Why I Decided To Join A Startup as a Software Engineer

Ronghao (Steve) Yang
M.Math in Computer Science
Outline

- I am going to talk about requirement engineering in my internship experiences.
  - I-Company and W-Company

- Answer 3 (3 out of 4) research questions from my own experiences.

- More discussions about my thoughts on my internships.

- Why I decided to join a startup as a software engineer.
4 Research Questions

- What are the roles of the clients and developers?
- What are the requirements prioritization criteria?
- What are the characteristics of the project’s settings that influence the prioritization process?
- How does an Agile development balance value creation for both the vendor and the client?
About The Paper

- The research questions are from the paper: Agile requirements prioritization in large-scale outsourced system projects: An empirical study.

- This paper studied three cases in industrial settings. All three cases are large outsourced projects.

- This paper analyzed how requirements prioritization and re-prioritization works in the three cases.
Requirement (Re)Prioritization

- Agile is becoming more and more popular ..... 
- Some of Agile principles:
  - Deliver working software frequently 
  - Welcome changing requirement 
  - Close, daily cooperation between business people and developers 
  - Etc. 
- They mean that requirement prioritization and reprioritization also happen frequently. 
- Requirement (re)prioritization is not exclusively in Agile ....... It exists in every project. 
- By answering to those research questions, I am showing how requirement decisions were made and why they were made in my projects.
About me and my internships

You guys have 6 internships !?!!?

I only had two, and 6 > 2

- I** (I-Company) – Research-based project. Worked on developing an AI based SQL optimization tool for their flagship database product.

- W*** (W-Company) – More of an engineering project. Worked on developing tools for merchants to upload product images and to search for similar products that are sold by other merchants.
I-Company v.s. W-Company

- I-Company
  - Agile
  - Big corporation
  - Two main phases: research phase and infrastructure development phase
  - Team size:
    - Research phase: 3 (junior?) engineers, 1 staff engineer, 1 senior engineer, 1 principal engineer
    - Infrastructure development phase: all team remembers from the research phase + 4 new engineers from worldwide

- W-Company
  - Non-Agile
  - Start-up
  - Team size: 5 engineers in the same office
What Are The Roles of the Clients and Developers?
I-Company

- Clients: Database users, mainly big corporations and governments.

- Clients were not directly involved in the development process. The AI project was a secret project from the public.

- However, to the optimizer team, one of the general needs from clients is to increase the speed of the DB product.

- Even though the clients were not explicitly asked about their requirements, the senior and principal engineers still had a rough idea about clients’ expectations.
What Decisions To Make?

- Why AI? – This decision defined the scope of the project.

- How fast is fast? – This is one functional requirement of the project. With what requirements met, the new optimizer can be accepted?

- How much faster? – This is one non-functional requirement.

- What AI? – Among different AI algorithms, which one should be chosen. (Tree vs Neural Networks)
- **Why AI?**
  - This decision was made by the VPs. It was a business value-based decision. I will discuss the decision later.
  - This decision defined the scope of the project. With the scope set, the engineers omitted all the possible non-AI solutions.

- **How fast is fast?**
  - At first, this decision did not seem to be difficult to make: being faster than the current optimizer is all we need.
  - However, there are two issues related to AI algorithms. 1) They require training 2) Their performances are data source dependent.
- How much faster?
  - Non-functional
    - The principal engineer viewed the experimental results and made decisions on whether an algorithm can be accepted. No formal requirements, it was an experience-based decision.

- What AI?
  - The engineering team came up with two solutions. 1) Tree-based solution 2) Neural network-based solution (Deep-Solution)
  - Each solution had acceptable performances
  - By (not predefined) benchmark, tree-based solution > neural network-based solution
  - However, the neural network-based solution was chosen for final production
  - It was a business value-based decision, I will talk about it later
Some thoughts about I-Company:

The roles of different engineers in the team were not clear to me. At the beginning of my internship, I thought I was supposed to report to one of the staff engineers in the team. However, I ended up reporting to both the senior engineer and the principal engineer. They had the final say.

I did not like how the decision for “how much faster?” was made. There was no formal requirements. I needed to go back and forth to discuss results with the senior and the principal engineer.

Even for “how fast is fast?”, there was no formal requirements. I was expecting some benchmark tools for algorithm comparison. However, no such thing existed.

As a result, I designed all the experiments and created synthetic datasets. I had to go through every one of them with the principal engineer.

Time was wasted.
W-Company

- Who were the decision makers?
  - I don’t know

- Why NN in this project?
  - (I think) it was obvious.
  - When it comes to image recognition, even humans cannot beat neural networks.
However, I do know something.
One decision was made when I was there. I know how and why it was made and who made it.

- The decision was to develop an Android app that looks like it is from a totally different company.
- But why? Let me explain.
- It was a secret project from customers, and I believe now it still is.

Who made the decision?

- Company VPs, however, the decision-making process was relatively transparent.
- Even interns had the opportunities to join the discussion.
- The motivations behind the decision were explained directly by the decision makers.
- Numbers and figures were shown.
Some thoughts about W-Company:

- I like how transparent the decision-making process was at W-company.
- When coding, I knew how my code is going to impact the business model.
- Roles were simple, a big project is divided into sub-projects, each sub-project was owned by one person.
What are the Requirements Prioritization Criteria?
I - Company

- In the research phase, there were two sub-phases: 1) Before having any acceptable solutions 2) After having some acceptable solutions.

- In subphase 1, the priority was to produce an AI algorithm that works.

- In subphase 2, the priority was to produce a Deep-AI algorithm that works as well as the AI algorithm developed in subphase 1.
So why AI and Deep-AI

- The word “Deep” just sounds so attractive.
- ”AI” sounds good, but “Deep learning” or “Deep AI” sounds better than just “AI”.
- No other DB products have AI optimizers.
- Of course, no other DB products have deep-AI products.
- To non-technical people, deep learning seems to be the true artificial intelligence and can do everything.

Tree-based AI vs Deep AI

- The tree-based algorithm performed better, not significantly better but still better.
- However, the deep learning-based algorithm was chosen as the default optimizer. It was believed that it had a higher business value.
Performance and Cost

- Cost > Performance

Two solutions were proposed at the time for deploying the AI algorithm.

- Dedicated Server Approach vs Serverless Approach

Cost and ease of maintenance always had higher priority than performance during the development process.
What Are The Characteristics of the Project’s Settings that Influence the Prioritization Process?
It was a research-based project

One of the properties of a research-based project is uncertainty. Therefore, it is not easy to have all requirements listed formally. For example, things like how much data does one algorithm need; what data source does the data come from; how often does the data source change….. Cannot be determined

For AI algorithms, there are highly context dependent, one cannot make decision without looking into the data
However, some thing could have been improved.

- Benchmarking tools
- Could have formal requirements of what benchmarks are considered “acceptable”
- Could also have formal requirements of what deviations are allowed for the deep-AI solution to have
- It could have saved time and effort
W-Company

- It was more of an engineering project than a research project. Yes, it did have some AI elements in it.
- The project was about building something rather than doing experiments.
- No formal requirements either.
  - Also had to check with the manager regularly to confirm if it has met the requirements.

- However, since it was an engineering project.
  - Many well documented open source production-grade projects available
  - Technical blogs and articles available
  - Stackoverflow
More on my internships

- Development Speed
- Location of Team Members
- Office Design
- Leadership Hierarchy
Development Speed

I-Company

- During the development phase, several new engineers joined the team. They needed to install several required software libraries for the project.

- From my experience, if no error occurs, this process normally takes less than 30 minutes.

- However, it took them 3 days......

- I had no idea about why it took so long and in daily scrums, everybody else including the team manager seemed to be fine with it.
Location of Team Members

- I-Company
  - The team expanded in the infrastructure development phase
  - New engineers located in San Jose, USA and Berlin, Germany
  - Almost impossible to organize meetings when all engineers are available
    - So much communication overhead

- W-Company
  - Team members in the same office
  - No commutation overhead, it takes less 5 seconds to reach any engineer in the team
Office Design

- I-Company
  - Cubical office design
  - Usually needed a slack message or an email to schedule a 5 mins meeting
  - The time spent on waiting for a response sometimes is longer than the meeting itself
  - So much communication overhead

- W-Company
  - Open office design
  - Basically no communication overhead
  - Talking to someone simply required standing up and walking for 5 seconds
Leadership Hierarchy

- I-Company
  - Too many layers, I did not even know the number, makes sense for big corporations.
  - Even though VPs made the decision for having an AI optimizer, as an engineer, I could not directly discuss about my proposed solutions with them.
  - Adds unnecessary overhead to software development.

- W-Company
  - Only two layers between me and the CEO.
  - As an engineer, I knew how several strategical decisions were in detail. To me, it was important. Knowing the impact of my code helps me to come up with better solutions.
  - (I personally think) it is important to have the business model in mind when writing code.
So I Decided to Join a Startup as a Software Engineer

- Several things changed since I started at UWaterloo
  - Research vs Engineering Products
    - Research has lots of uncertainty, the probability of failure is much higher
    - (I personally feel that) engineering products have higher customer impact
  - Big Corporations vs Startups
    - Big corporations allowed me to explore different projects
    - Startup is more fun, fast-paced, dynamic
    - As a developer, I felt I had more impact
One more thing!
Thank You