Communication networks have been shifting their focus from providing connectivity in a client/server model to providing a service or content. This shift has led to topic areas like Service-Oriented Architecture (SOA), Heterogeneous Wireless Mesh Networks, and Ubiquitous Computing. Furthermore, probably the broadest of these areas which embarks all is the Internet of Things (IoT). The IoT is defined as an Internet where all physical entities (e.g., vehicles, appliances, smartphones, smart homes, computers, etc.), which we interact daily are connected and exchanging data among themselves and users. Due to the variety of devices which connect to it, it is expected that the IoT is composed of multiple technologies interacting together, to deliver a service. This technologies interactions renders an important challenge that must be overcome: how to communicate these technologies effectively and securely? The answer to this question is vital for a successful deployment of IoT and achievement of all the potential benefits that the IoT promises.

This thesis proposes a SOA approach at the Network Layer to be able to integrate all technologies involved, in a transparent manner. The proposed set of solutions is composed of primarily the secure implementation of a unifying routing algorithm and a layered messaging model to standardize communication of all devices. Security is targeted to address the three main security concerns (i.e., confidentiality, integrity, and availability), with pervasive schemes that can be employed for any kind of device on the client, backbone, and server side. The implementation of such schemes is achieved by standard current security mechanisms (e.g., encryption), in combination with novel context and intelligent checks that detect compromised devices. Moreover, a decentralized content processing design is presented. In such design, content processing is handled at the client side, allowing server machines to serve more content, while being more reliable and capable of processing complete security checks on data and client integrity.

Approved for distribution by Ratan K Guha, Committee Chair, on October 20, 2016.

The public is welcome to attend.