ECE297 Communications

Dr. Ken Tallman

February 5, 2014

UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

Design Document

By the **design document deadline,** each team must hand in the **M2 Design Document** that includes the following content.

- Cover Page
  - Includes document title, team identification, and submission date
- Table of Contents
  - Provides a listing of the document contents
- Introduction
  - Uses a situation-problem-solution structure to contextualize your project. The Introduction should establish the purpose of the document and answer the following: Who will use your server? Why? What currently exists? Where is the gap or opportunity? How does your design fill that need? As part of this discussion, in at least one well-researched paragraph, identify the potential user, and explain why you have chosen this user. How does, or how will, your server meet this user's needs? What benefits does it provide? At this early stage in the project, your choice may be general (a type of industry or business), but as you move toward the next milestone, we expect that your choice will become more specific. Include at least three respectable research sources in this discussion.
- Software Architecture
  - UML Component Diagram, providing an overview of your software system
  - UML Sequence Diagram, showing the interactions between the server and the client
  - A short written explanation of each diagram
- System Requirements
  - Functions, objectives, and constraints
  - Functional requirements and constraints must be introduced with the auxiliary *shall*, and constraints must be defined in verifiable terms.
- Design Decisions
  - Includes all the important M2 design decisions
  - As a guide, view Design Considerations above in this file.
  - Make a case for these decisions using elements of argument. Identify any alternatives you considered, and explain the reasoning behind your choices.
- Conclusion
  - A short "summing up" statement returning your reader to the document's purpose.
- List of References
  - Use IEEE format to document your research sources.
- Appendices
  - Appendices are optional.
  - Include important information, including important figures and tables, in the body of your report. Include "optional reading" in appendices.
- Performance Evaluation Report
  - This report is due with your M2 code (February 16). The instructions are stated above in this file.

The main body of this document may contain no more than seven (7) pages. These seven pages include written text, tables, diagrams and other graphical material, but do not include the cover page, table of contents, list or references, and appendices. The report may contain no more than two (2) pages of appendices. You are expected to use single-spaced block paragraphs, standard font, for your written text, and you must label all tables and figures.

Sections of each design document must have individual author identified by name and student number. In cases where revision/editing/proofreading are performed by teammates other than the original author, please indicate this information, providing names and student numbers.

The text must be submitted to Turnitin.com. For information on registering with Turnitin.com, please view Turnitin Registration Information here.

Your Communication Instructor will use this grading rubric to grade the assignment.

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ECE297 Turnitin Submission Instructions

All teams are required to submit three design documents to Turnitin.com. These documents are due by 11:59pm on the following dates:

February 9, 2014: M2 Design Document: Basic Storage Server
March 9, 2014: M3 Design Document: Extended Storage Server
March 30, 2014: M4 Design Document: Concurrent Storage Server

Only one member from each team is required to make the submission. Please refer to the table below for your Class ID.

**The Turnitin.com password for all students in this class is: ECE29714

Tutorial Instructor/CI	Class ID
ECE297 Tutorial Mina Arakawa	7533603
ECE297 Tutorial Paul Barrett	7533627
ECE297 Tutorial Brendan Bowles	7533630
ECE297 Tutorial Maria Cioni	7533639
ECE297 Tutorial Dan Hamilton	7533655
ECE297 Tutorial Judith Muster	7533667
ECE297 Tutorial Ted Nolan	7533676
ECE297 Tutorial Donna Schatz	7533882
ECE297 Tutorial Neil Shyminsky	7533891
ECE297 Tutorial Melanie Stevenson	7533898
ECE297 Tutorial Ken Tallman	7533921

What should we include in our component diagram?

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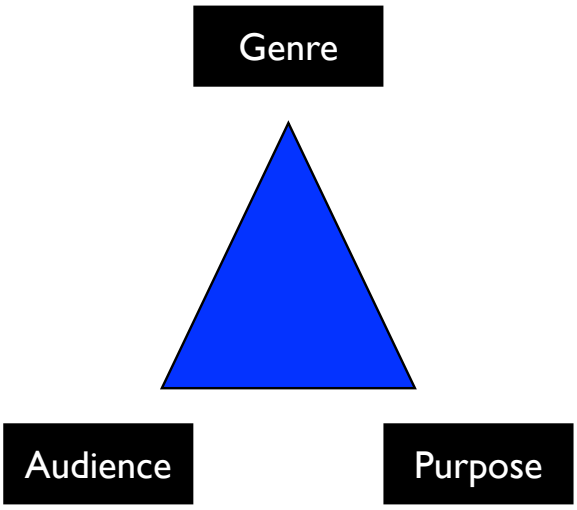
What should we include in our component diagram?



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What should we include in our component diagram?

- The following examples are not necessarily excellent or even good; in fact, some may be poor.
- The examples are provided for discussion.
- Directly copying any of the examples for your reports would be an academic offence.

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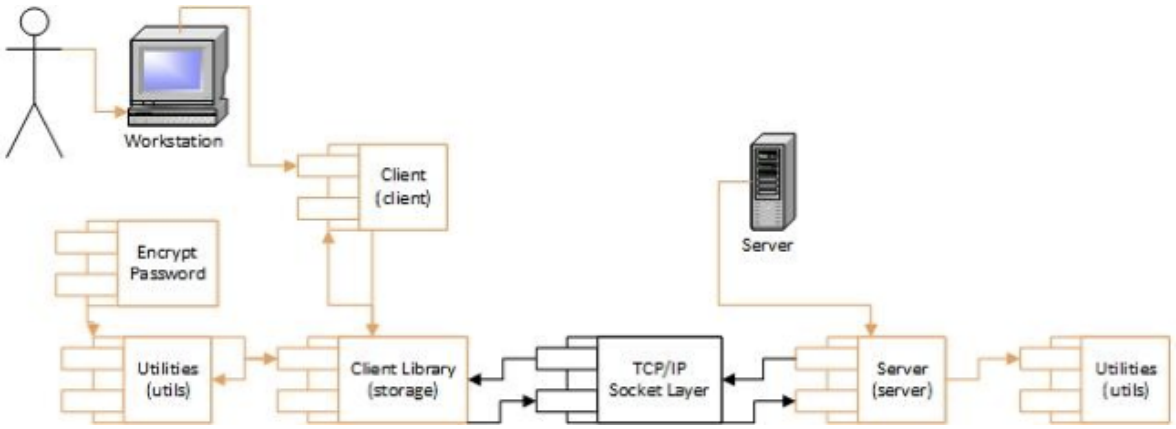
#1



#2

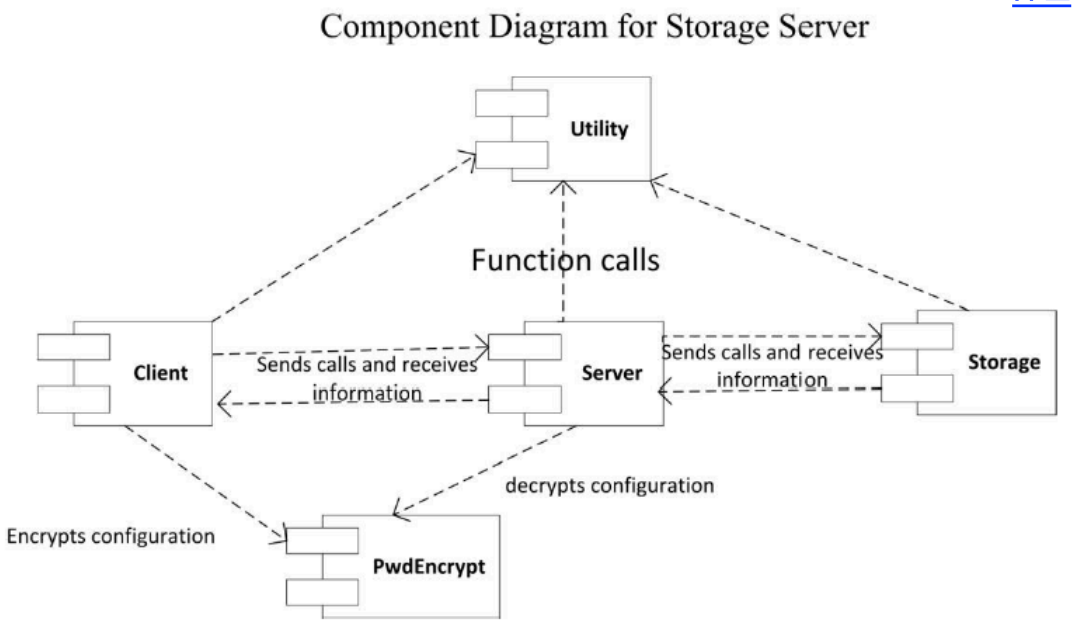
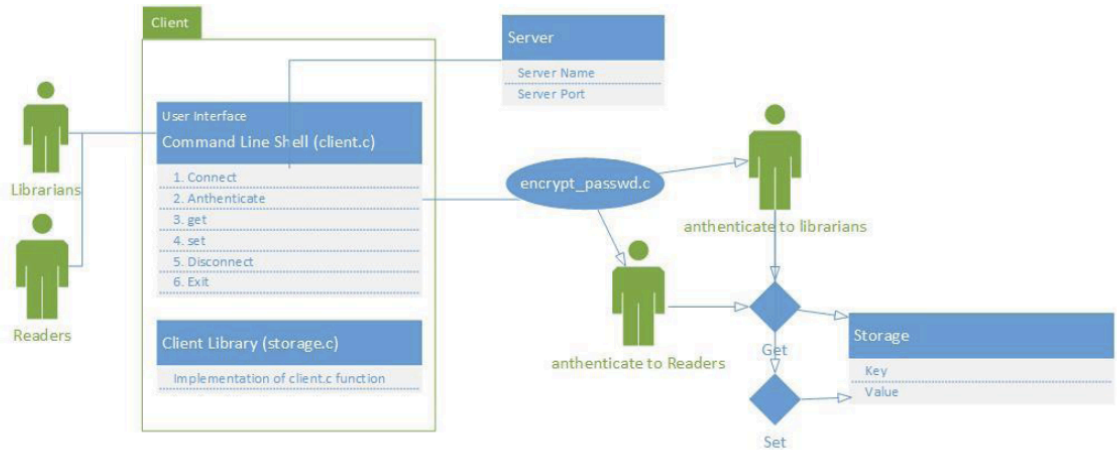
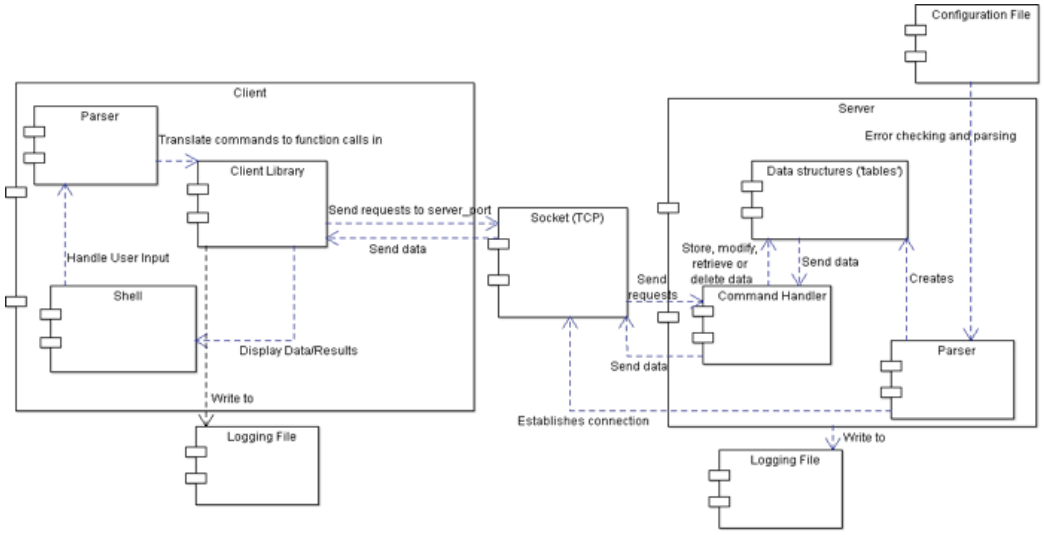


Figure 1. UML component diagram

#3


Client
Server
Server Name
Server Port
User Interface
Command Line Shell (client.c)
1. Connect
2. Anthenticate
3. get
4. set
5. Disconnect
6. Exit
Client Library (storage.c)
Implementation of client.c function
Librarians
Readers
encrypt_passwd.c
anthenticate to librarians
anthenticate to Readers
Get
Set
Storage
Key
Value

#4

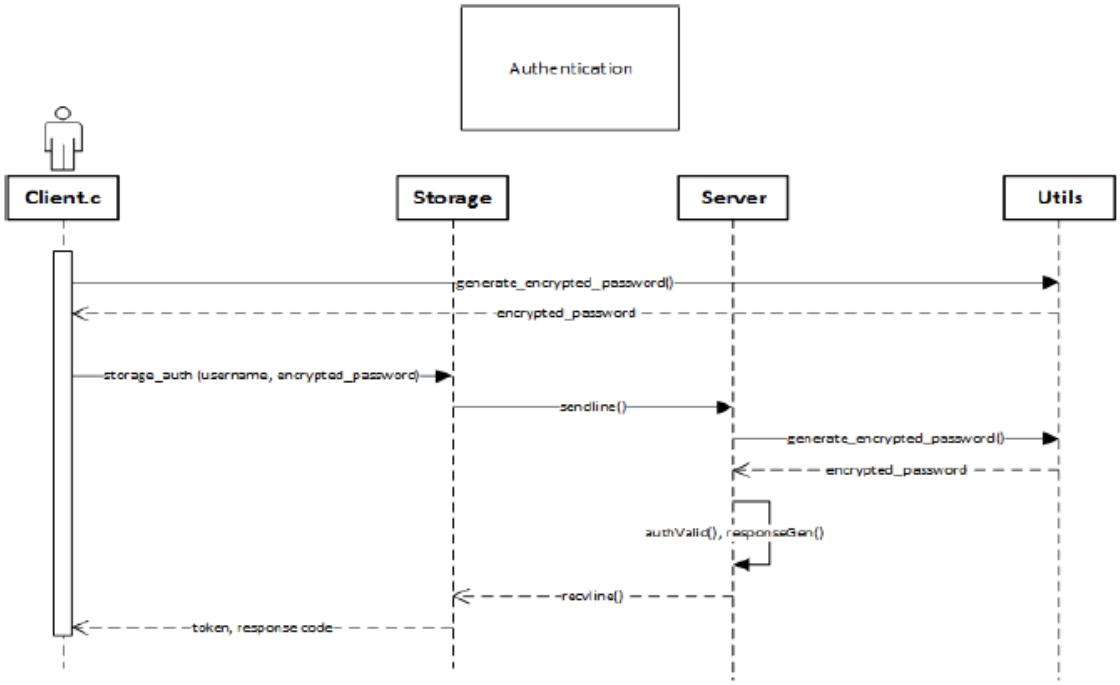

Configuration File
Client
Parser
Translate commands to function calls in
Client Library
Send requests to server_port
Send data
Handle User Input
Shell
Display Data/Results
Write to
Logging File
Socket (TCP)
Server
Error checking and parsing
Data structures (tables)
Store, modify, retrieve or delete data
Send data
Creates
Send requests
Command Handler
Parser
Send data
Establishes connection
Write to
Logging File

Is the sequence diagram on the course website a good example?

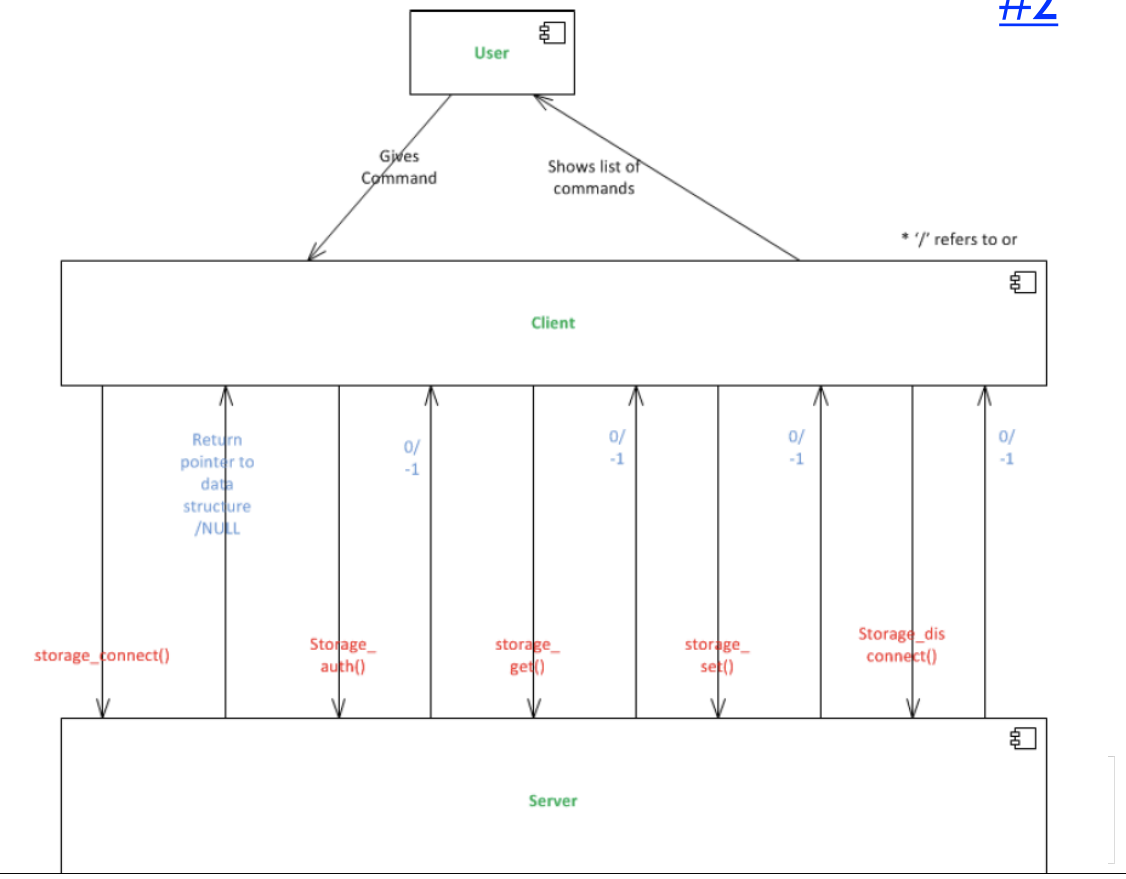
Is the sequence diagram on the course website a good example?

- Does it show the initial interaction between the server and the configuration file?
- Does it show how the system handles errors?

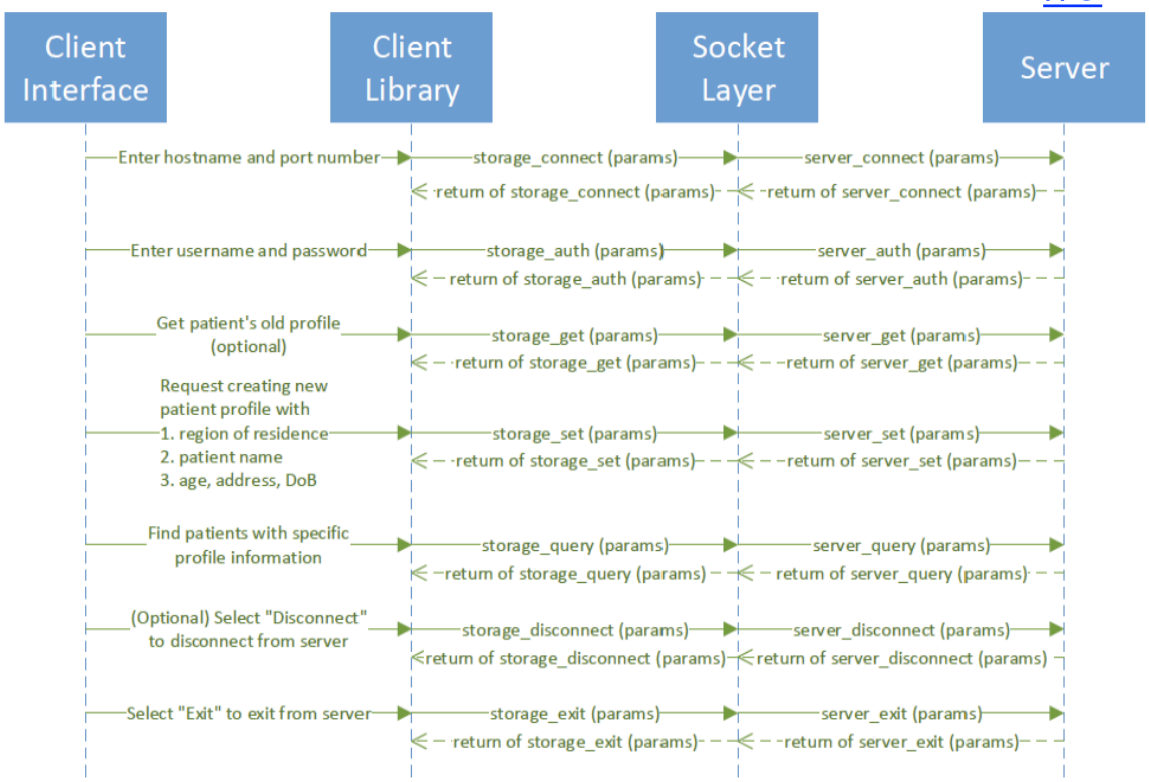
#1


Authentication
Client.c
Storage
Server
Utils
generate_encrypted_password()
encrypted_password
storage_auth (username, encrypted_password)
sendline()
generate_encrypted_password()
encrypted_password
authValid(), responseGen()
recvline()
token, response code

#2


User
Gives Command
Shows list of commands
* '/' refers to or
Client
Return pointer to data structure /NULL
0/ -1
0/ -1
0/ -1
0/ -1
storage_connect()
Storage_ auth()
storage_ get()
storage_ set()
Storage_dis connect()
Server

#3



How should we explain our figures or tables?

Advice from Michael Alley

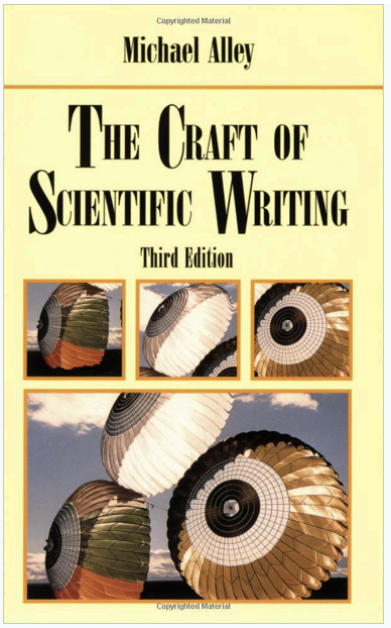


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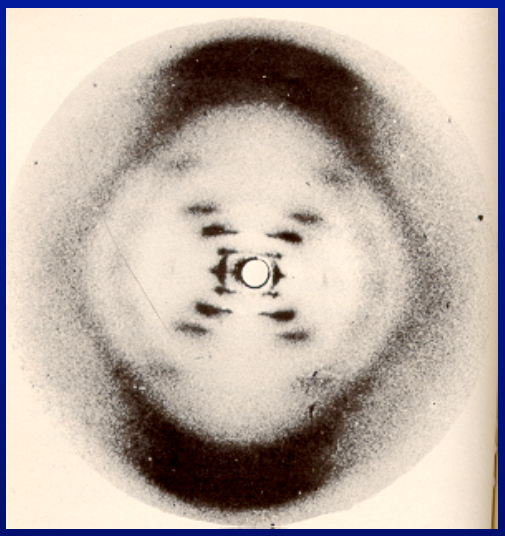
Illustration:

The Meshing of Words With Images

Keep it as simple as possible, yet no simpler.

Albert Einstein



X-ray photograph of DNA [Rosalind Franklin, 1952]

www.writing.engr.psu.edu/handbook/visuals/07.ppt

Tables can present words as well as numbers

Table 2. Sequence of events in the Chernobyl accident [Wolfson, 1991].

Date	Time	Power Level	Event
April 25	1:00 a.m.	3200 MW	Operators begin power descent
April 25	2:00 p.m.	1600 MW	Power descent delayed for 9 hours Emergency core-cooling system disconnected
April 25	11:10 p.m.	1600 MW	Operators switch off automatic control Power descent resumed
April 26	1:00 a.m.	30 MW	Power minimum reached
April 26	1:19 a.m.	200 MW	Operators pull rods beyond allowable limits Operators start two additional coolant pumps Operators violate coolant flow limits
April 26	1:23 a.m.	2,000,000 MW	Power surges by factor of 10,000 in 5 seconds

www.writing.engr.psu.edu/handbook/visuals/07.ppt

When presenting numerical data, you choose between tables and graphs

Table 2. Blood glucose levels [Carlson, 1982].

Time (hour)	Normal (mg/dl*)	Diabetic (mg/dl)
midnight	100.3	175.8
2:00	93.6	165.7
4:00	88.2	159.4
6:00	100.5	72.1
8:00	138.6	271.0
10:00	102.4	224.6
noon	93.8	161.8
2:00	132.3	242.7
4:00	103.8	219.4
6:00	93.6	152.6
8:00	127.8	227.1
10:00	109.2	221.3

* decaliters/milligram

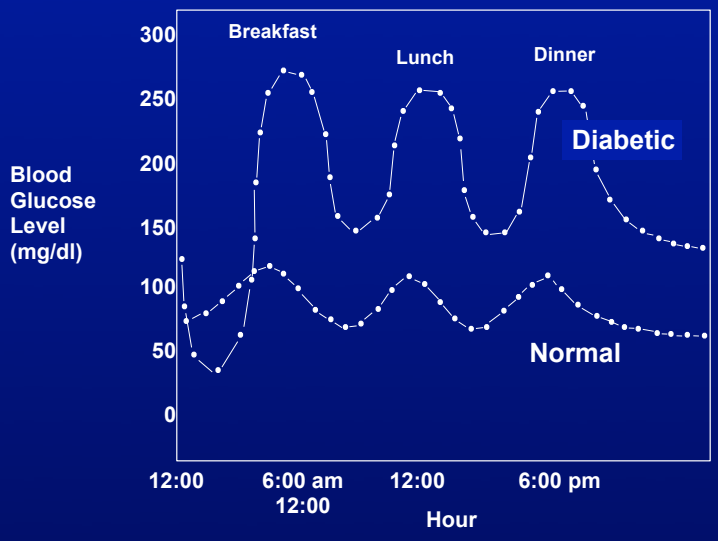


Figure 11. Blood glucose levels for normal individual and diabetic [Carlson, 1982].

www.writing.engr.psu.edu/handbook/visuals/07.ppt

Graphs come in many forms

Average dose: 160 mrem

85 mrem — Natural Sources

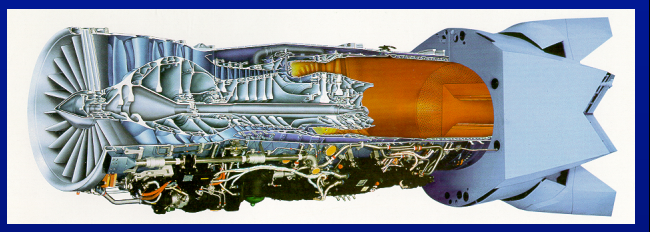
70 mrem — Medical Sources

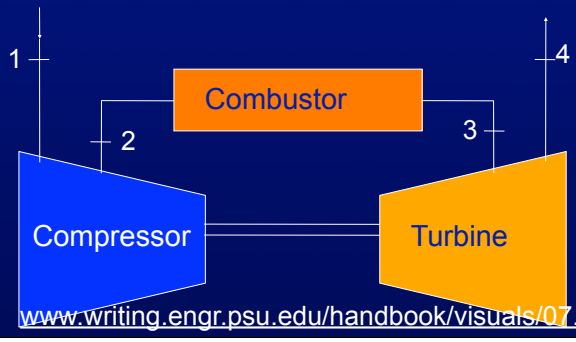
{ Fallout: < 3mrem
Occupational: < 1mrem
Nuclear power: < 1mrem

Figure 6. Estimated annual dose of radiation in the United States [GPU Nuclear, 1985].

www.writing.engr.psu.edu/handbook/visuals/07.ppt

When presenting images, you choose between photographs, drawings, and diagrams





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The main advantage of photographs is realism

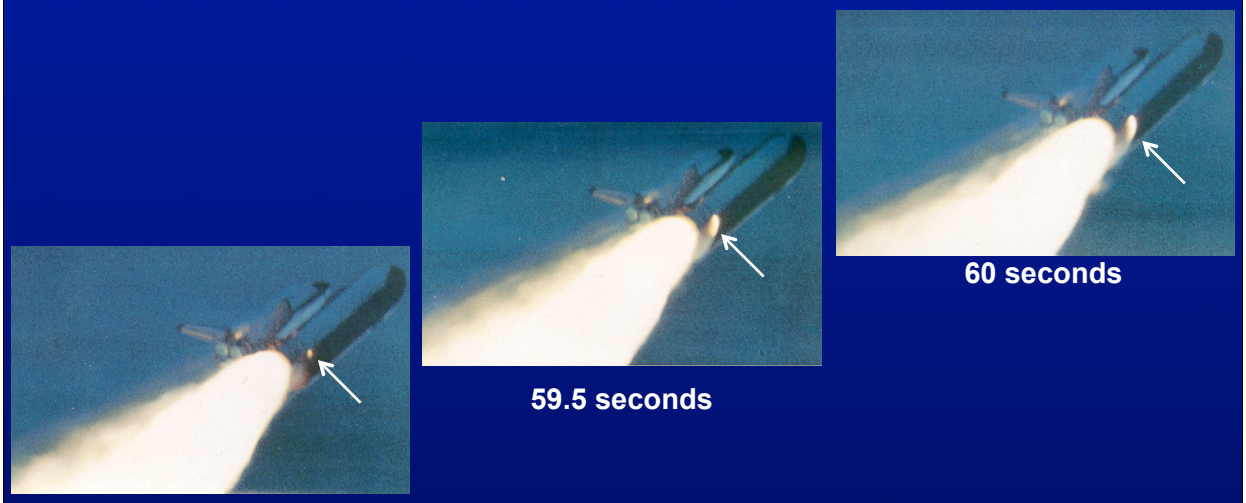

Figure 2. Space Shuttle Challenger, from about 59 seconds to 60 seconds into launch (January 28, 1986). On the right rocket, flame first becomes visible and then impinges on tank.

www.writing.engr.psu.edu/handbook/visuals/07.ppt

One advantage of drawings is control of detail

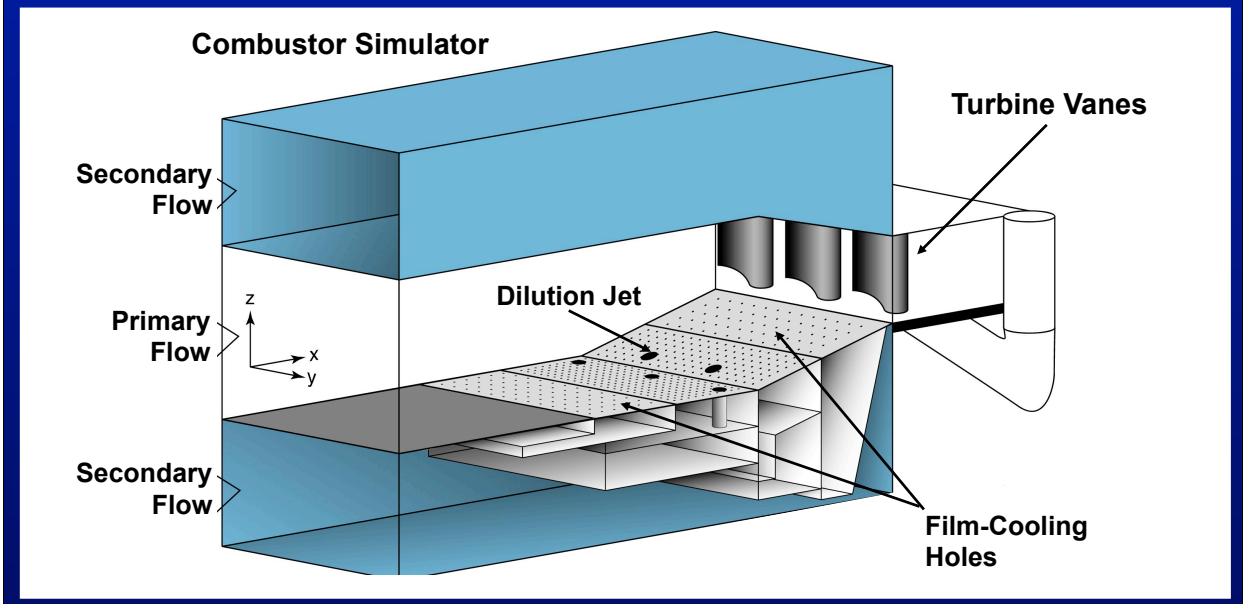

Figure 5. Wind tunnel experiment at Virginia Tech for evaluating film-cooling designs for the blades of gas turbine engines [Thole and others, 2000].

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The main advantage of a diagram is the ability to show flow of a variable through a system

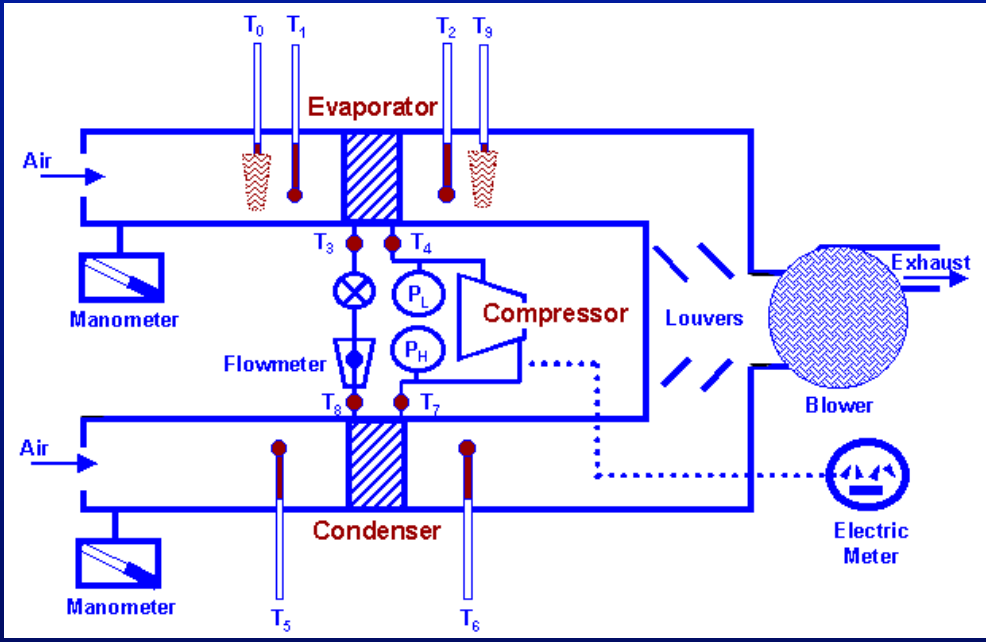

Figure 8. Schematic of test stand for evaluating components of an air conditioner design.

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Scientists and engineers often use illustrations that are too complex for the text

The thermal storage system stores heat in a huge, steel-walled tank. Steam from the solar receiver passes through heat exchangers to heat the thermal oil, which is pumped into the tank. The tank then provides energy to run a steam generator to produce electricity. A schematic of this system is shown in Figure 5.

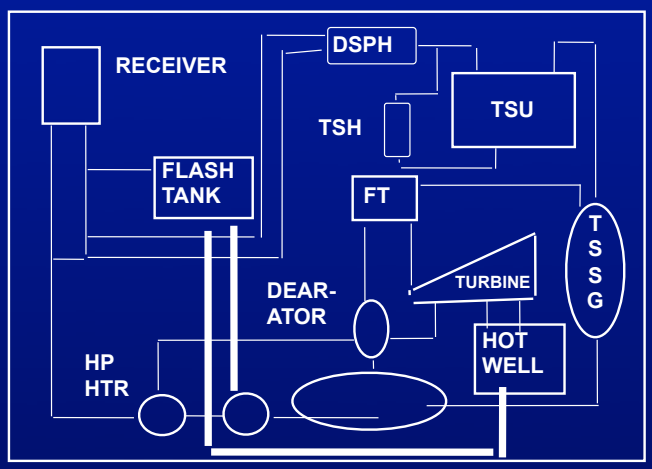

Figure 5. Schematic of thermal storage system.

www.writing.engr.psu.edu/handbook/visuals/07.ppt

The precision of the illustrations should reflect the precision of the text

The thermal storage system, shown in Figure 6, stores heat in a huge, steel-walled tank. Steam from the solar receiver heats a thermal oil, which is pumped into the tank. The tank then provides energy to run a steam generator to produce electricity.

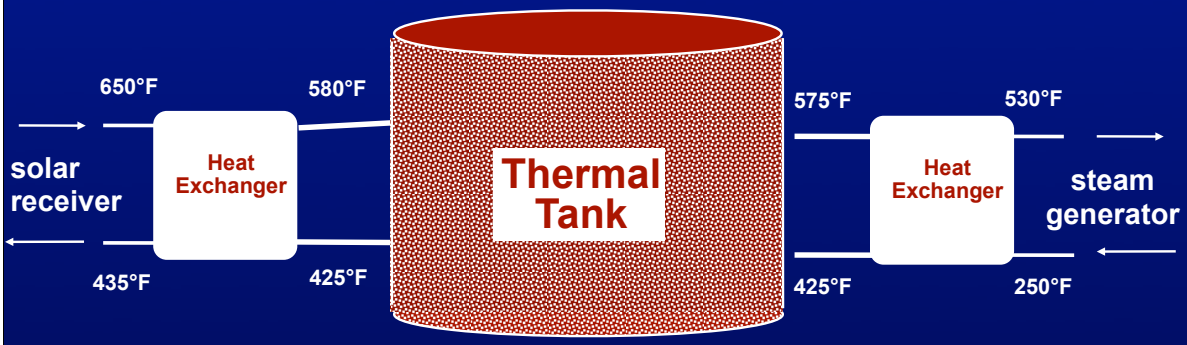

Figure 6. Schematic of thermal storage system for the solar power plant.

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For clarity, you should introduce and explain illustrations in the text

..., as shown in Figure 7.

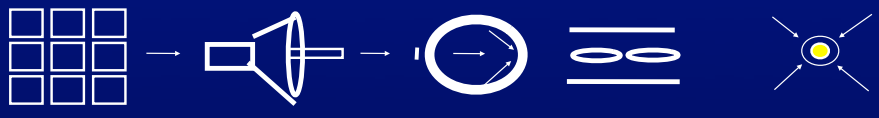

Figure 7. Title of figure. Some formats allow you extra sentences to explain unusual details.

www.writing.engr.psu.edu/handbook/visuals/07.ppt

Illustration is the meshing of words with images

Our system for testing the launch controls of the rocket consists of four main parts: computer, electro-mechanical interface, camera, and digitizer. In this system (shown in Figure 9), the computer generates test commands to the rocket through the electro-mechanical interface. The test results are read with a television camera, and then digitized. The computer receives the information from the digitizer, and then directs the next test command.

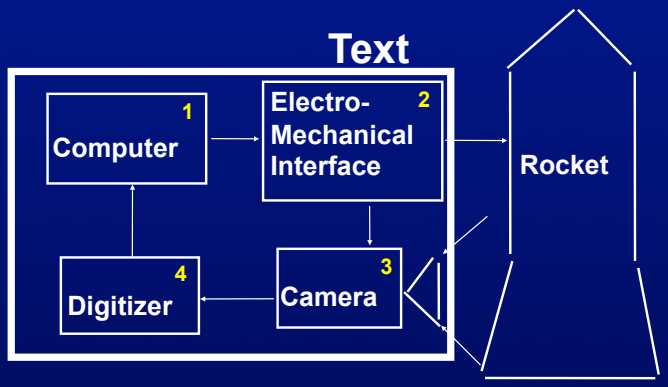

Figure 9. System to test launch controls for rocket.

www.writing.engr.psu.edu/handbook/visuals/07.ppt

Are the text and figure effectively meshed?

Component Diagram for Storage Server

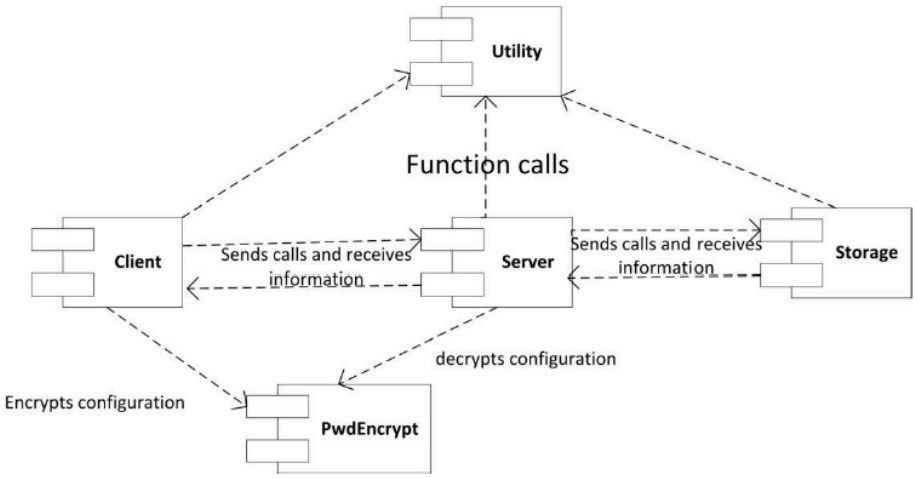

Figure 1. UML component diagram

A **UML component diagram** is a structure model that provides a clear visual perspective of the system structure in terms of each critical component [2]. Each box is a component of the program. The arrows show dependencies, i.e. the client, server, and storage all depend on the utility for various functions used.

Is this an effective table? Why or why not?

Data Structure	*Advantages*	*Disadvantages*
Separate Chaining Hash tables	- Retrieval and insertion time complexity is O(1) [4]	- Using hash functions makes it harder to implement
Linked Lists	- Fast insertion with time complexity O(1) for unsorted linked lists [6] - its size is dynamic	- Allows only sequential access to elements O(n) [6] - Requires extra storage
Binary Search trees (BST)	- Memory-efficient - Dynamic storage structure	- Insertion is slower than the other data structures, O(n) at worst case (O(log N) at best [7]
Arrays	- Easier and faster to access the elements with time complexity O(1) [6] - Takes up less memory	- Its size is static - Insertion/Deletion requires memory reallocation

Table 2: Advantages and disadvantages of database structure alternatives

FAQ

- What is a good site for UML diagrams?
  - http://stackoverflow.com/questions/15376/whats-the-best-uml-diagramming-tool
- Is it true that we never use direct quotation in engineering documents?
  - Engineers directly quote legal codes and regulations. As well, binding specifications are often quoted.
- If we are including short strings of our code in our design document, what type of font should we use for the code?
  - A standard choice is `Courier New`

FAQ

- How specific should the objectives section be? Should we include goals with metrics for each objective?
  - Include goals with metrics where possible.
- Should the M2 DD list only the functions required in M2 or should it include functionality for the subsequent milestones?
  - Include only M2 functionality.
- Our target user is a car rental agency. How would we research this user?
  - You might choose a particular agency. You might test their online system. You might speak with an agency representative.