

## ITM 50: BIS, LECTURE #4

Agenda:

1. Review of Lecture #3
2. Information Technology
  - Information representation & processing
  - Information Technology, Building Blocks
3. Client-Server Architectures in a Data Center
  - How to develop an IT to solve a business problem
    - Software architecture ("App")
    - Hardware architecture
4. HW #2
5. Midterm

## Review of Lecture #3

1. All major companies are run using Enterprise Application Software:

— PLM software for managing products & services

Product Life-Cycle Mgmt

— SCM software to manage the companies Supply Chain (from Customers to Suppliers)

— ERM (nee ERP) software to manage all operations internal to the company (see Cisco Case Study, HW#2, Prob 2)

— CRM to manage customer relationships & marketing/sales of the product.

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Vendors of Enterprise Application Software:

SAP, Oracle, IBM, Microsoft, .....

2. All of these Enterprise Application Systems are collecting large amounts of data

3. The future → The digital company, refers to :

- Data : use of data for competitive advantage

- cloud : to achieve speed & be more innovative

- mobility ; as a way of changing the way we do work.

4. Underlying the digital company is the increasing need for security

5. The end-game is to connect all people, processes, & things using the Internet & the Web : IOT (Internet of Things)

6. The rise of cognitive computing: getting computer to think, reason, see, feel, touch, hear, ..... (e.g. IBM WATSON; Google DeepMind)

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## Information Technology

The Information Economy focuses on the creation, capture, storage, retrieval & manipulation of data, information, and knowledge.

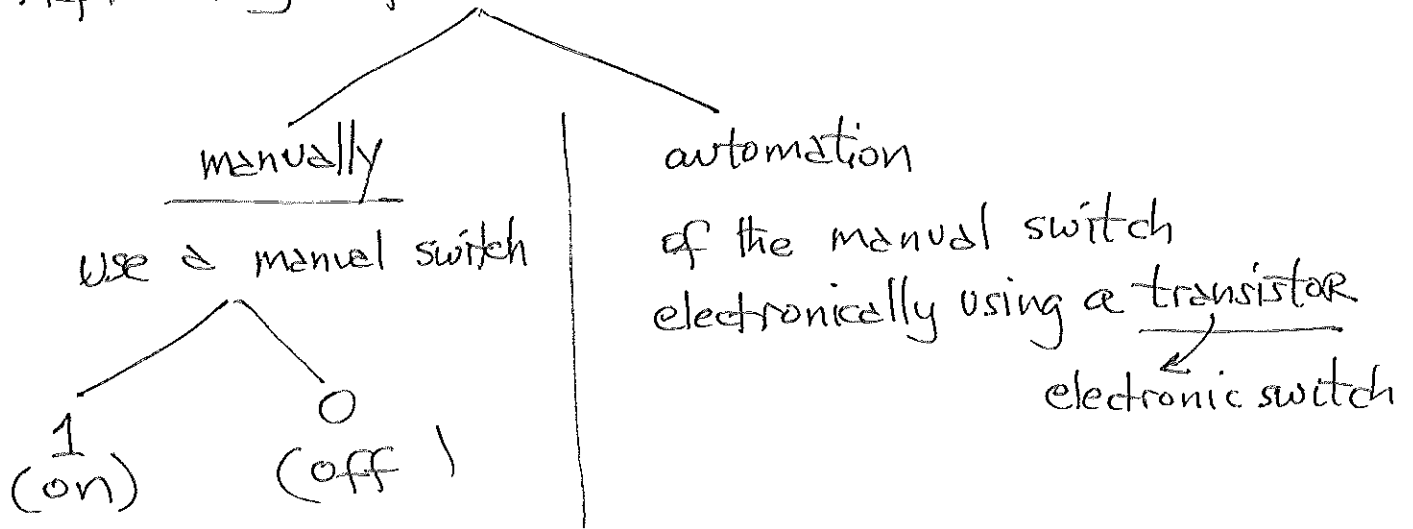
### Definitions

Information: text, numbers, video, games, entertainment, money, & other financial instruments

Knowledge: understanding & judgement based on large amounts of information

Networks & computers comprise the technical foundation of the Information Economy

# Representing information



Information is represented in "bits"

1 bit  $\begin{cases} 0 \\ 1 \end{cases}$

Numbers in a computer are represented in powers of 2 using binary digits

0 represented by 0

$$1 = 2^0 = 1 \text{ (binary)}$$

$$2 = 1(2^1) + 0(2^0) = 10 \text{ (binary)}$$

$$3 = 1(2^1) + 1(2^0) = 11$$

$$4 = 1(2^2) + 0(2^1) + 0(2^0) = 100$$

$$5 = 1(2^2) + 0(2^1) + 1(2^0) = 101$$

Binary arithmetic:

$$\begin{array}{r}
 4 \longrightarrow \text{binary } 100 \\
 + 5 \longrightarrow 101 \\
 \hline
 9
 \end{array}
 \quad
 \begin{array}{r}
 1001 = 1(2^3) + 0(2^2) + 0(2^1) + 1(2^0)
 \end{array}$$

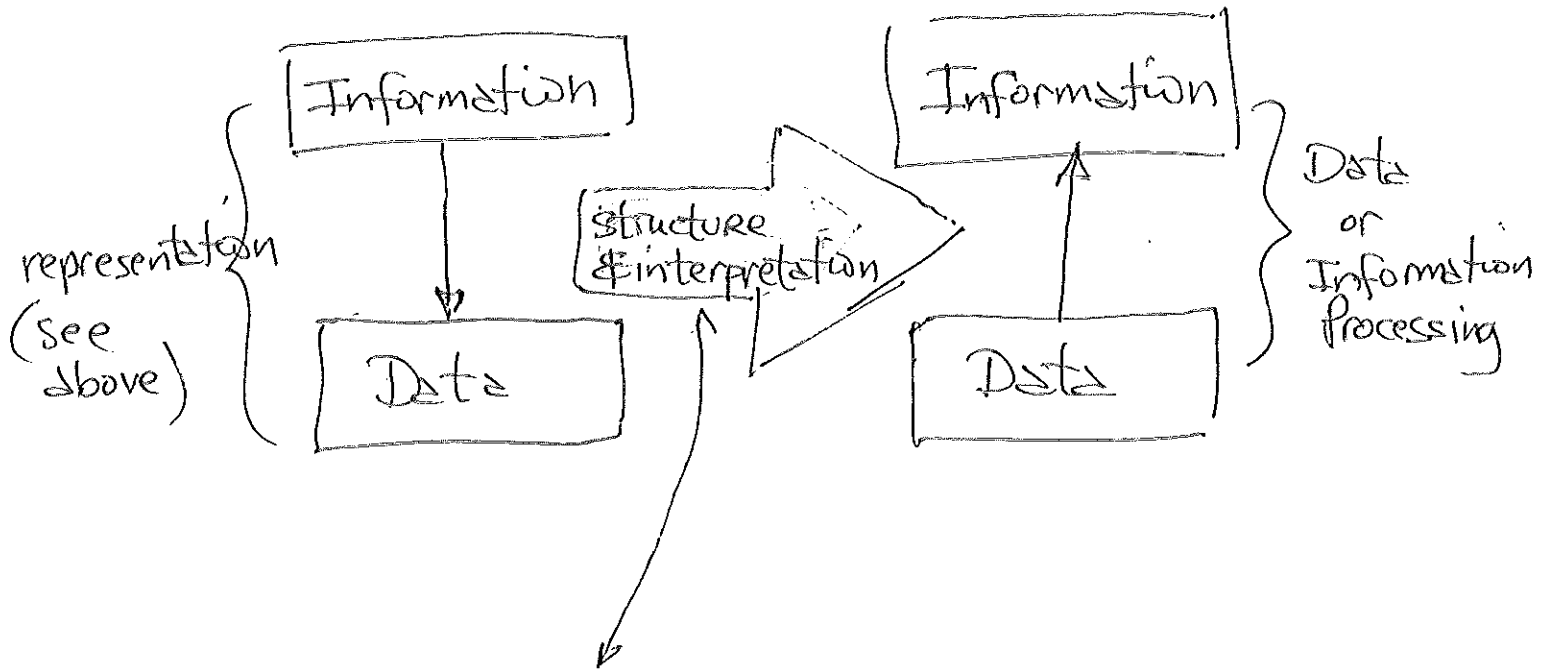
Key idea: Any information can be represented by binary digits or bits

For example, 7 bits can be used to represent the English alphabet

a  $\rightarrow$  0000000  
 b  $\rightarrow$  0000001  
 c  $\rightarrow$  0000010  
 : : : :  
 : : : :

In Information Processing we do the reverse,

data (given)  $\longrightarrow$  information (extract)



In order to process information we need to impose structure (on the data) & have rules for interpreting the data representation.

### Example

Data could represent money (cash)

structure are the financial rules governing the manipulation of money, for example, trading (in stocks).

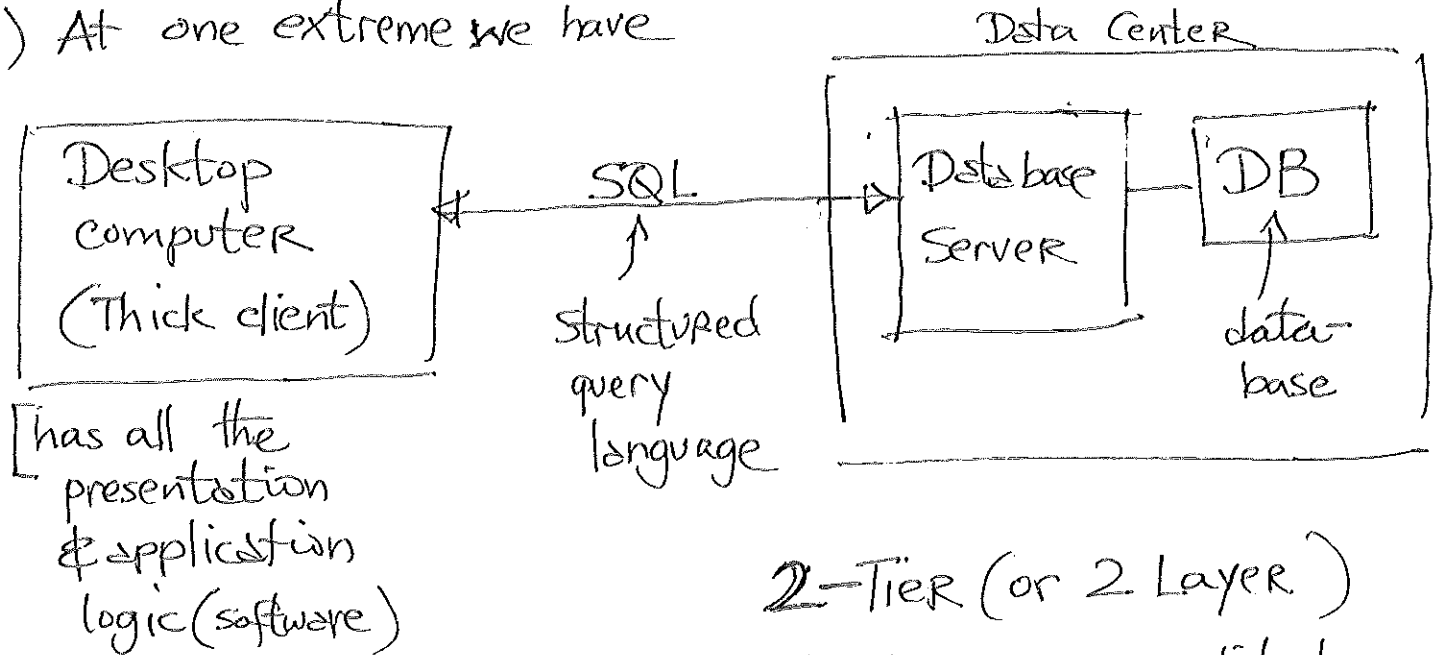
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Important : Read chapter on "Information Technology" in the Course Reader (UNA by DGM, Chapter 4)

# Information Technology Building Blocks:

## Client-server architectures in a Data Center

(i) At one extreme we have



2-Tier (or 2 Layer)  
client-server architecture

(ii) At the other extreme we have

n-tier (or n-layer) client-server architecture

- client layer
- presentation layer
- application layer
- DB layer
- o o o o

} depending on  
the complexity  
of the application

Fundamental IT Design Problem: In a traditional data center infrastructure, how many layers should the IT client-server architecture have?



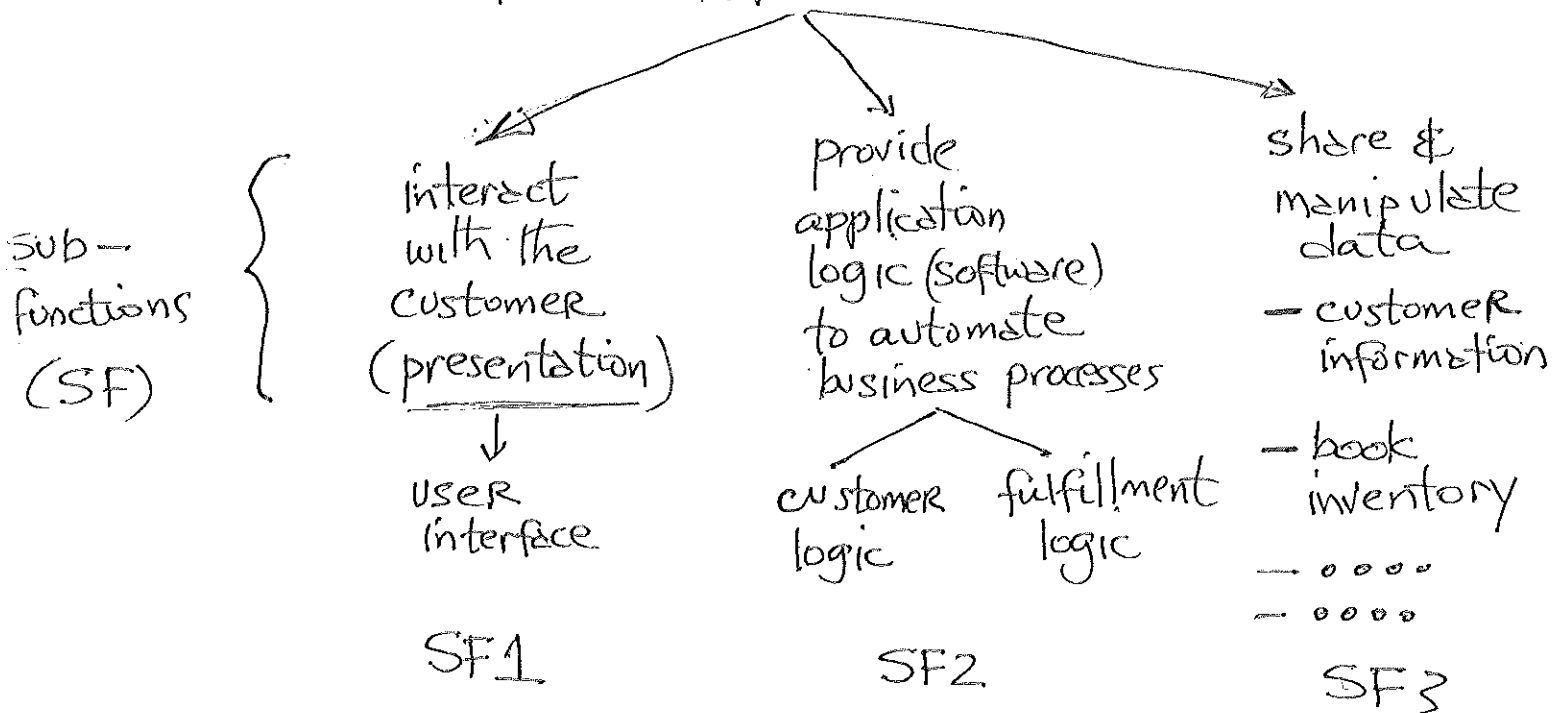
Process for developing a IT architecture (software & hardware) in a traditional data center

Example : selling books on-line (Amazon as a start-up in 1995)

Step 1 Define the business or organization problem (challenge) that needs to be solved

e.g. automate the on-line selling of books to customers [Main function or purpose or "WHY?" ]

Step 2 ; Define the necessary business processes that need to be automated by the software application



3. Translate the business processes into the requirements (functions & features) for the software ;

Create a use-case for a user using the software application (e.g. customer buying a book on-line) in order to define all the <sup>key</sup> functions & features of the software ;

Example

= Type in the URL for the application  
(provide the URL for the application)

= Present the homepage to the user

-                   o o o o  
                         o  
                         o  
                         o

feature  
or function

→ - provide a shopping cart to  
          place your book order

-

step

4. Define the software architecture;

- Define the necessary sub-functions (or layers or tiers)

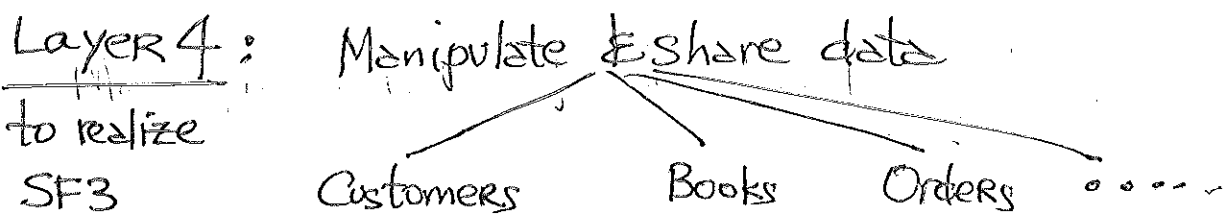
We have the following sub-functions (from step 2):

Layer 1 : Enable the Graphic User Interface (GUI) for the client (customer or user) on the client's computer  
(Thin client)

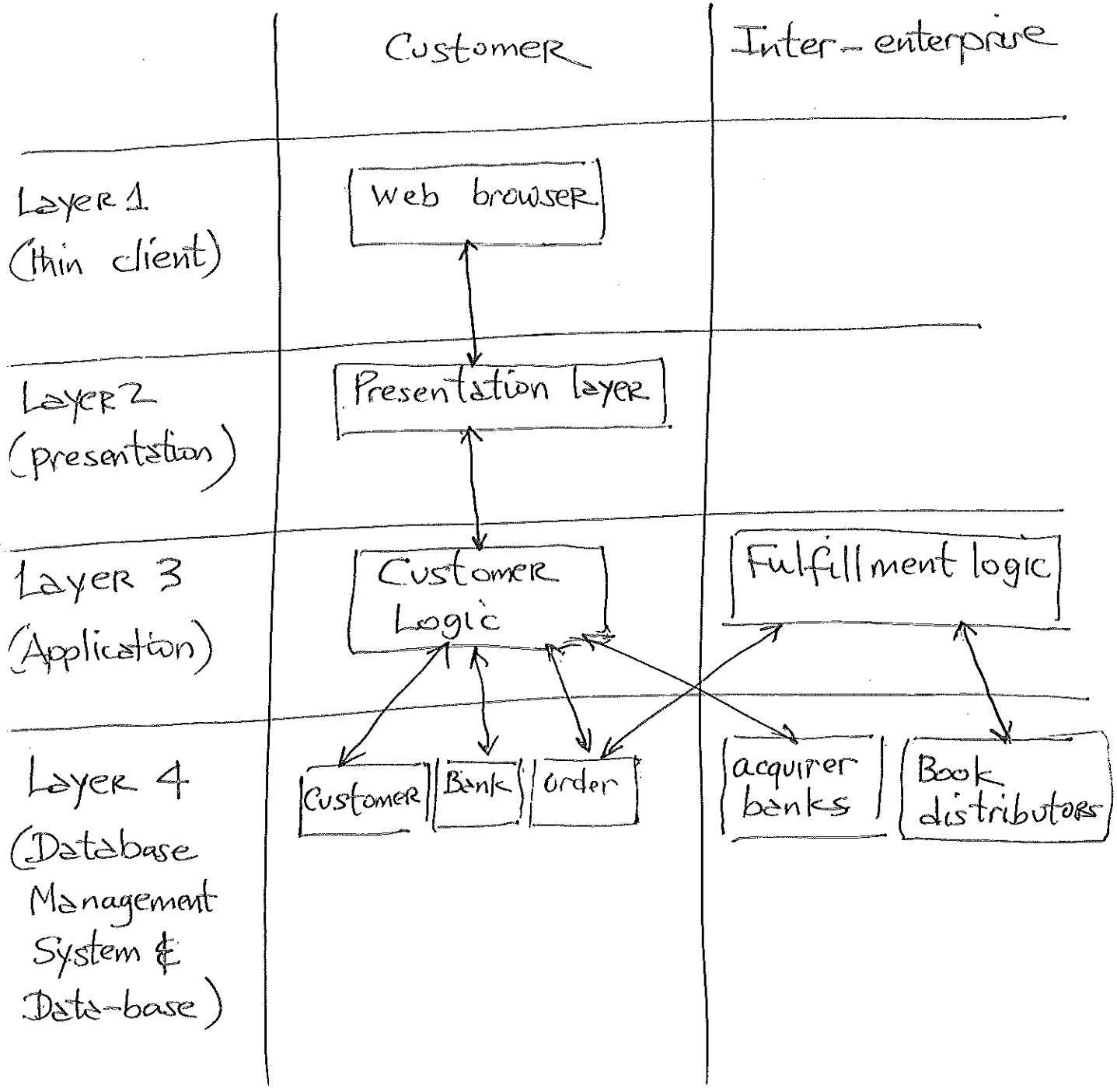
Layer 2 : Present the necessary information (book catalogs, order information, ...)  
to realize SF1  
- Create the GUI for the client  
- Enable the visualization, data entry, communication with the application & output of results

Layer 3 : Perform the application logic (provide)  
to realize SF2  
Customer logic  
• customer information  
• interacting with the book catalog (including order entry, payment)  
• .....

fulfillment logic  
• interaction with banks  
• interaction with book distributors  
• .....



Software architecture diagram:



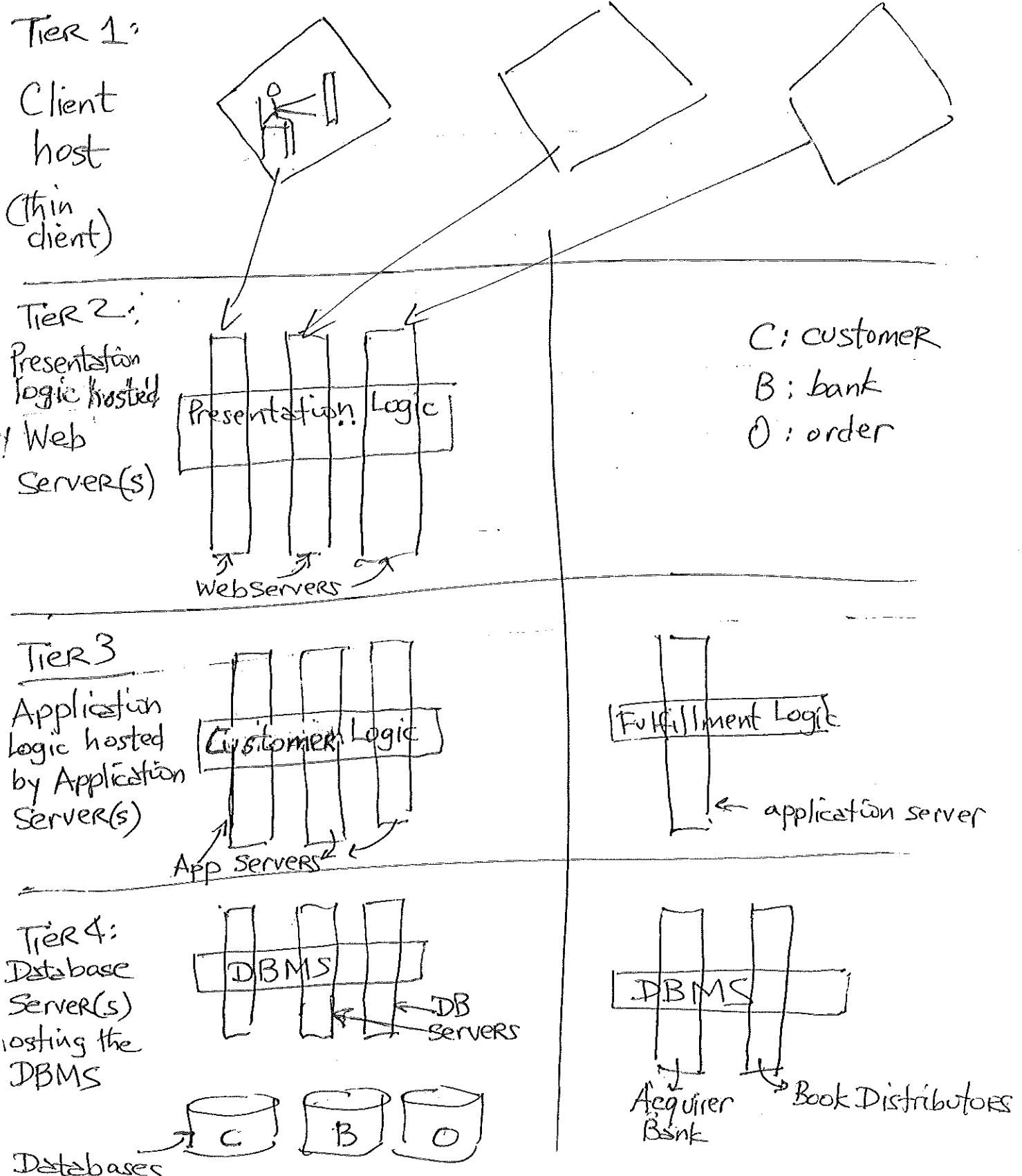
Step 5 :

Determine the number of server tiers to host the software architecture (from step 4)

For example, if each layer of the software architecture above has its own server-layer, then we would have 3 server layers (or tiers) : presentation, application & data-base

If we chose to combine the presentation & application layer in one-server layer, then we have 2 server layers

Hardware architecture diagram for a 4-tier (or layer) client-server architecture; client tier + 3 server tiers;



Note : There are different programming languages & protocols between the different layers

(CGI, HTTP, HTML, SQL, ....)

↑  
Common  
gateway interface

The next steps in IT design would be to specify

- (I) The DB infrastructure
- (II) The Network infrastructure