

Software Architecture and Scalability for Internet of Things

Portfolio Task – Final Project (*Revised 12th September 2023*)

Pass / Credit / Distinction / High Distinction Level Task

I. OVERVIEW

This assessment is a multi-graded task that requires you research, plan, design and implement a final project that demonstrate Internet of Things (IoT) scalability. You will apply the key concepts and technologies you have learned throughout the trimester for this project.

NOTE: Please indicate clearly whether you are a SIT314 or SIT729 student by including this sentence at the start of your Abstract section in your report:

“This document forms part of the assessment for [SIT314 or SIT729 - choose one] Software Architecture and Scalability for Internet of Things”.

II. FORMATTING REQUIREMENTS

Your submission to OnTrack must meet the following basic requirements:

- Formatted professionally with the report style of your preference.
- External sources are appropriately cited and referenced **with the referencing style of your preference.**
- Sufficient report length as you deemed appropriate for presenting your work.
- Converted to **Portable Document Format (PDF)** format

III. PROJECT AIM

The aim of the project is to plan, build a prototype and document an application for IoT controlled smart lighting in a large building. This is very much like smart lighting solutions from Philips Hue, LIFX, TP-Link and Xiaomi.

The difference is that it must be designed to work in a large building, with many thousands of lights and switches. It will be controllable via physical switches, mobile apps or a web-based interface. Focus should be on ensuring the scalability of the system, this is in terms of both the technical scalability aspects but also the non-functional aspects such as security and trust of the system.

Some suggestions below:

- To generate data, you can either use real smart lighting data if you have your own lights, you can mock-up a smart light using an Arduino or Raspberry Pi and LEDs/switches, or you can generate the data programmatically using a random number generator. Do what you feel is necessary to demonstrate the prototype.
- You should use an appropriate format to transfer data between the different parts of the system – e.g. JSON or XML.
- Use online services where appropriate, including Amazon Web Services, CloudMQTT, MongoDB Atlas, Now, Heroku.
- Where possible, text should be fully referenced with appropriate academic sources to justify your ideas. For example, in your description of the aims of the system, it would be a good idea to reference academic and commercial systems.

IV. PROJECT REPORT STRUCTURE

Your report should document the design and development of your prototype IoT application. This must provide evidence of the completion of the project. Include full code listings, any configurations and screenshots of your deployments.

The following provides a rough idea of a good structure for the final report. Refer to the marking scheme at the end of this document for more details.

- 1) Title: Give a title for the IoT solution you have implemented
- 2) Abstract: Describe in a nutshell your proposed IoT solution, the technologies you used, and how this solution achieved IoT scalability.
- 3) Introduction: Problem Description, including the aims of the system
- 4) Requirements of the system
- 5) Proposed Solution / System design (including diagrams and relevant implementation details)
- 6) Description of data formats
- 7) Discussion on how IoT scalability is achieved (including screenshots of functioning prototype)
- 8) Conclusion
- 9) References

V. ASSESSMENT

You will be graded according to the **Marking Rubric** on the last page of this task sheet.

VI. SUBMISSION

Please submit your document in PDF to OnTrack by the specified due date.

***** Please see the next page for Marking Rubric *****

Marking Rubric	Pass	Credit	Distinction	High Distinction
Format	<ul style="list-style-type: none"> The submitted report is formatted professionally All figures/tables are appropriately labeled The submitted report is in PDF format 	All Pass requirements	All Pass requirements	All Pass requirements
Structure	<ul style="list-style-type: none"> The submitted document is properly structured The topic is divided into a simple but clear structure using the section headings detailed in Section IV The content is complete but some sections are lacking required detail A reference list is provided and correct 	All Pass requirements plus: <ul style="list-style-type: none"> Clear use of sub-sections as required to clearly delineate different aspects of the project All sections have a sufficient level of detail The reference list is professionally structured and complete 	All Credit requirements plus: <ul style="list-style-type: none"> Suitable references have been located and used for all claims made by the student 	All Distinction requirements
Technical content (See next page for more detailed breakdown of the technical content criteria)	<ul style="list-style-type: none"> A flawed and incomplete evaluation of the proposed IoT solution Minimal discussion on the issues raised Minimal diagrams and figures used 	All Pass requirements plus: <ul style="list-style-type: none"> A clear evaluation of the proposed IoT solution Some discussion of the issues raised Some diagrams and figures used SIT729 students only: <ul style="list-style-type: none"> Decent implementation details of the proposed solution Decent use of schematic diagrams to present the architecture/layout of the proposed solution 	All Credit requirements plus: <ul style="list-style-type: none"> A detailed evaluation of proposed IoT solution A complete analysis of the issues raised Good use of diagrams and figures SIT729 students only: <ul style="list-style-type: none"> Good implementation details of the proposed solution Good schematic diagrams to present the architecture/layout of the proposed solution Critical analysis of the implemented solution supported with diagrams and figures 	All Distinction requirements plus: <ul style="list-style-type: none"> A detailed, in-depth evaluation of the proposed IoT solution A complex and thorough analysis of the issues raised Excellent use of diagrams and figures SIT729 students only: <ul style="list-style-type: none"> Excellent implementation details of the proposed solution Excellent use of schematic diagrams to present the architecture/layout of the proposed solution Critical analysis of the implemented solution supported with diagrams and figures Critical reflection on how the proposed and implemented solution can be further extended as future work Discussion on how the proposed and implemented solution can be applied to the real-world in a broader context

Marking Rubric	Pass	Credit	Distinction	High Distinction
Problem description and aims of the system	<ul style="list-style-type: none"> Problem is not well defined, or description lacks significant detail needed to understand problem features or why it is a problem. 	<ul style="list-style-type: none"> Problem description lacks detail and demonstrates insufficient understanding of problem features. 	<ul style="list-style-type: none"> Description conveys major features of problem and relates relevant dimensions that make the problem hard to solve. 	<ul style="list-style-type: none"> Description presents cohesive and thorough understanding of the problem and why it is difficult to solve given current knowledge and capabilities in computing and/or engineering.
Requirements of the system	<ul style="list-style-type: none"> List of unstructured system requirements. 	<ul style="list-style-type: none"> Functional and non-functional (quality) requirements listed. Good attempts relate these to high-level system requirements. 	<ul style="list-style-type: none"> Ranked requirements based on an estimation of effort or time needed. 	<ul style="list-style-type: none"> Relationships between requirements clear including risks of not completing features.
System design	<ul style="list-style-type: none"> Overall design and block diagram. 	<ul style="list-style-type: none"> Convincing argument for decisions made. 	<ul style="list-style-type: none"> Well-referenced to commercial and academic systems. 	<ul style="list-style-type: none"> Innovative system design, fully referenced and justified.
Data formats	<ul style="list-style-type: none"> XML or JSON 	<ul style="list-style-type: none"> Well-described and justified argument for data format. 	<ul style="list-style-type: none"> Use of JSON or XML schemas. Fully annotated data descriptions. 	<ul style="list-style-type: none"> All messages in the system using well -defined and run-time checked data formats.
Scalability	<ul style="list-style-type: none"> General description of how the system performance scales. 	<ul style="list-style-type: none"> Consideration of scalability issues beyond performance. 	<ul style="list-style-type: none"> Fully referenced academic literature of scalability issues in IoT applications. 	<ul style="list-style-type: none"> Clear and well-defined consideration of scalability in all aspects of system design.
Language	<ul style="list-style-type: none"> Basic language and grammatical skills 	<ul style="list-style-type: none"> Good grammatical structure and flow of argument 	<ul style="list-style-type: none"> A document suitable for reading by a professional audience 	<ul style="list-style-type: none"> An excellent report suitable for reading by an professional and academic audience