

Systems Analysis & Design

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Workshop No. 2 — Systems Design

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Welcome to the second workshop of the *Systems Analysis & Design* course!

In **Workshop #1**, you performed a detailed **systems analysis** of your assigned real-world system, collecting primary data and identifying system elements, relationships, sensitivity considerations, and complexity factors. Now, you will build upon those analytical insights to formulate a comprehensive **systems design** that addresses the challenges, opportunities, and requirements identified in your initial analysis.

This workshop focuses on translating analytical findings into practical design solutions while applying rigorous systems engineering principles and design methodologies.

General Workshop Definition: Systems design is the process of defining architecture, components, modules, interfaces, and data flows to satisfy specified requirements derived from systems analysis. In this workshop, you will transform your analytical insights into a coherent design blueprint that addresses system optimization opportunities, mitigates identified risks, and enhances overall system performance and functionality.

Workshop Scope and Objectives

- **System Architecture Design:** Develop a comprehensive design blueprint that addresses the challenges, bottlenecks, and optimization opportunities identified in Workshop #1.
- **Engineering Principles Integration:** Apply systems engineering principles including modularity, scalability, maintainability, and reliability in your design approach.

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- **Complexity and Sensitivity Management:** Incorporate strategies to address unpredictable behaviors, sensitive parameters, and complexity factors discovered during your analysis.
- **Implementation Planning:** Define technical approaches, methodologies, and implementation strategies for your proposed design.
- **Documentation and Communication:** Produce a comprehensive System Design Document that clearly presents your architecture, design decisions, and implementation roadmap.

Design Methodology and Requirements

1. Analysis Review and Requirements Definition:

- Synthesize key findings from Workshop #1, emphasizing critical constraints, performance bottlenecks, and optimization opportunities
- Translate analytical insights into measurable design requirements (performance, reliability, scalability, usability)
- Define stakeholder needs and system objectives based on your data collection and analysis

2. System Architecture Design:

- Develop a high-level architectural diagram illustrating system components, data flows, and component interactions
- Define module responsibilities and interfaces based on your element analysis from Workshop #1
- Apply systems engineering principles to ensure architectural coherence and design quality
- Address system boundaries and integration points identified in your initial analysis

3. Complexity and Risk Mitigation:

- Design specific mechanisms to address sensitivity factors and variability identified in Workshop #1
- Propose monitoring, feedback, and control strategies for managing chaotic or unpredictable system behaviors
- Include error handling, redundancy, or adaptive mechanisms where appropriate
- Address potential failure modes and system resilience considerations

4. Technical Implementation Strategy:

- Recommend appropriate technologies, tools, frameworks, or methodologies with clear justification
- Define implementation phases, integration approaches, and deployment strategies
- Specify technical standards, interfaces, and interoperability requirements
- Consider resource requirements, constraints, and feasibility factors

5. Performance and Optimization Design:

- Address specific optimization opportunities identified in your systems analysis
- Define performance metrics, monitoring approaches, and success criteria
- Include strategies for continuous improvement and system evolution
- Consider scalability and future growth requirements

Deliverables and Documentation**1. System Design Document:**

- *Executive Summary:* Concise overview of design approach, key decisions, and expected outcomes
- *Requirements Analysis:* Translation of Workshop #1 findings into design requirements and constraints
- *System Architecture:* Detailed architectural design with component diagrams, data flows, and interface specifications
- *Implementation Strategy:* Technical approach, methodologies, tools, and implementation roadmap
- *Risk and Complexity Management:* Strategies for addressing sensitivity, variability, and complexity factors
- *Performance and Quality Assurance:* Metrics, monitoring, and validation approaches
- *Conclusion and Next Steps:* Summary of design decisions and recommendations for future development

2. Visual Design Representations:

- System architecture diagrams showing component relationships and data flows
- Process flow diagrams illustrating operational sequences and workflows
- Interface and integration diagrams demonstrating system connectivity
- Use professional diagramming tools such as *draw.io*, *Lucidchart*, *Visio*, or *TikZ* in *L^AT_EX*

3. Repository Management and Documentation:

- Create a `Workshop_2_Design` folder within your existing GitHub Course repository structure
- Include the complete System Design Document in PDF format
- Provide all diagram source files and supporting documentation
- Update your repository `README.md` to include Workshop 2 overview, methodology, key design decisions, and links to deliverables

Submission Requirements

- Submit your complete System Design Document as a single PDF through the designated course platform
- Include your GitHub repository link with updated Workshop 2 materials
- All documentation must be in **English** and follow professional technical writing standards
- Ensure proper citations for methodologies, frameworks, or external sources referenced in your design
- Document must clearly reference and build upon findings from Workshop #1

Important Guidelines and Considerations

- **Continuity with Workshop #1:** Your design must directly address findings, challenges, and opportunities identified in your systems analysis. Demonstrate clear linkage between analytical insights and design decisions.
- **Systems Engineering Rigor:** Apply established systems engineering principles and methodologies throughout your design process. Justify design decisions using engineering principles and best practices.
- **Practical Feasibility:** While encouraging innovative solutions, ensure your design is realistic, implementable, and considers real-world constraints and limitations.
- **Stakeholder Consideration:** Address stakeholder needs, user requirements, and operational constraints identified during your data collection and analysis phases.
- **Documentation Quality:** Maintain professional standards in documentation, including clear explanations, logical organization, and effective visual communication.
- **Future Development:** Design with consideration for future workshops where you will refine and potentially implement aspects of your proposed system.
- **Ethical and Safety Considerations:** Ensure your design addresses safety, security, privacy, and ethical considerations relevant to your system domain.

*Good luck, and continue developing your expertise in **systems design** by creating comprehensive, well-engineered solutions that address real-world challenges identified through rigorous analysis!*