Ambiguity and Architectural Questions

Homework: assignment number 3

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ABSTRACT

Four aspiring architects embarked on a mission to delve into a proposed traffic signal system. Armed with a product description, they crafted a series of questions for analysts to refine and expand on the system's requirements. Leveraging insights from the description, professors' suggestions, and their own academic knowledge, the team employed the spiderweb method to organize and categorize their questions. The spiderweb, visualized on a whiteboard with sticky notes representing each question, served as a roadmap, prioritizing questions based on their urgency (the center representing immediate needs). This collaborative effort produced a clear framework for analysts to understand the team's inquiries and their respective priorities. However, further research is necessary to identify potential information gaps, limitations, and future directions. Open communication with analysts, including their identities, will be crucial for uncovering these unknowns and charting the best course forward.

KEYWORDS

Spiderweb method, categories, priorities, exploration, knowledge sharing, communication, requirements

1 INTRODUCTION

A world where traffic signals have a mind of their own and can think for themselves, regulating traffic based on vehicle density to avoid inconvenience to drivers, is not easy to be introduced. Such ideas are what drive the potential in a traffic signal control system. However, there are ambiguities in the vision of this system. The "Questions of Ambiguity and Architectural" group – the architects of this vision – undertook an expedition to unravel the soul of this system and make clear its way forward.

With the questions crafted by the group, triggered by the lack of clarity in the system specification, they have scratched the surface of their research to unveil what is behind all those efforts to optimize traffic flow and reduce emissions. They looked into details about "what" and "how" for this intelligent system. They developed a visual tapestry using sticky notes as their questions through their investigative process referred to as the spiderweb method. Those inquiries, represented by sticky notes, are placed under specific categories and determined according to their importance for being dealt with immediately, showing an emerging structure of their architectural vision.

This report is presented to you as a connecting line between the familiar and unfamiliar, and as a path that unfolds before us, taking into account the ambiguities of the proposed system. It reveals what questions need to be answered before construction can even begin to build our future in which traffic lights and vehicles work together, like dancers in perfect synchrony. A perfectly harmonious symphony of efficiency and convenience.

2 DEMYSTIFYING TRAFFIC FLOW: Q(&A) SURVEY (PART 1)

The most common problem that affects our time, sanity, and planet is traffic jams. There is, however, some hope in the project of a new system of traffic light control – this technology may help build an ideal architecture for effective ways to commute. To be sure it's even possible to make a blueprint, though, the group will have to establish what exactly this system is. In their phase one investigation adventure, they are the detectives out to solve the mystery and answer all the questions surrounding the traffic light control system.

Their queries are more than just questions, they resemble chisels and hammers that help to remove ambiguity and reveal the truth of the "what" and "how" within the thoughtful mechanism. Each question represents a step towards gaining understanding that leads to a scenario where traffic lights and automobiles move effortlessly in coordinated control.

Do you want to know the answers to the 20 questions? Every question is designed to bring us one step closer to showing the way towards a greener and more effective transportation ecosystem. Let's start our journey!

(1) What is the expected budget for developing?
(2) Will the system primarily be used in urban, suburban, or rural areas?
(3) Are there any specific deadlines for the project?
(4) Do we already have any structures in place that we can use for this project?

Supervised by Ademar Manuel Teixeira de Aguiar and Neil B. Harrison.

(5) Will the system need to integrate with any existing traffic management software?
(6) What are the primary goals for implementing the traffic signal control system?
(7) Are there any specific safety regulations that the system must comply with?
(8) Are there any geographical or environmental constraints that need to be considered?
(9) Will the system require any ongoing maintenance?
(10) Are there any preferences or restrictions regarding the technology stack to be used?
(11) What level of redundancy or failover capability is required for the system?
(12) Will the system need to accommodate peak traffic hours or special events?
(13) How to handle communication with traffic signals in areas with poor connectivity?
(14) Are there any plans for scalability of the system?
(15) What are the expected operational hours for the system?
(16) What types of data will the system collect and analyze?
(17) How will the system handle data backups and disaster recovery procedures?
(18) Will the system incorporate machine learning for traffic forecasting?
(19) Will the system have the ability to generate reports tailored to specific user needs?
(20) Will the budget cover ongoing maintenance beyond the initial development phase?

This selection of 20 questions represents our most crucial considerations, but additional inquires are presented in the "More Questions" section for further exploration.

3 WEAVING A COHESIVE VISION: CATEGORIZING AND PRIORITIZING QUESTIONS (PART 2)

In the wilderness of disconnected problems, a coherent pattern appears. For Section Two, the group shall now travel with a web analogy where they deploy the spiderweb approach. Picture the web as crafted using logic, spinning it until its strands splay outward to establish an intricate network of themes within a multilayered system. The strands serve as repositories of queries, while the queries themselves seem to be suspended like colorful pearls, which are placed strategically across these lines with each pearl's position alluding to its level of priority or importance.

They took many pictures, but this one is a symbol of their work, showing an intricate tapestry formed by the various pieces of data they collected. It displays the logical groupings they have identified, which can be likened to threads in the fabric. It indicates that the priority was determined by time, with questions most immediately in need of attention being closest to the core, like bursting buds that are yet to come out.

Ambiguity dogged every step taken in crafting the spiderweb you see below. Every line represents a resolution to countless questions that had to be answered in their long process of fact-finding and reporting. This web of knowledge is a testament to their ability to steel through ambiguity and emerge with a clear path forward. Also, they invite you to walk the spiderweb with them. They want you to see how they categorized the questions below. What each category of question says about the strategy as it developed. The urgency with which they called these questions. Which of the critical questions demand immediate attention, and what they must answer in the journeys ahead. This journey through the spiderweb promises to be not only informative but also visually captivating, a glimpse into the organized mind of the "Ambiguity and Architectural Questions" team. You can better visualize the figure 1 in the annexes, Spiderweb section.

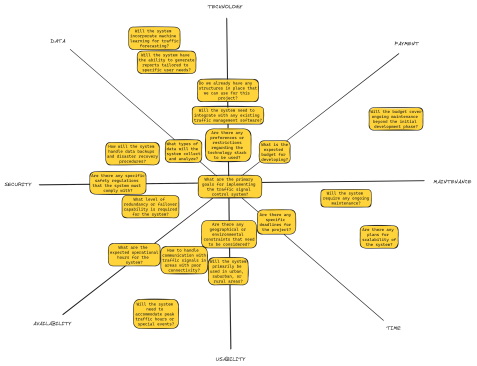

Figure 1: Spiderweb Method

The table establishes a clear connection between each question and its corresponding category.

Questions	Category	Time to answer (phase)
1	Payment	Initial
2	Usability	Middle
3	Time	Initial
4	Technology	Initial/Middle
5	Technology	Initial
6	All	Now
7	Security	Middle
8	Usability	Initial/Middle
9	Maintenance, Time	Middle
10	Technology	Initial
11	Security, Availability	Initial/Middle
12	Availability, Usability	Final
13	Availability, Usability	Middle
14	Time, Maintenance	Final
15	Availability	Middle
16	Data	Initial
17	Data, Security	Initial/Middle
18	Data, Technology	Final
19	Data, Technology	Final
20	Maintenance, Payment	Final

Table 1: Spiderweb table conversion

4 UNVEILING THE CORNERSTONES: FIVE CRITICAL QUESTIONS FOR OUR TRAFFIC SYSTEM (PART 3)

From the sprawling interconnection of investigations, five questions stand out like landmarks and define the heart of the system. In this final stage, they will explore these vital concerns and explain their meanings and consequences. Every question is significant because it forms a foundation on which the architecture of the system rests. It has the ability to even fundamentally change how it operates.

They unmask their significance by explaining why they matter, who they affect, and when answers are necessary. They talk about "how" looking at their answers affects such things as its structure, design or success.

You'll be enthralled with their five-minute presentation in which they aim to untangle these questions' intricacies as well as their effects that can cascade into shaping future traffic flow. Thus they invite you all to think, to puzzle over things and help them picture a world where cars move through intersections with orchestrated efficiency – an exquisite ballet of sorts.

(1) **What are the primary goals for implementing the traffic signal control system?**
   - **Why** is this question important? The main objectives of the system will be made known by understanding its goals, and hence, informing any subsequent decisions and design processes.
   - **Whom** does this question impact? This query impacts stakeholders, developers, and end-users as it sets the direction and purpose of the system.
   - **When** can this question be answered? This issue must be dealt with during the initial phases of analysis to determine project scope and requirements.
   - **How** does the answer to this question impact the architecture of the system? The primary purposes describe what a system should do in terms of functions, how scalable it should be as well as performance requirements that would influence its overall structure.

(2) **Are there any specific safety regulations that the system must comply with?**
   - **Why** is this question important?Compliance with safety regulations is crucial for ensuring the system's reliability and preventing potential hazards or accidents.
   - **Whom** does this question impact? This question primarily impacts developers, regulatory authorities, and end-users concerned with safety standards.
   - **When** can this question be answered? This question should be addressed early in the project life cycle to incorporate safety measures into the system's design and development.
   - **How** does the answer to this question impact the architecture of the system? Compliance with safety regulations may require specific design considerations, such as fail-safe mechanisms or redundancy in critical components.

(3) **Will the system need to integrate with any existing traffic management software?**
   - **Why** is this question important? This helps to have a unified traffic management infrastructure, which avoids duplication of functions and enhances compatibility with old systems.
   - **Whom** does this question impact? The developers, system administers, and end-users who depend on integration for efficient traffic management are the people affected by this question.
   - **When** can this question be answered? Integration requirement planning and examination of current software for compatibility make the best time to address this query at the beginning phase of analysis.
   - **How** does the answer to this question impact the architecture of the system? The design of systems, data outsourcing protocols and interfaces with other external systems are influenced by matters regarding integration.

(4) **What level of redundancy or failover capability is required for the system?**
   - **Why** is this question important? Redundancy and failure-over capabilities ensure system reliability and continuity of operation minimizing disruptions during unexpected events or failures.
   - **Whom** does this question impact? This question impacts developers, system administrators and end-users concerned about the availability and resilience of the system.
   - **When** can this question be answered? During the design phase this question should be addressed to incorporate redundant measures and failover mechanisms in the system architecture.
   - **How** does the answer to this question impact the architecture of the system? The required level of redundancy influences The hardware configuration network topology and replication strategies shaping the system architecture for robustness.

(5) **Will the system incorporate machine learning for traffic forecasting?**
   - **Why** is this question important? Machine learning can improve traffic forecasting accuracy leading to more effective traffic signal optimization and improved system performance.
   - **Whom** does this question impact? This question affects developers, data scientists and end users who seek advanced traffic management capabilities.
   - **When** can this question be answered? This question should be addressed during early planning to assess the feasibility and potential benefits of integrating machine learning into the system.
   - **How** does the answer to this question impact the architecture of the system? For the integration of machine learning capabilities additional computational resources data processing pipelines and integration with existing algorithms determine the system architecture for data analytics and forecast modeling.

5 MORE QUESTIONS (EXTRA)

- How will the system handle potential conflicts with emergency vehicles?
- How will the system be tested and validated before deployment?
- What are the options for data anonymization and privacy protection?
- What are the potential ethical considerations of using AI in traffic management?
- How will the public be informed about the system and its benefits?
- What are the acceptable latency requirements for detection and signal changes?
- How will the system differentiate between different types of vehicles (e.g., cars, trucks, bicycles, pedestrians)?
- How will the traffic signals communicate with each other to coordinate timing?
- What specific sensors will be used to detect oncoming traffic, and how will they be installed?
- Will the system be able to provide real-time data on traffic conditions to drivers or other stakeholders?
- Are there any regulatory or legal requirements that the system needs to comply with?
- What is the expected lifespan of the system, and how will maintenance and upgrades be handled?
- Are there specific performance metrics or goals that the system needs to meet?
- How will the system address potential security threats or vulnerabilities?

Explore these supplementary questions, some similar to previous ones, for a nuanced perspective on the project.

6 CONCLUSIONS AND FUTURE WORK

This project served as a valuable reflection on the architect's role in streamlining project progress. By employing the insightful spiderweb method, the team were able to effectively visualize and organize the questions crucial for refining requirements and gaining a deeper understanding of the product. This visual approach not only illuminated potential challenges and limitations, but also pinpointed areas requiring further research and discussion. The collaborative process facilitated by the spiderweb empowered the team to identify key areas for advancement and pave the way for the project's continued success.

The spiderweb method proved itself a valuable tool in exploration, so bellow the team wrote some conclusions about it. It excelled at:

- **Visualizing connections**: The web-like structure effectively revealed relationships between questions, helping us uncover patterns and connections that might have remained hidden otherwise.
- **Organizing and prioritizing**: Categorizing questions by theme and time-frame provided clarity and focus, guiding us to address the most crucial inquiries first.
- **Enhancing collaboration**: Everyone benefited from the shared visual representation, leading to broader understanding and identification of previously missed aspects.
- **Flexibility and scalability**: The method readily adapted to our specific needs and could comfortably accommodate additional questions or categories as needed.

However, we also encountered some limitations:

- **Complexity**: Creating and interpreting the spiderweb proved more intricate than a simple list, requiring careful consideration.
- **Subjectivity**: Reaching agreement on the placement of certain questions within the web presented a big challenge for the team due to inherent subjectivity.
- **Limited detail**: Each question might have required additional context beyond what the web could convey, necessitating further documentation or discussion.
- **Difficulty as questions increase**: With a large number of questions, visualizing and comprehending connections became difficult. This is why the team limited the spiderweb to 20 questions, with additional ones included in the report.
- **Static representation**: The web captured a snapshot of relationships at a specific point, potentially failing to adapt to the dynamic nature of evolving projects.

A SPIDERWEB

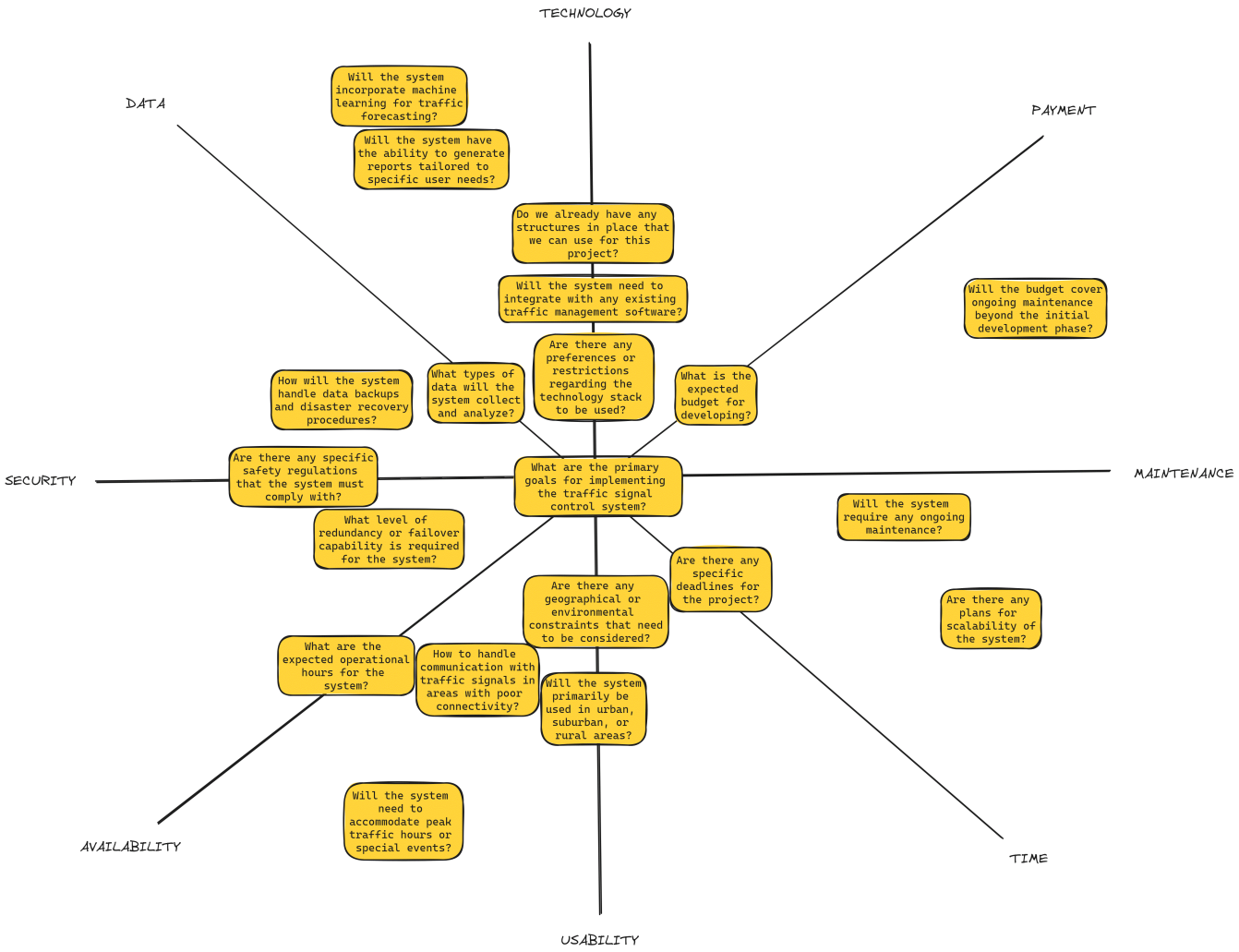

Figure 2: Spiderweb Method (amplified)