

4 Design (Due Oct 22nd)

4.1 Design Content

Briefly describe what is the design content in your project.

The first semester will hold a rough draft of an IEEE Research Paper. This will involve compiling all individual research, data, and information into a comprehensive and cohesive research paper describing the alternatives to *GENI*.

In the second semester, we strive to create and simulate Network and Security related introductory labs. We'll have a design flow of creating Lab Documentation, the Lab Simulation, and then supplemental documentation on the justification and reasoning behind the lab. The content of our design is the hardware specification and user statistics of each specific platform and the comparisons between them.

4.2 Design Complexity

Provide evidence that your project is of sufficient technical complexity. Use the following metric or argue for one of your own. Justify your statements (e.g., list the components/subsystems and describe the applicable scientific, mathematical, or engineering principles)

1. The design consists of multiple components/subsystems that each utilize distinct scientific, mathematical, or engineering principles
2. The problem scope contains multiple challenging requirements that match or exceed current solutions or industry standards.

In the first half of our project, our design consists of a Research Paper that is set to be published by the end of the second semester. We plan on following the IEEE Research Paper format and follow the principles and guidelines set forth by the standard.

For the second semester, we plan on implementing some introductory labs for ARA with a focus on Network and Security. The design will consist of multiple components from an abstract viewpoint. There will be a lab document that is educational and informative and a good walkthrough on the purpose and design of the document.

A singular Lab will consist of the following submodules:

- Lab Document (For students to follow)
- The Step-by-Step Lab Simulation
- Lab Justification/Explanation
 - I.e. Why this? Why that? The purpose.

While taking into consideration the hardware and software constraints of each of the 8+ specific platforms being analyzed.

4.3 Modern Engineering Tools

What modern engineering tools were used for this design? Their roles.

Computer

- LaTeX (Overleaf)
- Research Databases (IEEE, etc)
- IEEE Research Document

Platform (Storage, IDE, VCS, Analysis Tools)

- Will be accompanied by the specific platform

4.4 Design Context

Describe the broader context in which your design problem is situated. What communities are you designing for? What communities are affected by your design? What societal needs does your project address?

List relevant considerations related to your project in each of the following areas:

Area	Description	Examples
Public health, safety, and welfare	How does your project affect the general well-being of various stakeholder groups? These groups may be direct users or may be indirectly affected (e.g., solution is implemented in their communities)	Increasing/reducing exposure to pollutants and other harmful substances, increasing/reducing safety risks, increasing/reducing job opportunities
Global, cultural, and social	How well does your project reflect the values, practices, and aims of the cultural groups it affects? Groups may include but are not limited to specific communities, nations, professions, workplaces, and ethnic cultures.	Development or operation of the solution would violate a profession's code of ethics, implementation of the solution would require an undesired change in community practices
Environmental	What environmental impact might your project have? This can include indirect effects, such as deforestation or unsustainable practices related to materials manufacture or procurement.	Increasing/decreasing energy usage from nonrenewable sources, increasing/decreasing usage/production of non-recyclable materials
Economic	What economic impact might your project have? This can include the financial viability of your product within your team or company, cost to consumers, or broader economic effects on communities, markets, nations, and other groups.	Product needs to remain affordable for target users, product creates or diminishes opportunities for economic advancement, high development cost creates risk for organization

Areas	Description
Public Health, Safety, and Welfare	Our solution poses no risk to the general public or wellbeing of people. Claiming anything of the sort is beyond far-fetched. Our solution is meant to help willing educational systems in providing resourceful research and useful lab designs.
Global, Cultural, and Social	Our solution is meant to be an educational jump in providing thorough research and evidence to suggest a preferred platform for introductory Network and Security Labs. Our solution will help mitigate the fall of GENI and encourage Iowa State University, and others, to make a better, smarter change in their lab approach.
Environmental	Our solution poses no risk to the environment. Most of the platform infrastructure is already built, and future plans are not at the expense or benefit of our goal. This Senior Design project cannot be held accountable or liable for any future environmental impacts.
Economic	Our solution poses no risk to the economy. While our solution could cost Universities who choose to participate and enact our research and labs, it is their prerogative and decision to spend their money. Other than that, our research and solution have no impact on the economy - none directly and none in an abstract stance.

4.5 Prior Work/Solutions

Include relevant background/literature review for the project

- If similar products exist in the market, describe what has already been done
- If you are following previous work, cite that and discuss the **advantages/shortcomings**
- Note that while you are not expected to “compete” with other existing products/research groups, you should be able to differentiate your project from what is available. Thus, provide a list of pros and cons of your target solution compared to all other related products/systems.

Detail any similar products or research done on this topic previously. Please cite your sources and include them in your references. All figures must be captioned and referenced in your text.

Previously, Geni was used as the main platform for the education and research components that we are seeking. As Geni is no longer available, we are looking for a new solution to transfer many of the experiments over so they can still be used for educational purposes. Depending on the platforms we wish to incorporate in our paper, and the information we wish to share regarding each of them, there could be some issues regarding the space available for the said educational and research purposes. We plan to cite other research papers to create a document that can provide good information and properly educate the readers so they understand why each platform is good and what to use it for to fully utilize the resources available.

4.6 Design Decisions

List key design decisions (at least three) that you have made or will need to make in relation to your proposed solution. These can include, but are not limited to, materials, subsystems, physical components, sensors/chips/devices, physical layout, features, etc.

Criteria/Categories - How we separate and divide the platforms

- Important for how we proceed with the research paper and the labs we create for universities.

Suitable Platforms - If we allow them into the research paper and why

- Important for ensuring we get the most relevant and useful information in our research paper

Research Methodology / Research Paper Format - How we choose to go forward with research and writing

- Important for meeting industry standards and expectations

4.7 Proposed Design

Within our current timeline, we've spent our time researching and preparing our Research Paper. Our project, at this current stage and center, does not include any physical or virtual implementation or testing.

First Semester

Goal: Research Paper Rough Draft Completed

- Introduction
- Explain Research Methodology
- Outline all System Architectures/Platforms
- Technical Details (Hardware/Software/Capabilities/Cost/Etc)
- Competing Platforms
- Timeline/Implementation
- Conclusion

Second Semester

Goal: Publish Research Paper + Create a few introductory Network/Security Labs

- The Labs:
 - 1) Initial Lab Document (Students are given)
 - 2) Step-By-Step Document that explains the lab and the process behind it (TA's+)
 - 3) Analysis and explanation of the lab: the why's, the how's, and the purpose.

4.7.1, Design 0 (Initial Design)

Design Visual and Description

Include a visual depiction of your current design. Different visual types may be relevant to different types of projects. You may include: a block diagram of individual components or subsystems and their interconnections, a circuit diagram, a sketch of physical components and their operation, etc.

Describe your current design, referencing the visual. This design description should be in sufficient detail that another team of engineers can look through it and implement it.

Justify each component in the design with respect to requirements.

It's important to note that our Senior Design project's main goal is to get a Research Paper published in IEEE format. The below image is roughly our design for this goal. This image is how our design will be implemented and should be easily readable by other engineers to understand our main goal.

Basic Page Format

The standard IEEE template contains the following sections in the same order:

1. Title Page (including the article's title, byline, membership, and first footnote)
2. Abstract – should be one paragraph long (preferably between 150 to 250 words)
3. Index Terms
4. Nomenclature (optional)
5. Introduction
6. Body of Article
7. Conclusion
8. Appendix(es)
9. Acknowledgment(s)
10. References
11. Photos and Biographies

Based on our timeline and Gantt chart, we will have a better understanding and depiction of what goes into our Research Paper by the end of the month, so stay tuned as this is a living document.

Functionality

Describe how your design is intended to operate in its user and/or real-world context. This description can be supplemented by a visual, such as a timeline, storyboard, or sketch.

How well does the current design satisfy functional and non-functional requirements?

This research paper, with some supplemental labs, will be accessible to Iowa State Professors and others Universities that were affected by the shutdown of GENI. This current design meets our functional and non-functional requirements by doing its intended purpose.

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(Complete at later date) (Per the document)

NOTE: The following sections will be included in your final design document but do not need to be completed for the current assignment. They are included for your reference. If you have ideas for these sections, they can also be discussed with your TA and/or faculty adviser.

4.7.2 Design 1 (Design Iteration)

Include Include another most matured design iteration details. Describe what led to this iteration and what are the major changes that were needed in Design o.

Design Visual and Description

Include a visual depiction of this design as well highlighting changes from Design o. Describe these changes in detail. Justify them with respect to requirements.

4.8 Technology Considerations

Highlight the strengths, weakness, and trade-offs made in technology available.

Discuss possible solutions and design alternatives

4.9 Design Analysis

- Did your proposed design from 4.7 work? Why or why not?
- What are your observations, thoughts, and ideas to modify or iterate further over the design?