administrative domain networks and provide higher quality and reliability among connections. The specific objectives are to facilitate the reestablishment of connections, decrease registry data traffic in a mobility environment and create mechanisms that reduce the latency and quantity of packet losses during the handover process.



(a) (b)

Figure 3. App implementation

The process for installing the app on mobile devices is easy. The AppSheet must be installed first. The app developed is called Mobility Protocol and after installation on the smartphone, the first screen presentation provides a brief summary of what the app is all about, the motive and reason for its creation. Figure 4 shows the screen application shortly after installation on a device mobile with Android or IOS system.

Figure 4. Home screen

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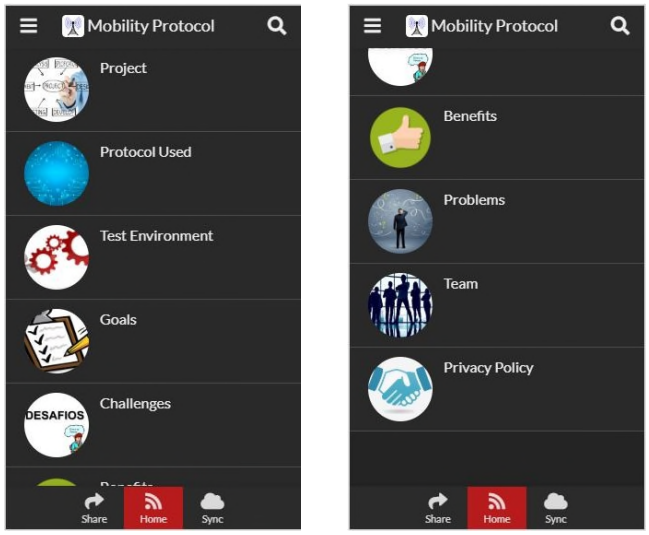
The main mission of the app in question is to inform and educate users about a very specific topic, which is the evaluation of mobility protocol. As a result, the model of structure plan used will be the index architecture model. For applications with a specific purpose, this type of structure is the best option. Figure 5 presents an organized menu for the app after adoption of the index architecture template. Figure 5 (a) has a print screen showing the top of the app main menu. In the app, there are several buttons in the main menu, and Figure 5 (b) illustrates the bottom section after scrolling vertically.



(a) (b)

Figure 5. Home

In a constant effort to optimize the application developed so that users always have a good experience and proper usability, the app has a feature for users to leave suggestions, ideas for possible improvements and/or compliments. The button that allows this connection between the user and the developer is called Feedback and is available in the upper left menu of the app, allowing the user to send the text to the email that the developer registered during creation of the project. The app created has not yet been shared with the academic community and other users who will use it, and we will thus not be able to provide any feedback from possible users at this stage. Figure 6 illustrates the menu where this resource can be found.

Through the development and usability tests performed, we have implemented the app that was proposed for this project. Simple texts were used for better understanding of the information that is being transmitted, the images illustrated in each topic are related, whenever possible, to the texts of each information and the colors have been chosen in order to achieve harmonization in the app set.

V. Conclusion and Future Work

Technology has made a major contribution to education, as demonstrated by the use of television, multimedia equipment and computers over the last few decades. However, because of continuing modernization, the latest mobile technologies deserve attention and can be applied in education, given that and a large part of the population already has access to a high-tech mobile device.

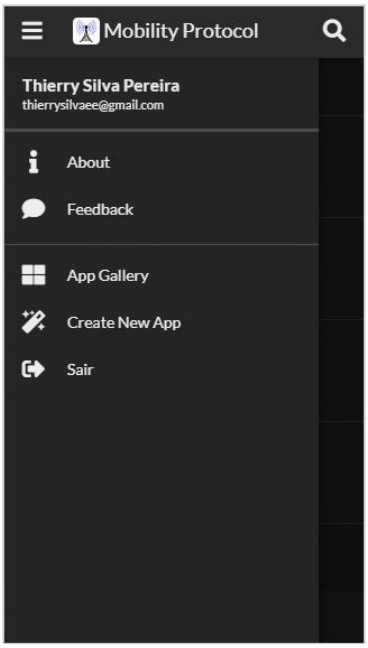


Figure 6. Menu

Although it is not a new topic and has already been dealt with by several academic researchers, the IP mobility management problem still deserves attention, especially in environments where the networks used by the mobile device do not have coupling and are located in many different administrative domains. Such scenarios are becoming more and more common and the quest for solutions is being treated with a focus on mobile devices.

This research is focused on the development of an app for mobile devices that will provide pertinent information for research. It will be carried out during the postgraduate course in the Telematics laboratory, where tests were performed for evaluation of mobility protocols, as a requirement for obtaining a specialist certificate.

The Mobility Protocol Assessment app has proved promising in its ability to provide a contribution to education, because it can aid in learning within the classroom, by providing more dynamics and better presentation of the information in an enlightening manner.

Therefore, in this context, the app developed meets the central objective of the research, which is to present useful information to the user and to show in a simple way how to apply them. However, the Mobility Protocol Assessment tool will not solve the mobility problem between heterogeneous networks by itself, and will always require research on the mobility issue and sharing of the results on the app.

As a suggestion for future work, this app can be disseminated throughout the academic community of the Federal Institute of Education, Science and Technology of Tocantins, in an effort to seek optimized versions. In parallel, there will be a search for solutions for mobile device mobility when moving along networks of different administrative domains, an issue that will always provide room for new academic research.

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