

Project Charter

Evaluating IoT Protocols

BI, Inc.

September 21, 2020

1. Introduction

Background Summary

- 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.

2. Objectives and 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.

High Level Requirements

- The purpose of this project is to compare some of the leading protocols: MQTT, CoAP, LwM2M, AMQP to determine their suitability under various use cases. While this comparison has been done untold times and published in industry press and research papers, there is nothing like digging in and discovering this for yourself.

- The team will learn about the fundamentals of the protocols and code up client and server-side apps that exercise the protocols with small, medium and large payloads. The characteristics of each protocol will be observed and measured using tools like Wireshark. An evaluation of the strengths and weaknesses of each will be documented. The initial coding will be on PCs and then, as time allows, on IoT platform(s), transferring data over wireless links, with cellular being the primary target.
- The primary goal will be to become proficient with the technologies and put them into action. Use of open source libraries are encouraged. If some team members are so inclined, we can move past the software/firmware implementation and dig into power consumption measurements. Wired and/or wireless PC connections are the MVP transport, but the team can explore BLE or embedded WiFi, if desired. On the server side, cloud services such as AWS and Azure can be explored.

Project Scope

In Scope:

- Any and all communication protocols which target low power IoT devices, including but not limited to:
 - CoAP
 - MQTT
 - LwM2M
 - AMQP
- Testing of performance with regard to various payload sizes and frequencies on consumer hardware (personal computers), as well as development boards
- Testing of power consumption on development boards
- Backend solutions (On-premise, AWS, Azure, etc) for the devices to call home to

Out of Scope:

- Other software that interacts with the protocols we are researching
- The selection and decision of hardware for the project
- Transition of existing hardware/software from proprietary protocols to protocols being investigated by the team

3. Project Approach

General Approach – Solution Delivery Process

- Researching each protocol BI Inc is considering for future deployment
- Testing each protocol for efficiency, power consumption, data usage.
- Evaluation of each protocol and report comparison.

Project Changes

- Changes to project scope and requirements will be reviewed and agreed upon by both the team members and project manager. Once agreed upon, said changes will be added to the project charter. After modifications to the project charter, a new copy of the charter will be pushed to the group github repository at: <https://github.com/ckardaras/iot>.

4. Project Overview

Key Milestones

1. **Project Charter** (this document)
2. **Project Plan**
3. **Software testing**, consisting of:
 - Client/server implementations
 - Varying payload size and frequency
 - Testing of different freely available implementations of the protocols
4. **Hardware Testing**, consisting of:
 - Tests of the different protocols running on hardware
 - Specific Energy Consumption testing and evaluation
5. **Presentation/Report to Company**, consisting of
 - Documentation of findings

Timeline

<u>Milestones</u>	<u>Tentative Date</u>
Project Charter	September 29, 2020
Project Plan	October 6, 2020
Software Testing	January, 2021
Hardware Testing	February, 2021
Presentation/Report to Company	May, 2021

Preliminary Cost Estimates

Hardware/Software Costs	Estimate
u-blox R410M EVK (\$250 x qty 4)	\$1,000
Sercomm TP540 EVK (\$200 x qty 4)	\$800
Azure, AWS Pricing	Up to 1 billion messages: \$1.00 (per million messages) Next 4 billion messages: \$0.80 (per million messages) Over 5 billion messages: \$0.70 (per million messages)

Acceptance Criteria

- Results of research on the protocols: features, pros and cons, development environment support, examples of real world commercial uses
- Each protocol demo'ed using a PC-based client, data exchange documented via Wireshark
- Each protocol demo repeated using the u-blox and Sercomm EVKs
- Data efficiency and power consumption comparisons between the protocols

5. Key Stakeholder Roles

Team Personnel	Role
Joe Newell	Project Mentor
Chris Kardaras	Team Leader
Nick Wentzel	Team Member
Luke McDonald	Team Member
Jacob Hans	Team Member

Sponsor Signature:



Date: 13 Oct 2020