

Proposal for Master's Degree Project

Title: Mapping Security Requirements with Technology in the Internet of Things

Advisor and Contact

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Summary / Scope

The Internet of Things (IoT) is a major business enabler, and the number of IoT devices growing at a fast rate. Sadly, pressed by the time pressure to quickly get to the market, some manufacturers are shipping devices which are easily compromised, or integrate security mechanisms and protocols in a poor manner.

This master's project is focused on IoT security. It touches areas such as Operating Systems, Networking, Information Security, Programming and Software Engineering. Its main objective is to build a mapping between security requirements and technologies given the specific constraints of IoT devices. It aims to contribute to the development of a *secure by design* IoT. This work should include testing security related technologies in at least one typical development platform for the IoT, and comparing the results with the ones obtained for desktops (or servers). The project should output a tool whose inputs are security requirements and a system model, outputting a list of mechanisms satisfying those requirements. The source code of the tool should be released as open-source.

The main research challenge consists in defining the security mechanisms as a function of the requirements, system model and device constraints.

During this master's project, the student will have the chance to engage in discussions with other people involved in the area of information security, as well as the opportunity to improve his or her knowledge in several computer science fields, namely computer networks and programming.

Objectives

As hinted in the previous discussion, this master's project has four main objectives:

1. Enumerating security requirements and security mechanisms available in the state of the art;
2. Performance testing security related technologies in at least one typical development platform for the IoT, e.g., well known firewall, intrusion detection system and a crypto suite;
3. Establishing a mapping between requirements and security mechanisms under the constraints of the IoT device; and

4. Implement a tool for proof-of-concept integrating that mapping.

Tasks

In order to achieve its objectives, the following tasks are proposed as an initial work plan for this master’s project:

- Task 1** Getting acquainted with the context of the problem at hands and with the objectives of the project, as well as with the technologies involved. Revision of the specialized literature and related works (2 months);
- Task 2** Enumerate security requirements and related technologies, as well as system models, and identify the technologies/mechanisms that are going to be tested in the scope of the work (1 month);
- Task 3** Testing of the technologies identified in the previous task (2 months);
- Task 4** Propose a mapping between requirements and technologies for the specific case of IoT devices (1 month);
- Task 5** Implementation and testing of a prototype of a tool for proof-of-concept (1 month);
- Task 6** Writing of the master’s dissertation, technical documentation and a conference paper (3 months, eventually distributed and interleaved with the time periods of other tasks).

Timetable

An approximate scheduling for the execution of the previously identified tasks is included below. The execution of a given task in a given month is marked with a cross (x).

Task \ Month	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
1	x	x									
2			x								
3				x	x						
4						x					
5							x				
6								x	x	x	

Expected Outcomes and Dissertation

The most visible outcome of this master’s project is a tool for mapping security requirements and system models into technologies for the specific case of IoT. The work leading to the development of the mapping and tool, namely the results of the performance tests to the technologies are nonetheless the main outcomes of this work. This work may be the subject of a scientific conference paper. The final dissertation, entitled “*Mapping Security Requirements with Technology in the Internet of Things,*” may be written in English aiming for the international dissemination of this work.

References

- [1] I. Alqassem and D. Svetinovic, "A taxonomy of security and privacy requirements for the Internet of Things (IoT)," 2014 IEEE International Conference on Industrial Engineering and Engineering Management, Bandar Sunway, 2014, pp. 1244-1248.
- [2] Musa Samaila, Miguel Neto, Diogo A. B. Fernandes, Mário M. Freire and Pedro R. M. Inácio, "Security Challenges of the Internet of Things," in Beyond the Internet of Things: Everything Interconnected, Jordi Mongay Batalla, George Mastorakis, Constandinos X. Mavromoustakis and Evangelos Pallis (Eds.), Springer, In Press.