

6.033 Spring 2018

DP Final Report Assignment

Due 5/7 at 11:59pm

Having now had two rounds of feedback on your design, it's time to write your final report. Unlike the proposal document, the report should contain enough detail that it could feasibly be turned over to Facilities for implementation. It should also contain an evaluation of your design.

Outline of the Report

Your team's report should be approximately 6000 words¹ and follow the basic outline below:

- **Title page:** Give your report a title that reflects the subject and scope of your project. Include your names, email address, recitation instructor, section time(s), and the date on the title page.
- **Introduction:** Summarize the problem to be solved and what your design is intended to achieve. When summarizing the problem, you should extrapolate and highlight the technical challenges that make this issue a hard systems problem from the design description. Outline your design and briefly outline why your design meets the requirements.
- **System Overview:** Provide a high-level description of your system that includes modules, interactions, and messages. This should include a system diagram and serve to introduce definitions for key terms used in the Design section. The system overview also provides an opportunity to prioritize the main system objective(s).
- **Design:** Explain your design. Identify your design's main components and protocols. You should subdivide the design, with corresponding subsections in the text, so that the reader can focus on and understand one piece at a time. Explain why your design makes sense as well as explaining how it works. Use diagrams, pseudo-code, and worked examples as appropriate.

It should be clear from this section that your design meets the specifications of the assignment (e.g., that it does not exceed the storage available on the servers nor the capacity of the network, etc.). Leave any major calculations to the evaluation section, though it's fine to reference those calculations beforehand (e.g., "Our design results in a communication overhead of fewer than 1Kbit/sec; see Section 3.1 for an analysis.").

- **Evaluation:** Evaluate your design. There are more details about this section below.
- **Conclusion:** Briefly summarize your design and provide recommendations for further actions and a list of any problems that must be resolved before the design can be implemented.
- **Author contributions:** A brief statement (typically 1-3 sentences long) describing the contributions of each author. These contributions could include designing specific components of the system, research or investigation related to the design problem, qualitative or quantitative evaluation, writing the text of the report, editing the report, creating figures, etc.

¹ As always, use this word count as a guideline. If you are writing significantly more than 6000 words, you're giving us too much detail. If you are writing significantly fewer than 6000 words, you are giving us too little. We care much more about the content of your paper than the exact word count.

- **Acknowledgments and references:** Give credit to individuals whom you consulted in developing your design. Provide a list of references if appropriate.

Evaluation

A good evaluation will do more than just calculate metrics relevant to your system; it will also use calculations to justify design decisions. For example, “Our method for transmitting data from the smart devices results in an overhead of only 1Kbit/sec, compared to a design without this method, which results in an overhead of 1Mbit/sec.”

At a minimum, your evaluation section should address the following questions:

- **What is the communication overhead of your system?**

Typically this will be a measure of the amount of traffic sent between smart devices and the FCS.

- **On average, how long does it take between when a smart device comes online and when it is capable of sending data to the FCS?**

That is, how long does it take for a smart device to be discovered and for there to be a route between it and the FCS?

- **On average, how long does it take data collected by a smart device to be transmitted to the FCS?**

- **How much data are you storing on the FCS? How long will it take before the FCS can't store any additional data?**

- **What parts of your system limit scale, and what are those limits?**

Could your system handle the addition of 5000 new thermostats and motion detectors? Could it handle 500 new cameras? Could it handle additional buildings that MIT might construct? Etc.

- **How long does it take your system to respond to a gateway failure? To a BLE+ Repeater failure (if you used such repeaters)?**

- **How long does it take for a software update to be delivered to all smart devices of a certain type?**

This will likely be a function of the size of the update.

- **How usable will Facilities find your system?**

Think about how Facilities is likely to query the data that you store on the FCS. It's reasonable to imagine that Facilities may want to access all temperature data from a particular thermostat, to determine which rooms are currently in use, etc. Given the way you've stored data on the FCS, can these basic queries easily be satisfied?

- **How many hardware components (repeaters, gateways) will your system require, and how will it handle buildings with unconventional layouts? What is the cost of your design?**

Your system should be able to work regardless of the layout of various buildings. As an example, a design that assumes that every room is a square is resting on a very unreasonable assumption.

In answering those questions, you should provide the appropriate numbers as well as some context for them. How do the values that you calculated affect users or other entities in the system? If your system takes X seconds to respond to a failure, is that good or bad? Did you make any trade-offs that involve these metrics? Etc.

Because every system design is different, you may need to discuss additional metrics specific to your system in the evaluation. Your evaluation should also address the use-cases presented in the design project write-up. You may pull those out into their own subsection, or mention them at different points within your evaluation. Whatever structure works best for your report is fine.

You should also consider how your system could evolve as Facilities upgrades their infrastructure (e.g., smart device hardware, etc.), or how it might handle additional future requirements. What would happen if Facilities increased their minimum requirement for the number of frames each camera must deliver? What if, at the start of crisis mode, Facilities wants to have access to the last minute of data from the camera in question in addition to the current data?

Finally, some design decisions may not correspond to calculable metrics; the most common case is preferring a simple, modular design over a complex one. Your design report should note when you made choices in the name of simplicity or other design principles. Depending on your report organization, it may be more appropriate to include this information in the design section than in the evaluation.

Security Issue

As part of the evaluation, we'd like you to address a security issue related to the DP. Since we don't cover security until the last quarter of the course, we do **not** expect you to redesign any part of your system to handle these issues (though you can if you want to).

- MIT wants to make sure that only Facilities staff members can log into the system. What form of access control would you recommend to solve that problem?
- MIT finds that, because of their low computational capabilities, smart devices are not capable of encrypting data. Is that problematic? In what ways?