

Advanced Certificate Program in Software Architecture

Capstone Project Evaluation Guidelines

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Learning Objectives and Overview

The purpose of this project is to give you an opportunity to begin the development of the architecture design of a software system using the concepts presented in the class. Working in teams, your team will take the initial steps in defining the architecture for a software system of your choice.

The primary objective is to put into practice the essential concepts of *architectural thinking* presented throughout the course. Specifically, the intent is to foster deeper thinking about what motivates architectural design decisions, architectural reasoning, trade-offs, and creating architectural documentation. The project will mirror the architecture design process in practice, including identifying key architectural drivers for your system, creating the design, possibly experimenting, documenting, and evaluating the design.

Team Task

Initial Architecture Design

The first step in the project will be to go over the Vision Document of the chosen case study and identify a set of core functionalities and quality attributes. Curate the functionality into a set of coherent requirements for your system. You will then take these requirements and

develop an architecture for the system using the techniques discussed in class, deciding styles and tactics to use, providing documentation that provides a rationale for your choices, and optionally describing any experiments you would need to conduct to further refine the architecture to be ready for implementation.

1. Describe the project context, including how the system relates to its key stakeholders and how it relates to third-party systems that it will need to interact with (e.g., a *system context diagram*).
2. The chosen requirements need not include everything described in the case study but can be a subset of the requirements. This subset should contain a core set of **at least five and no more than ten main functional requirements** of the system to come up with a **Minimum Viable Product (MVP)** of the system. You may include any additional features to fill in any gaps so that you have a more coherent product. Any assumptions related to functionality must be clearly stated.
3. Decide the **two or three most important quality attribute requirements** that will be used as the primary drivers for architecting the system. You can do this by prioritizing the quality attributes that are important in this system *using your best judgment about the domain*. These quality attribute requirements should be used as the basis for designing the first version of the architecture for your system. Elaborate these in a utility tree similar to what was presented in class. Make sure to indicate the importance and the difficulty values in the tree.
4. Identify the architectural style(s) that will be used in the project. Provide a rationale for why particular style(s) were chosen and what qualities you think might be promoted or hindered as a result. As part of your rationale, you might want to discuss why other styles were not chosen.
5. Document your architecture in the form of diagrams using appropriate views as discussed in class. You should at least have a system context diagram and one component and connector diagram. Depending on your quality attributes, a module view and/or deployment view may also be necessary.
6. Capture at least two decisions in Architecture Decision Records that address the quality attributes you have identified above. Remember that it is good practice to aim for three consequences. Use the template defined in <https://github.com/joelparkerhenderson/architecture-decision-record/tree/main/locales/en/templates/decision-record-template-by-michael-nygard> The ADR should be clear in discussing rationale, alternatives considered, and trade-offs.
7. Describe the next steps for refining the architecture. Be as specific as possible, for example, outline prototypes or experiments that you might carry out to resolve issues, decide between alternatives, and/or reduce risk and uncertainty that you have.

Project Deliverables and Milestones

Project Proposal (10% of the total grade)

Abstract, the introduction of the problem statement, project details, approach to solving the problem

Draft Report Review (10% of total grade)

The purpose of the draft report review is to provide an opportunity for your team to get feedback regarding your progress on the final project from the course instructors. The document does not need to be in a completed final format, but the general outline of your architecture design document should be in place. At a minimum the design document should include an almost-complete draft of the system context; the functional and quality attributes you are basing your design on, candidate styles/patterns, and key design decisions and rationale you have made at this point or are considering.

Final Report (65% of the total project grade)

The final report should be approximately a 10-12 page document + 1 title page, which should have the name of the project and the team members.

Each team should prepare an architectural design document (as a final report) that contains all the activities described above, including architectural system context, architectural drivers and diagrams, ADRs, planned architectural activities, etc. You should use the guidelines for producing an architecture document as presented in the class on Architecture Documentation.

Final Presentations (15% of total grade)

Each group will be given 15 minutes to present followed by 5 minutes of questions. The final presentation should summarize the four elements of the report described above. Focus your presentation on one or two key (high priority, difficult, contentious) architectural design decisions you are considering to achieve the qualities required of the system. More details on the presentation will be provided as the date gets closer.

Evaluation Rubrik

Oral Presentation (15 Points Total)

Consider the following areas:

- Appropriate context setting (3)
- Summarization of key architectural drivers (3)
- Discussion of Analysis, Tradeoffs, Key Decision Points, Refinement Activity Plans (3)
- Views – consistency, use of legends, clarity (3)
- Presentation quality - timing, readability, clarity, question answering (3)

Project Writeup: (65 points Total)

- Project Description/Context: 5
- Drivers: 20
- Design: 20
- Analysis: 10
- Next steps: 5
- Quality: 5

Project Description: 5 points	
Topic	Points to Consider...
Context (5pts)	<p>Did the team provide a clear, concise explanation of the project, domain, and business goals?</p> <p>Do they understand the system design boundary?</p> <p>Is there a description of the primary stakeholders for the system, how they will interact with the system, and what their expectations are?</p>
Architectural Drivers: 20 points	
Topic	Points to Consider...
High level functionality (5pts)	Is there a <i>clear</i> description of key functionality that the system must provide?
Constraints (5pts)	<p>Did the team articulate the constraints on the design space (business or technical)?</p> <p>Are the constraints articulated by the team, really constraints (as opposed to being a functional requirement, design decision, etc.)?</p>
Quality Attributes (10pts)	<p>Did the team develop quality attribute scenarios (It is common for students to create scenarios that are really functional requirements)?</p> <p>Do they have at least a clear stimulus and measurable response? Are they specific?</p> <p>Are the quality attribute scenarios prioritized? Has the prioritization method been explained? (This may be done in the utility tree.)</p>
Architecture Design (20pts)	
Topic	Points to Consider...

Primary Architectural Approaches:	Are the overarching architectural approaches (styles, patterns, tactics, etc.) for solving the problem clearly articulated?
Drawings and prose	Are all drawings clearly labeled, have legends, are understandable, and are supported with well-written prose?
Perspectives	Has the team adequately represented the system in the three perspectives (dynamic, static, and physical perspectives) with adequate views appropriate for the system?
Architectural Alternatives	Has the team considered alternative approaches or did they apply any mitigating structures or tactics to compensate for risks, sensitivity points, or tradeoffs? Did the team describe the tradeoffs of the alternative approaches? Are the alternative approaches realistic or obvious non-choices? If a choice was made, has it been adequately described and justified?
Architecture Decision Records	Are there two ADRs? For each ADR is there a Decision, Status, or Consequences field? Is this an architectural decision? Do the consequences make sense (describe attributes supported and inhibited by the question)
Analysis of architecture: 10 Points	
Topic	Points to Consider...
Analysis	Does the team's analysis reflect how their design choices relate to the architectural drivers in terms of the structures they are considering? Is the relationship between context (business goals), architectural drivers, and design decisions reflected in their analysis? Has the team clearly justified their choices, tradeoffs, and rationale? Have they clearly articulated their rationale?
Next step refinement activities: 5 Points	
Topic	Points to Consider...
Appropriateness	Is the activity valid (e.g., experiment, formal analysis)? Is the activity addressing an architectural decision to be made (e.g., if the experiment is to decide between two performance tactics, is performance being measured)? Is the case made that this is architectural?
Clarity	Is the activity clearly defined and scoped? Is there a valid definition of done?
Overall Quality of Report: 5 Points	

Topic	Points to Consider...
Report Mechanics	What is the quality of the written report in terms of organization, readability, grammar, spelling, appearance, and writing style?

References

- *CMU 17-635 & 17-882 - Architectures for Software Systems Spring 2023 - Final Project*
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