Master Thesis:
Secure and stable comunication over wireless networks under heavy load

A Goal Document for a Master's Thesis work
by

Mattias Eklund & Carl Nilsson Nyman

Students:	Mattias Eklund	Carl Nilsson Nyman
Civic reg nbrs:	19880116-0071	19911008-1412
Email address:	mat10mek@student.lu.se	mat10cni@student.lu.se
Main supervisor:	TBD	
Examiner	TBD	
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1 Introduction

The need for secure and stable connections via wireless interfaces has become more and more relevant today. Users in a system should be able to trust a connections stability and security. By extension companies that supply services that depend on wireless connectivity should be able to guarantee stability and security in their connections.

2 Backgound and motivation

Uniti is a rather new company that is producing an electric vehicle that can be controlled remotely. For this purpose Uniti has expressed the need for a stable and secure communication between their vehicle and mobile devices, such as a tablet or laptop computer.

Wireless communication is allready used in the car industry today, and is used för (among other things) updating allready existing software on platforms allready in use. This is to ensure that bugs and security flaws in older models gets patched out as they are discovered.

This communication is however not time critical as updates are performed when the vehicle is not in use. The communication that Uniti requires for this is much more time critical as input from a mobile device will affect the vehicle in very close to real time.

We have read some articles [2] concerning more general internet security on both the link layer and application layer and they have broght up som interesting points concerning different holes in security. Alot of research have lately concerned preventing DoS (Denial-of-Service) attacks while there also has been always been a steady research into the security holes that wireless networks give rise to.

3 Project aims and challenges

The aim with this Master's thesis work is to research and implement a stable and secure connection between Uniti's car and mobile devices such as a telephone or laptop via wireless connection on networks.

The problems lies in ensuring that the connection remains stable on networks that are under heavy load while not contributing too much to the latency of the connection. Setting up the connection and making it secure is also of great concern but our aim within this project has its focus set on ensuring low latency and stability between units.

4 Approach and methodology

The thesis project will be based on the requirements set by the different parts of the company Uniti's infrastructural software. This software is based partially in their car which uses Robot Operating System (ROS) but also in their cell phone application which is built in Unity3D. Most of this project will include implementing a network link between these parts. Uniti has already started looking at developing some kind of link, which is what we will initially work with to build upon.

5 Previous work

Earlier work has been put into this field both on university level and at the company Uniti itself. Most of the work on Uniti's end have however been performed by people who are not dedicated to that specific area. These implementations did however not meet all the needs of their systems.

According to [1]

6 Advancements and Outcome

The theoretical knowledge used within this project will be rather easy to verify the success of, seeing as the implementation of the different protocols and integration with different wireless medias will provide feedback easily. Something that is harder to verify by oneself is whether or not a certain solution is safe in terms of network security or whether or not it is stable under heavy loads, as these things require larger experiments to verify.

7 Resources

We will work with our thesis at Uniti's office in Lund where Uniti will provide office space, workspace, and workstations. Uniti will also provide access to their test platform and their prototype car, with potential access to extra external hardware if needed.

During our thesis work, we will work by integrating our ideas into Uniti's current source code. Network tests and simulations will be performed with the help of Uniti's equipment.

References

[1] Giuseppe Bianchi. Performance analysis of the ieee 802.11 distributed coordination function. 2000.

[2] Les Owens Tom Karygiannis. Wireless network security. Technical report, National Institute of Standards and Technology, 2002.

This Goal Document is approved by:

Main supervisor

<name here>	Date

Examiner

<name here>	Date