1. Introduction

1.1 Purpose of Document

This is a requirements specification document outlining the main functional and non-functional requirements for researching and evaluating common open source Internet of Things (IoT) protocols.

1.2 Project Summary

Project Name:	Evaluating IoT Protocols
Project Members:	Jacob Hans Chris Kardaras Nick Wentzel
Responsible Users:	Joe Newell, BI Inc.

1.3 Background

- Established in 1978, BI Incorporated is the world's leading full-service electronic monitoring company today BI offers a full continuum of monitoring technologies and related supervision services for parolees, probationers, pretrial defendants, and individuals involved in the immigration process. their innovative products and services assist more than 1,400 agencies.
- BI Inc's Monitoring Technologies includes:
    - Global Positioning Satellite (GPS) technology for intensive offender tracking
    - Court admissible, transdermal and mobile breath alcohol monitoring devices
    - Radio frequency solutions to detect absence or presence in the home and other defined locations
    - Electronic monitoring software solutions with powerful case management, offender analytics, and easy to use mobile apps
    - Equipment-free biometric voice verification for random and/or scheduled offender monitoring
    - Monitoring services, administrative support and data management to meet agencies' needs and budgets

Business Problems/Opportunities

- The delivery of data is at the foundation of the Internet of Things (IoT). Proprietary, home-grown protocols were really the only option in the early days, but now, many industry standard protocols exist. Each one is typically suited for a particular set of scenarios, with trade-offs around complexity, flexibility, overhead and power consumption.

- BI Inc is considering using a publicly available IoT data protocol over a proprietary protocol in order to communicate with their IoT devices. While there are public papers researching various IoT protocols, BI Inc is interested in investigating these protocols to get the best possible understanding of their uses and how they would integrate with their systems.

1.4 Project Scope

Business Objectives

- Create an in-depth report of IoT protocols and their relevant applications to include the following areas:
    - Evaluating appropriateness of industry standard IoT Protocols (MQTT, AMQP, CoAP, LwM2M)
    - Ranking of protocols based off of efficiency, robustness, power requirements, infrastructure, and security
    - Final presentation and breakdown report of protocols to BI inc.

2. Functional Objectives

2.1 Main Requirements

1. Perform an in-depth research and analysis into some of the leading open source protocols to include MQTT, AMQP, CoAP, and LwM2M. Research into other leading protocols should be conducted after a strong understanding of the other protocols are done.

2. Each of the protocols will be implemented on a PC with client and server programs to get an understanding of how the protocols can be utilized in code.

3. After each client/server implementations have been conducted for each protocol, a wireshark capture outlining the different communications for each will be done. This will then include an analysis of how much data is being sent from a network perspective.

4. Security considerations for each protocol will also be considered and investigated to understand best practices and applications to protect data transfer.

5. Power consumption is another major component to this project and the above implementations for clients. Each of the protocols will have client code run on the evaluation kit provided by the sponsor. The evaluation kit will then be tested amongst different parameters to understand the power consumption for each protocol.

6. A presentation for each protocol will be made and presented to the project mentor outlining the major aspects of the protocols.

3. Non-Functional Objectives

3.1 Protocol Presentations

- Each protocol presentation will consist of main features, pros and cons, development environment support, and specific examples of real world commercial uses.
- The robustness of the protocol will also be included to consider what happens when connections are dropped or lost in transit.

3.2 Testing method

- Each protocol will be tested for bandwidth overhead costs, robustness, and power consumption
- Test robustness by implementing planned “network outages” by cutting the connection and evaluate how the protocol recovers
- Tests will include various size payloads and frequency of reporting to simulate different potential implementations, as well as stress power consumption in different ways

3.3 Security Testing

- Understand and implement different security practices for each of the protocols outlined above.
- Perform baseline security testing such as wifi snooping to test the security features of the transmission.