COMP5567 Distributed Algorithms and Protocols for Blockchains Project Assignment

Due: 23:59, 27 Nov 2023 (Wednesday)

This is a group assignment. You are required to form a group of 1-4 members. Considering your *really diverse* backgrounds, I have given two options for the project assignment as follows, and you are expected to complete either of them.

Option 1

You're required to program a blockchain prototype that is superior to the state-of-the-art. The basic requirements are as follows:

- The prototype should run on at least 10 nodes across at least two physical machines and function well if any node fails.
- You need to implement at least a consensus protocol in your prototype; it is not necessarily taught in this subject.
- Your developed prototype should be novel from at least one perspective, e.g., an important application or an efficient algorithm that has never been considered before.
- You are recommended to have an application scenario together with your developed prototype.
- You are required to write a report about your prototype. The report is expected to include the title, link to your source code, group members and percentage of contributions of each member, summary, system architecture, functions and how they are implemented, and at least 3 screenshots of the developed prototype.

An example is as follows:

- Food traceability is important, and blockchain is an essential technique to guarantee the authenticity of food information. So I develop a prototype of blockchain-based food tracing.
- I use proof of work as the blockchain consensus algorithm.
- In the prototype, the different stakeholders along the food supply chain, e.g., farmers, warehouse keepers, and retailers, can upload the food information.
- There is a large amount of food information on the blockchain of various food items. In the literature or practical systems, there is no formal description or implementation of a high-efficiency food tracing algorithm.
- I design a high-efficiency food tracing algorithm that takes the ID of a food item as input and outputs all the related information recorded on the blockchain.

The grading is based on: 1) the source code (40%)'s functionalities, novelty, and readability, 2) the report (20%)'s completeness and clearness, and 3) the presentation (40%)'s logic, clearness, and attractiveness.

Option 2

You're required to write a mini research paper (no limit on the number of words) that advances the state-of-the-art. The requirements are as follows.

- You need to give an overview of your research topic.
- You need to refer to some existing work; recent papers are preferred.
- You need to explain in detail why and how your proposed approach is new and advances the field.
- You need to evaluate how good your proposed approach is with theoretical proof and/or numerical results.
- You need to write a report that includes the title, group members and contributions of each member, abstract, introduction, related work, proposed approach, performance evaluation, and conclusion.

An example is as follows:

- Sharding is a technique that significantly improves the system throughput of blockchains.
- Existing sharding protocols include Elastico, Omniledger, and RapidChain. They incur inferior performance because the improper load balancing.
- I propose BrokerChain (it is actually a work published in IEEE INFOCOM'22) that models the shards and transactions among shards as a weighted graph. I propose a novel graph-splitting algorithm that balances the workload among different shards and reduces the number of cross-shard transactions.
- The experimental results show that BrokerChain improves blockchain system throughput from 2,000 to 4,000.

The grading is based on: 1) the report (60%)'s completeness, originality, novelty, comprehensiveness, and readability, and 2) the presentation (40%)'s logic, clearness, and attractiveness.

Important Notes

For either option, you are required to:

- Send me an email by 15 Nov 2023 containing your proposed topic and group information.
- Submit the presentation slides via Blackboard by 23:59, 27 Nov 2023.
- Do a presentation on 29 & 30 Nov 2023. The presentation order will be announced after the number of groups is fixed.
- Submit the report via Blackboard by 23:59, 7 Dec 2023.

Some other notes are as follows:

- You can put your source code publicly available on GitHub.
- You are encouraged to include a demo video in your presentation if you choose Option 1.
- You are NOT encouraged to record and play a video as your presentation because it will dis-attract the audience.
- For each single group, please delegate one member to do the submission. In normal cases, the members in the same group will receive the same grading result.
- You are welcome to discuss your idea with me.