

COMPUTER SCIENCE TRIPOS - PART II - PROGRESS REPORT

# Building a Blockchain Library for OCaml

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**Project Supervisor:** KC Sivaramakrishnan

**Project Overseers:** Marcelo Fiore & Timothy Jones

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## 1 Work Completed

### Using the Tools

Before starting this project, I had no experience using OCaml, Irmin<sup>1</sup> or Lwt<sup>2</sup>. I spent some time learning OCaml as a language and how to write idiomatic, thread-safe code. I have also now become very familiar with Ezirmin which provides a simplified API to Irmin.

This work was completed in the first half of Michaelmas, in accordance with my initial work schedule.

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<sup>1</sup>Irmin is a library which uses a Git backend to provide an immutable block store

<sup>2</sup>Lwt is a library used to handle threading in OCaml

## **Building a Distributed Ledger**

My proposal suggested that I would have built the functionality for adding data to the blockchain by the end of Michaelmas. Whilst I was a week behind with this work, it has now been built and is functioning.

## **Consensus Protocol**

In my project proposal, I declared that I would need to research which consensus algorithm would be the most suitable for my project. I suggested investigating options including Proof of Work, Proof of Stake, Paxos and Raft.

I have completed extensive research on these protocols and have developed a leader based approach - such as the one employed by Raft - which uses the Proof of Work algorithm to periodically reallocate a leader in a group of nodes.

I have faced a few difficulties with using Ezirmin which have delayed progress on building consensus into the project. Specifically, I have come across a bug whilst using the file system backend. In trying to fix this issue, I have had to spend time reading through and understanding the library at an implementation level.

Whilst the bug has not yet been fixed, I have switched to using an in memory backend for the time being which is working as expected.

Additionally, come to realise that this is by far the most substantial piece of work required for this project - more so than suggested in my proposal.

I am therefore running roughly 2-3 weeks behind with this work.

## **Dissertation**

Work on the written dissertation has been going well. I have completed a first draft of an Introduction and Preparation section and am running 2 weeks ahead of schedule with this. This should go some way to making up for the delay in building the consensus module.

## **2 Changes to the Original Proposal**

There is still work to be done, as outlined in my original project proposal, however there are a couple of things which have changed slightly.

The bug in Ezirmin, described earlier, still needs to be fixed, but I am working with KC - my supervisor and the library's author - to do this.

I also now believe that building of my evaluation program will not take as long as suggested in my proposal (the first 6 weeks of lent). Whilst, I will be starting work on this, 1-2 weeks later than I suggested in my proposal, I believe that due to my greater proficiency with OCaml and scripting languages, it should only take around 3 weeks to complete.

Overall, I have been making good progress with my project. Whilst I am behind on some parts, I am also ahead on others and overall I think I am on track to completing the project in good time.