IT in Construction

Lecture #3

Construction Management Information System
System Recognition and Analysis

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Construction Engineering and Management

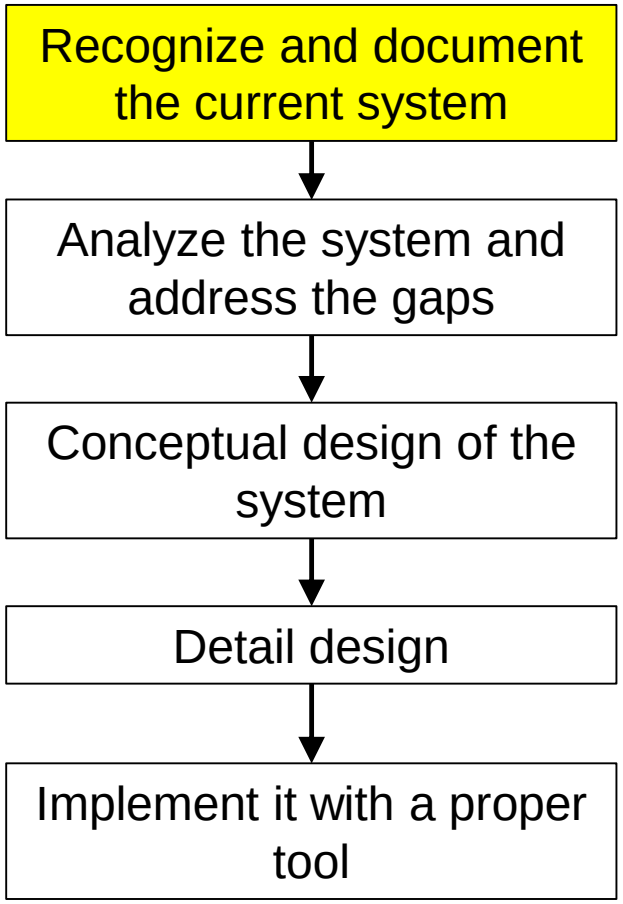
Outline

- System Recognition
- CASE Tools
- System Analysis

System Recognition

Introduction

MIS development phases:



Introduction

- ***Why*** and ***When*** do we need to develop “MIS or system automation projects” in a construction company?
- How many construction managers are really familiar with the features they need out of a new system automation project?
- Are you, as a construction manager, able of developing an MIS system in your own company?

- We, as construction system analyzers, can not depend on the list of new system requirements sent by, non-system-expert construction managers.
- So we need to recognize current system features and capacities before prescribing a new fancy, but unusable, MIS and IT related tools for the organization!

Introduction

- ***System recognition is not an easy task***!!!!
  - Construction work is spread among different construction sites to capture information flow we should visit different sites,
  - Construction folks are not pioneers in IT, in fact most of them are unfamiliar with MIS terminologies and are reluctant to cooperate!
  - There is high volume of information flowing in a construction company to capture,

Examples:

Introduction

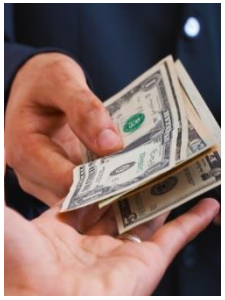
Daily material received

Elements installed

Workers timesheet

Work done by sub-contractors

Quality inspection results



Money paid to subcontractors

Bids submitted

Bids in progress

Collect system information

- Through a combination of ***interviewing*** employees, circulating ***questionnaires***, ***observations*** and ***studying existing documentation***, the system analyst comes to a reasonable understanding of the system.
- This is the most time consuming phase!
- You, as an outsider to the system, face tonnes of new system information.
- It takes time for you to understand and digest system information if you are a ***stranger*** to the company!

How can we recognize a new (or to be built) organization?

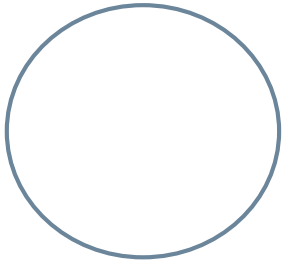
Collect system information

- During system recognition you are bombarded by massive amount of data/ information from different parts of the organization/ system.
- Creating piles of unorganized and mixed system recognition reports only adds the complexity.
- We need a tool which can efficiently document system information.
- A tool which captures the important parts of system aspects, not random details that never are going to be used!

Data flow diagram

- In MIS development our approach to the system recognition is recognition of flow of information within the organization.
- By recognizing and analyzing the flow of data within the organization we can recognize organization's characteristics and find and address existing gaps within the organization.
- **Data flow diagram** (***dfd***) is a tool used for *documenting* data flow recognized within the organization, *analyzing* data flow adequacy, and later on in the system analysis phase *identifying* data flow gaps within the organization.

Data flow diagram – Elements



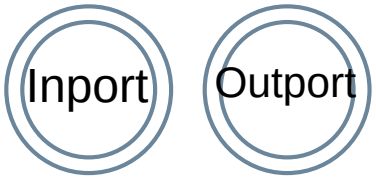
Process: transfers input data to output

data

External interactor: interacts with our system; sends data to and receives from our system

Flow of data: transfers data.

Data store – archive: Stores data



Data in-port/ out-port

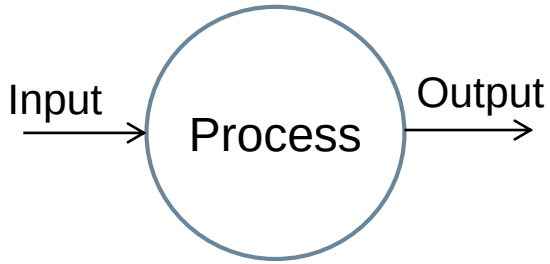
Data flow diagram – Process Vs Procedure

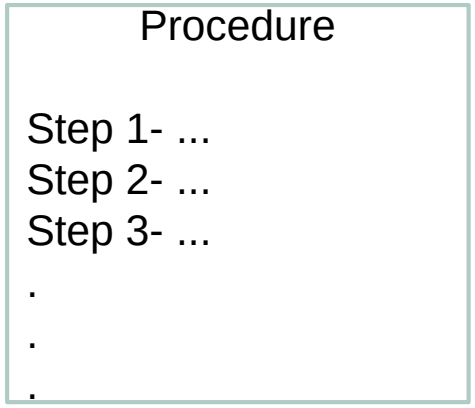
- **Process** (or business process)(formal definition): is a collection of related structured activities or tasks that *produce* a specific *service* or *product* or achieve an *end. Examples:* designing process, purchasing process, fabrication process and construction process.
- **Procedure**: A series of steps taken to accomplish an end. *Examples:* medical procedure, quality test procedure, installation procedure and turnover procedure.

Question: What is difference between process and procedure?

Data flow diagram – Process Vs Procedure

- **Process Vs Procedure**
  - *Process*: What to do! — *Procedure*: How to do!
  - *Process* is output driven — *Procedure* is task driven
  - *Process* consists of procedure(s) — *procedure* consists of steps





- According to its complexity, a process can be divided into sub-processes or procedures

Data flow diagram – Process Vs Procedure

- Process and procedure are addressed in similar terms:
  - Project planning process Vs Project planning procedure
  - Project control process Vs Project control procedure
  - Construction process Vs Construction procedure
  - Maintenance process Vs Maintenance procedure

Is there any difference in the real meaning when a term is called a "process" or "procedure"?

Data flow diagram – Process view

- The process view follows a high level (or top-down) view to the system compared to the step by step approach followed in the procedure view.
  - By talking about procedure we need to get involved in steps and logic or mechanism of the work!
  - A process might contain one or more procedures inside. For example there might be multiple *planning procedures* (e.g., initial planning development procedure, resource leveling procedure, time crashing procedure, cost planning procedure, etc.) to be followed in a *planning process* to be able to create the plan (as main output of the process) from initial planning requirements (as main input of the process).

Our approach to system recognition and design is follows a *Process view approach*!

Data flow diagram – Context level

- First level of data flow diagram is called context level or level zero in which we illustrate data interactions between our system (organization) and external interators (EIs) (or *external entities*)! .

Data flow diagram – Context level

- Therefore, when you started recognizing a complex construction system you need first to identify main “external interactors” which send data to and receive data from the system.
- Usually data received from external interactors is the main ***driving force*** in the system, different processes and procedures are followed in the system to properly accommodate and respond to the received data!

No external data received to/ sent from the system, no interaction to the outside world! What does it mean?

- Be careful to properly identify as many as influential external interactors, BUT! do not worry if you missed some! the step by step or structured approach followed for recognizing the system can identify few missing external interactors!

dfd example (bidding system)

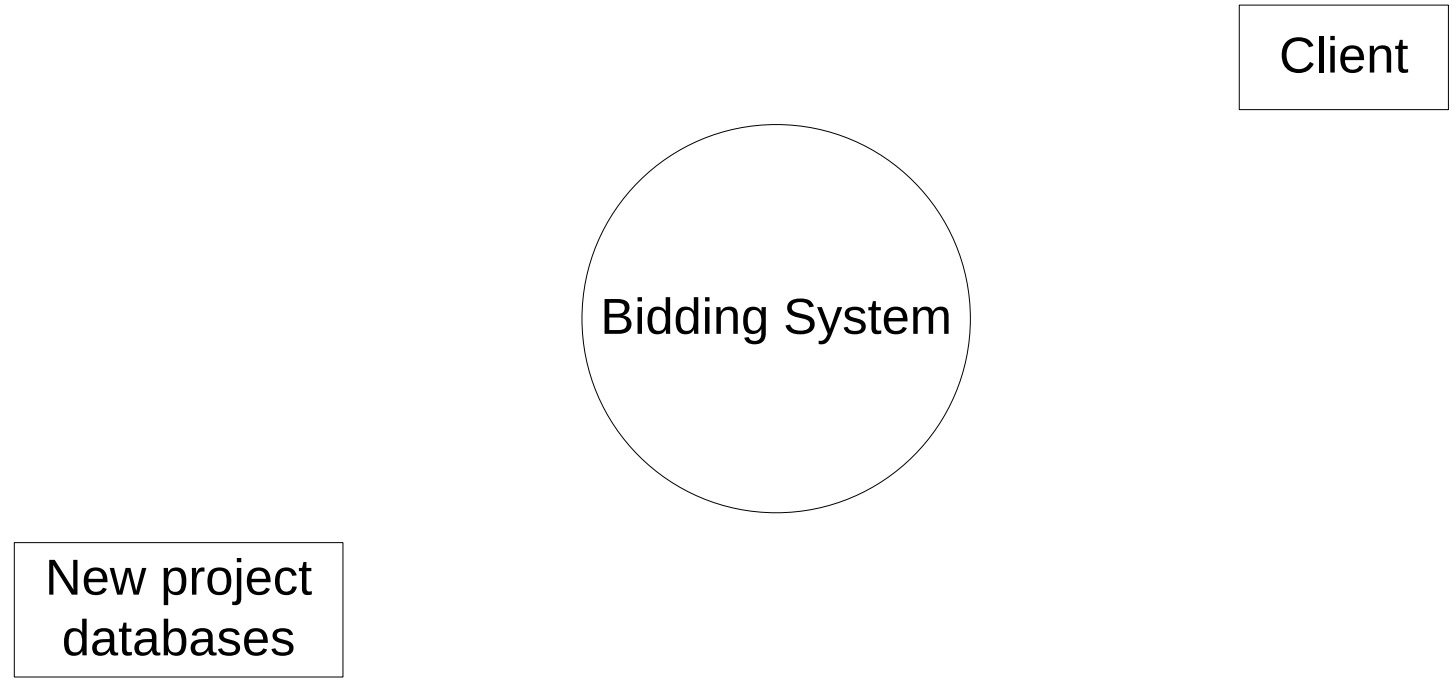
- A construction company has found that its deficiencies in managing efforts on bidding for new projects and bringing new projects to the company has caused a considerable damages to the company. The company's top management just has discovered that in last two years the company has spent too much money on preparing several bid documents for a client which just has announced but started any new project for a while; in some new projects company's estimation has had a considerable difference with the second bidder; contracts department has missed the bidding due of several important projects.

  Top management now has decided to re-build its current bidding system to rescue the company from this crucial situation. You as the construction manager in the company are assigned to manage the company's efforts in this system improvement project!

Dfd example (bidding system)

- For context level or level zero dfd, first, find main “External Interactors” to the system.

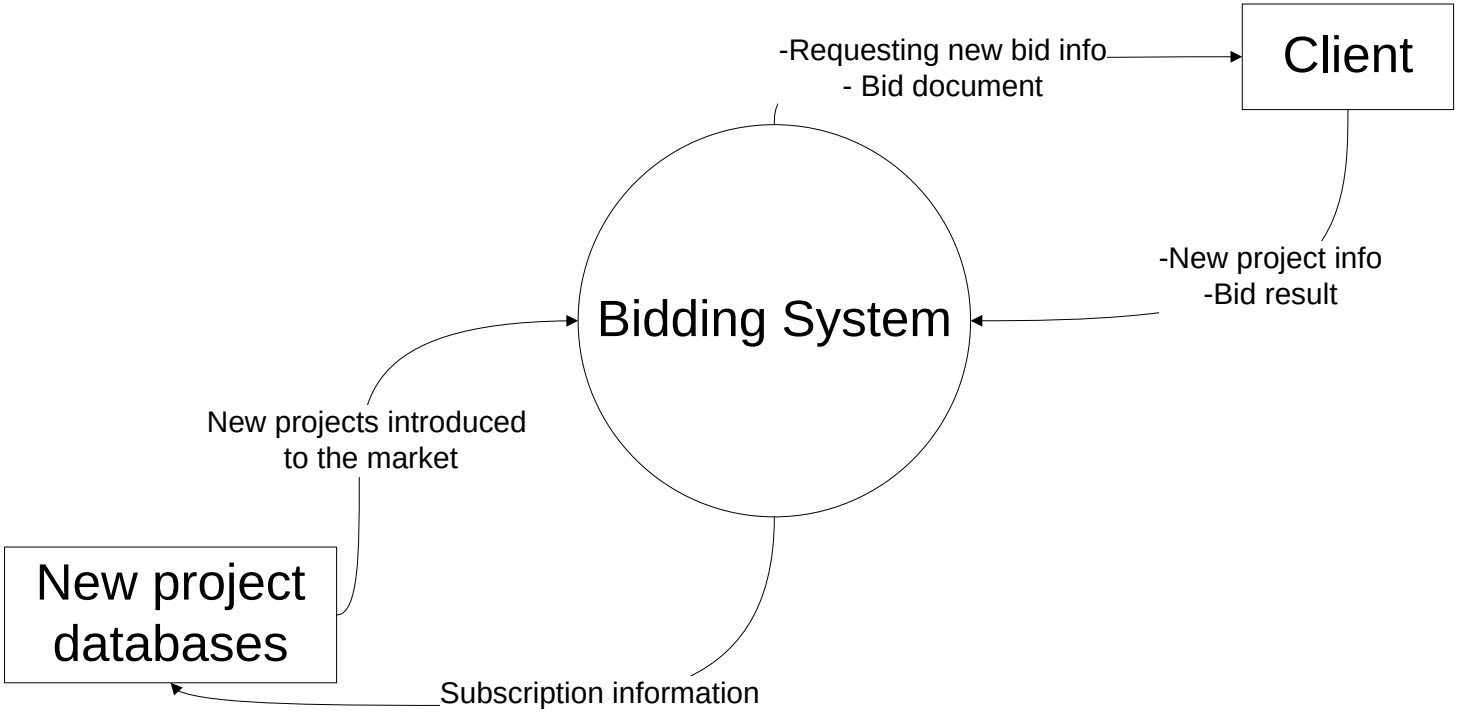
Bidding system in a construction company – dfd - L0



Dfd example (bidding system)

- Then identify their main data flow to the system.

Bidding system in a construction company – dfd - L0

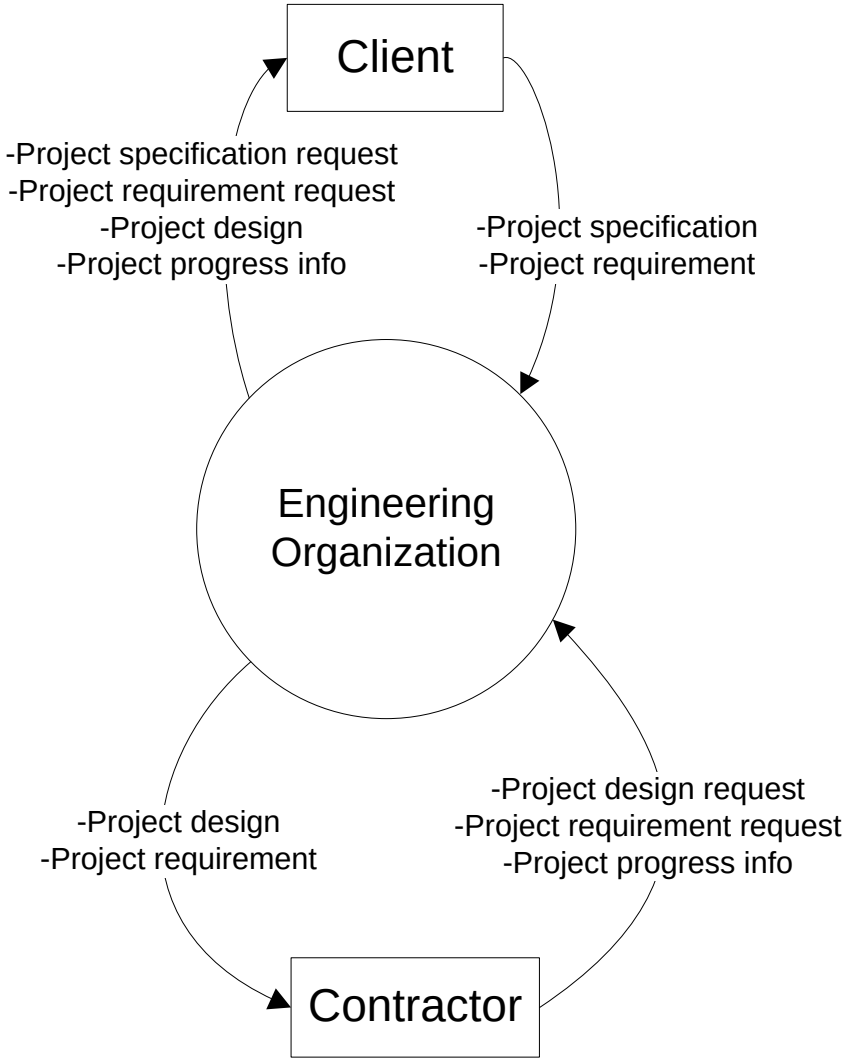


In class practice 1

Draw context level dfd of a typical engineering (designing) company.

In class practice 1

Dfd at context level:



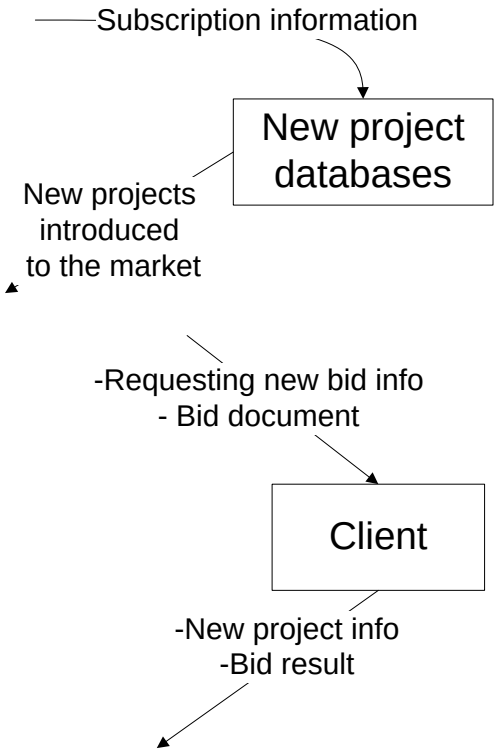
Data flow diagram – Level 1

- Second level of data flow diagram is called level 1 in which we outline main system processes!

Dfd example (bidding system)

- When breaking down the dfd to the next level, all **external interactors** linked to the broken down process/ system go directly to the next level with the data linked to it!

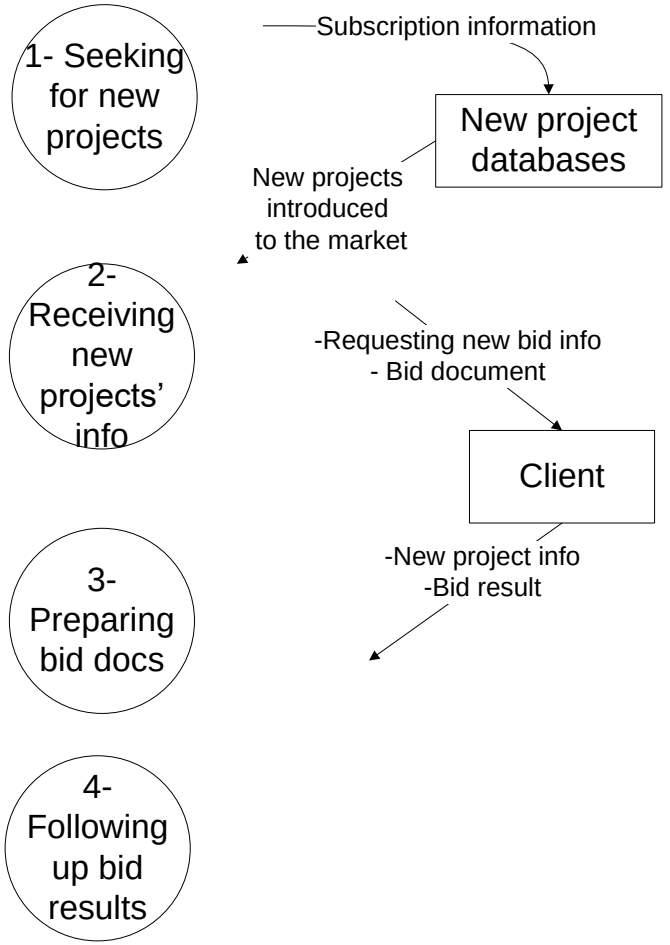
Bidding system in a construction company – dfd – L1



Dfd example (bidding system)

- Identify all processes in the level

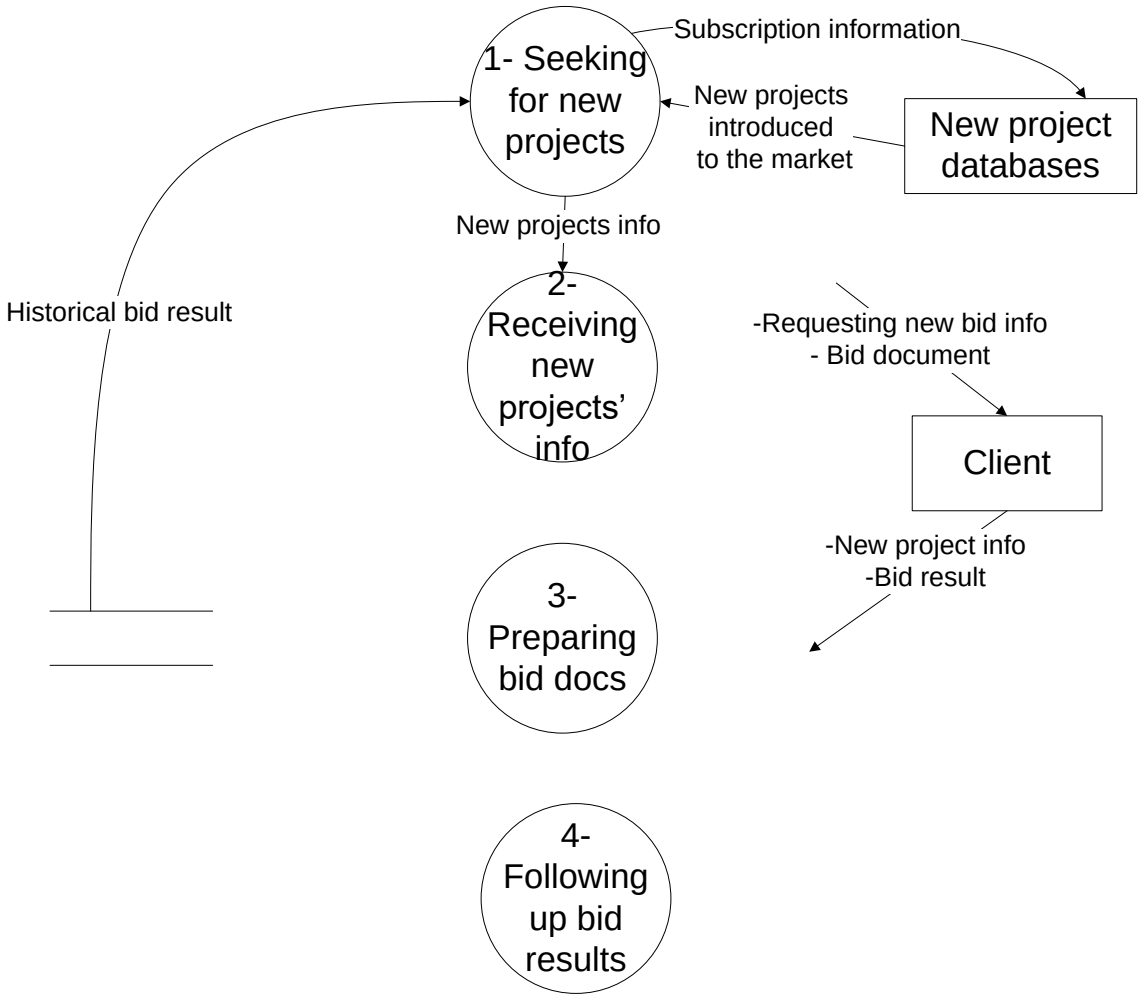
Bidding system in a construction company – dfd – L1



Dfd example (bidding system)

- Identify in/ out data to each process. Start from the process which logically comes first!

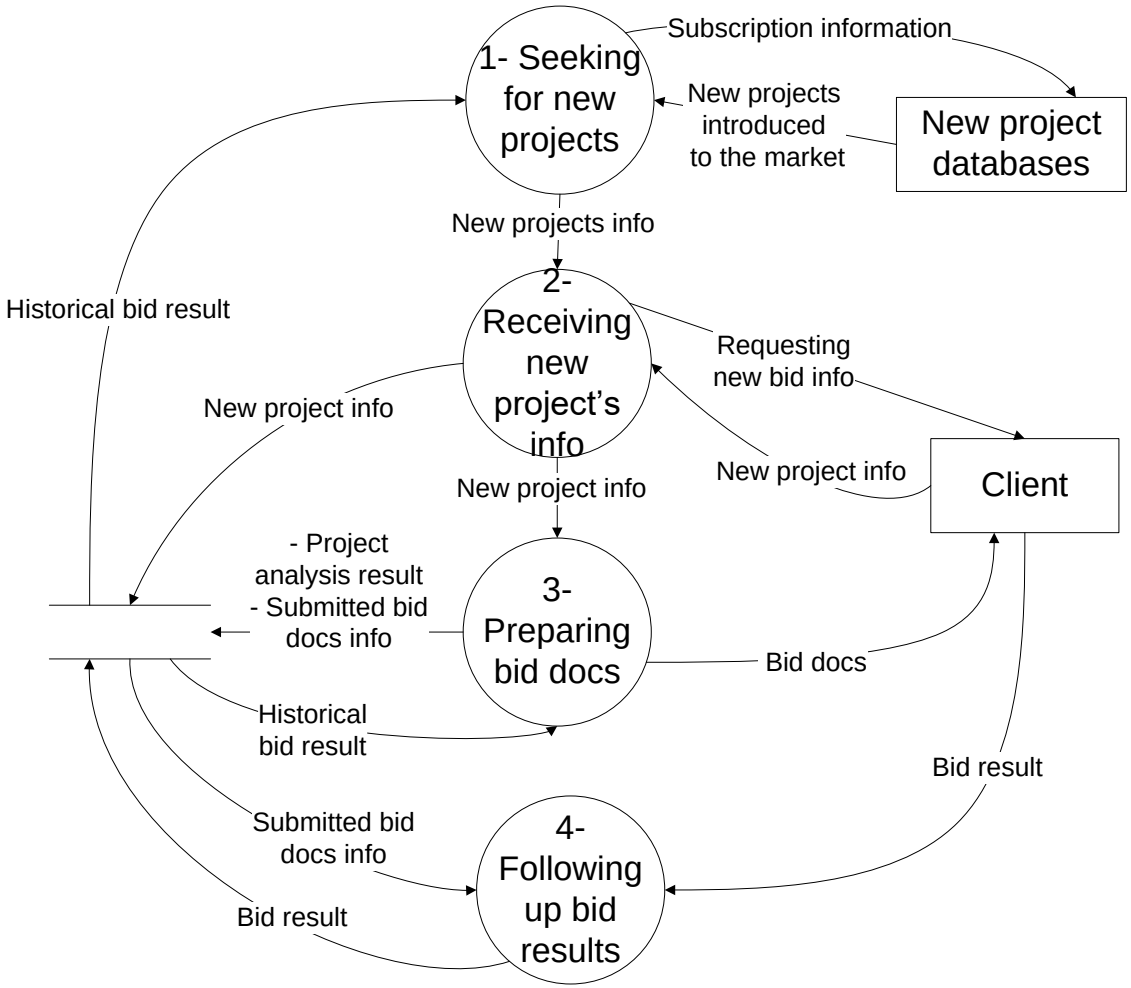
Bidding system in a construction company – dfd – L1



Dfd example (bidding system)

- Continue this method until completing all in/ out data flows are complete.

Bidding system in a construction company – dfd – L1

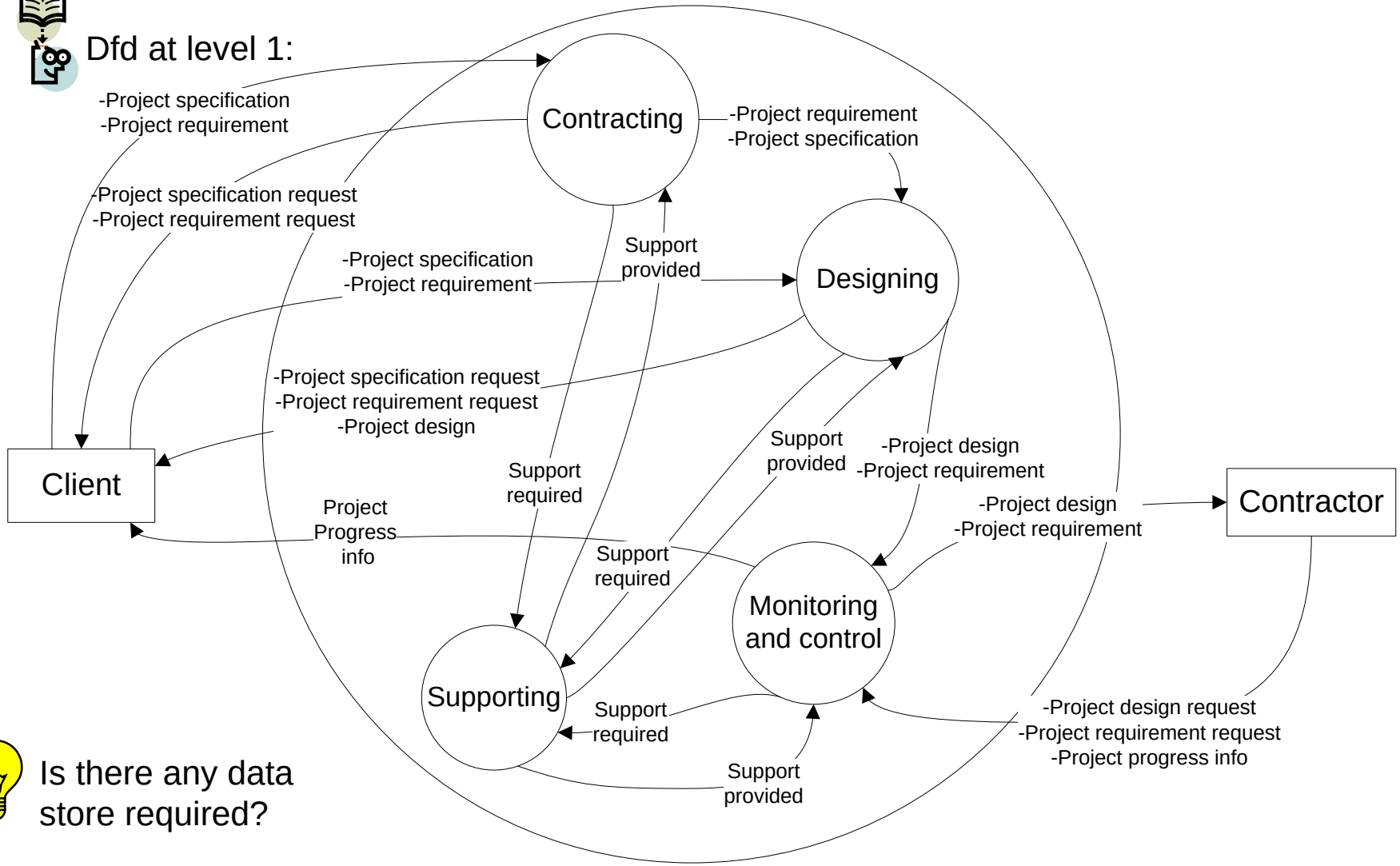


In class practice 2

Draw a first level level dfd of a typical engineering (designing) company. The company designs different projects and then controls implementation of designs!

In class practice 2

Dfd at level 1:



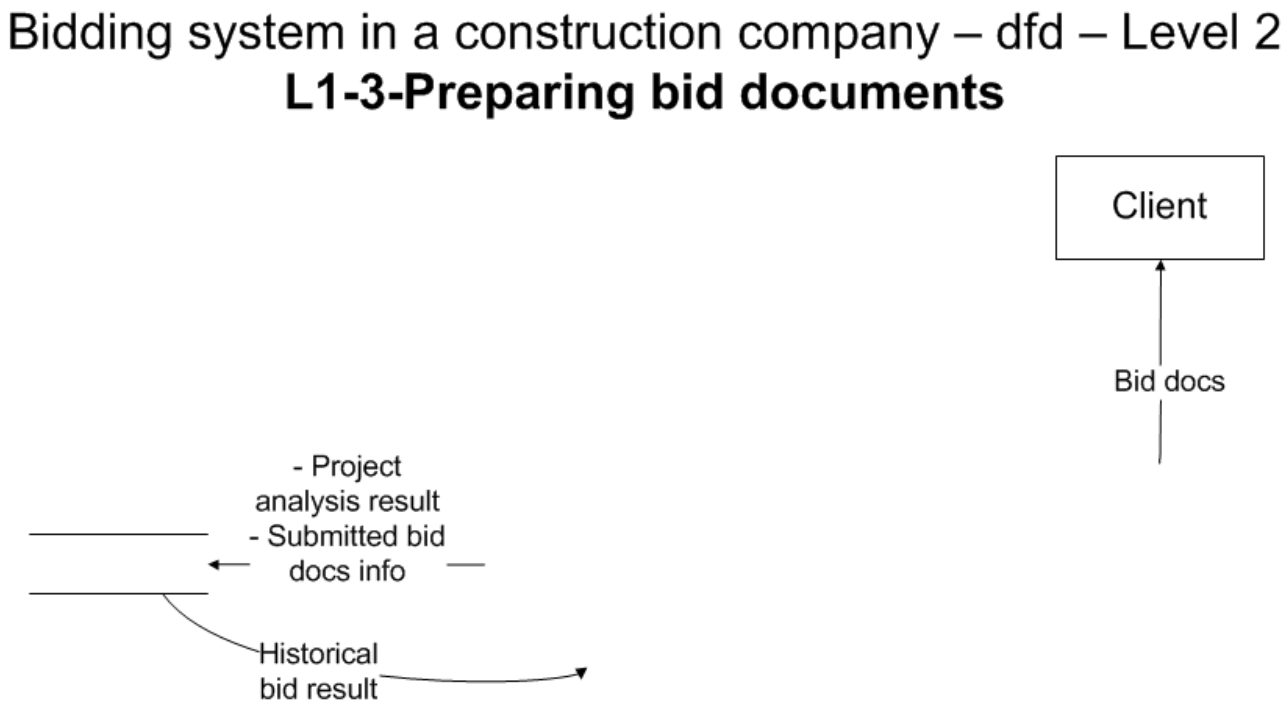
Is there any data store required?

Data flow diagram – Other levels

- Continue breaking down processes to sub-processes until you reach to a procedure level, where data manipulation happens through steps!
- Use proper dfd coding method to address different dfd levels and dfd elements within levels. Examples:
  - 2- Purchasing, 2-1-Finding supplier 2-2-Ordering material 2-3-Controling Material
  - 3- Constructing, 3-1-Receiving material on site, 3-2-Assembling, 3-3- Erecting

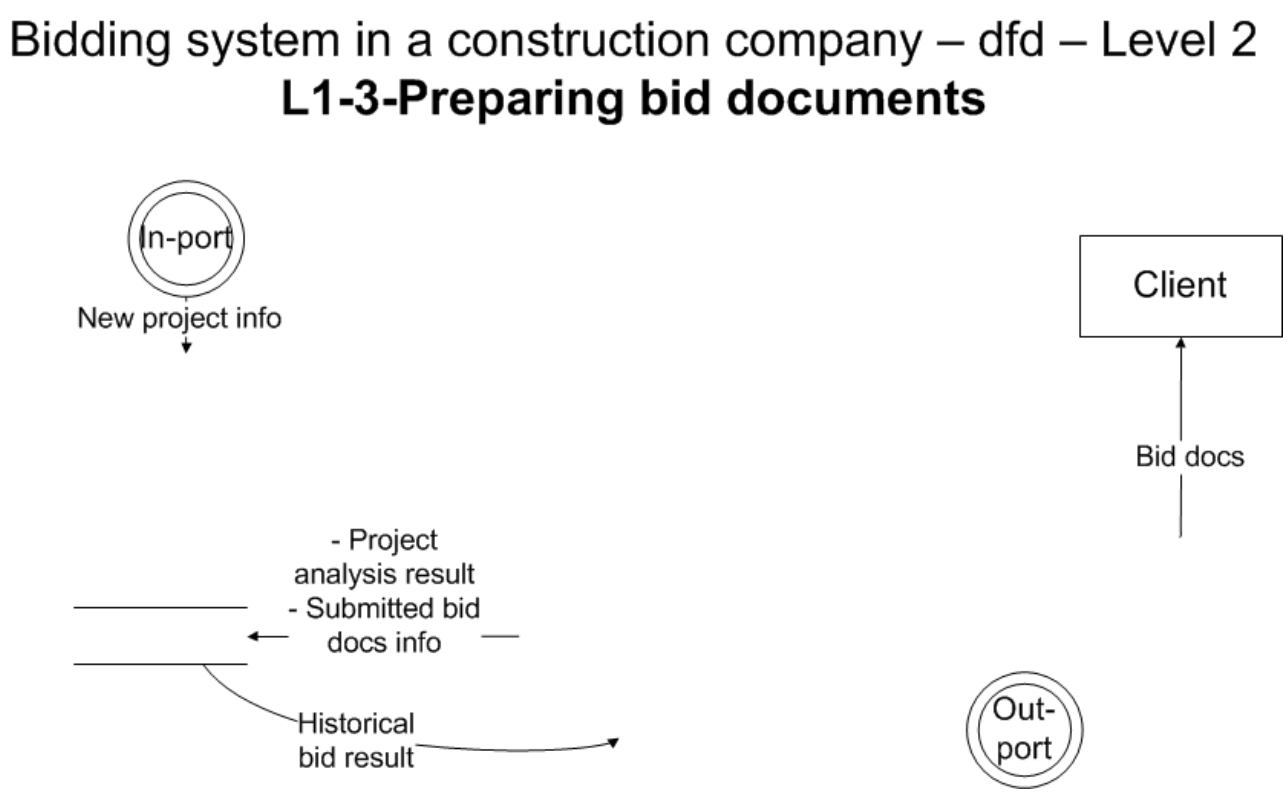
Dfd example (bidding system)

- When breaking down the dfd to the next level, like external interactors, **data stores** linked to the broken down process/ system go directly to the next level with the data linked to it!



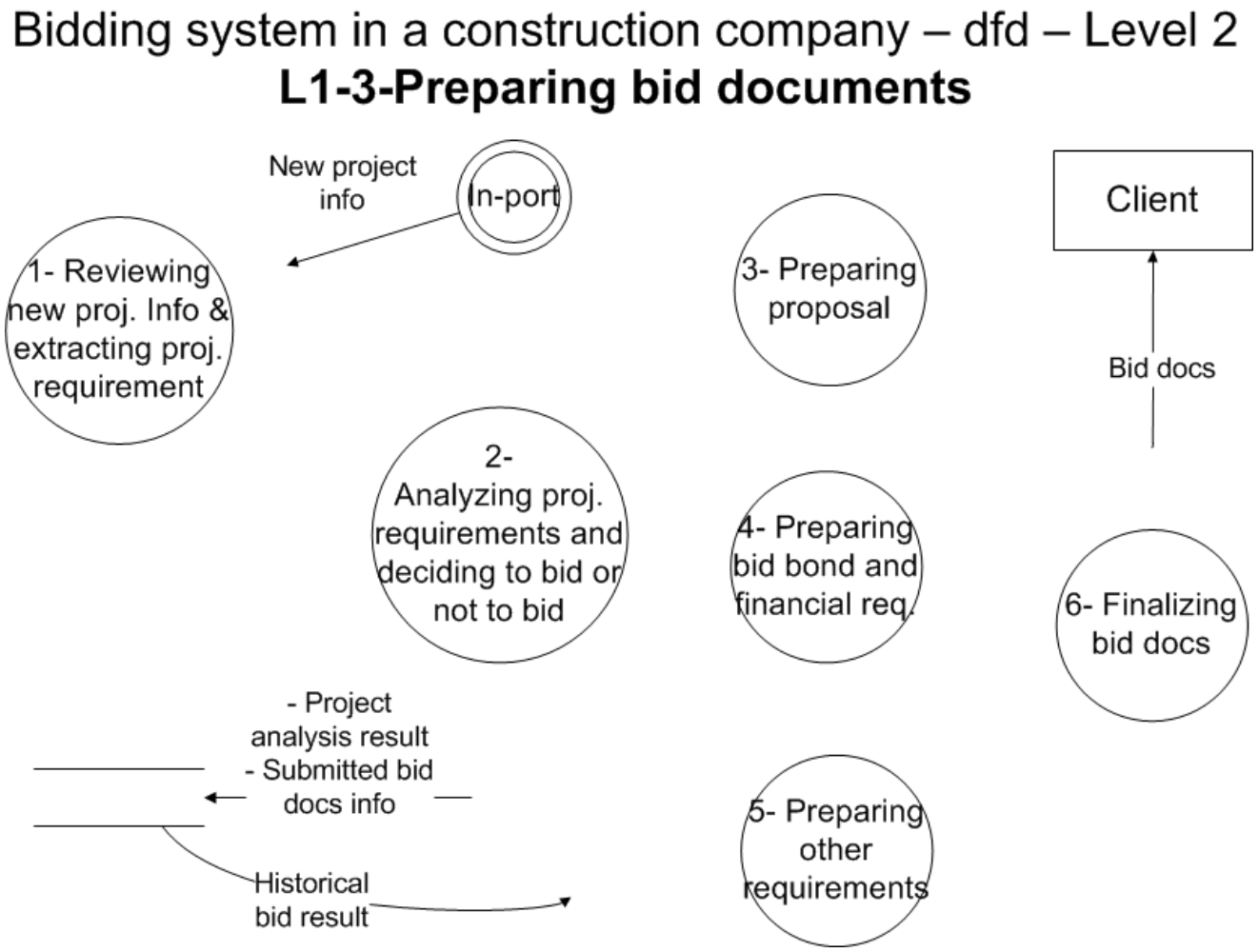
Dfd example (bidding system)

- When breaking down a process (or system) to the next level, all input data linked to the process from other processes come from **In-port** node and all output to other processes go the **out-port** node.



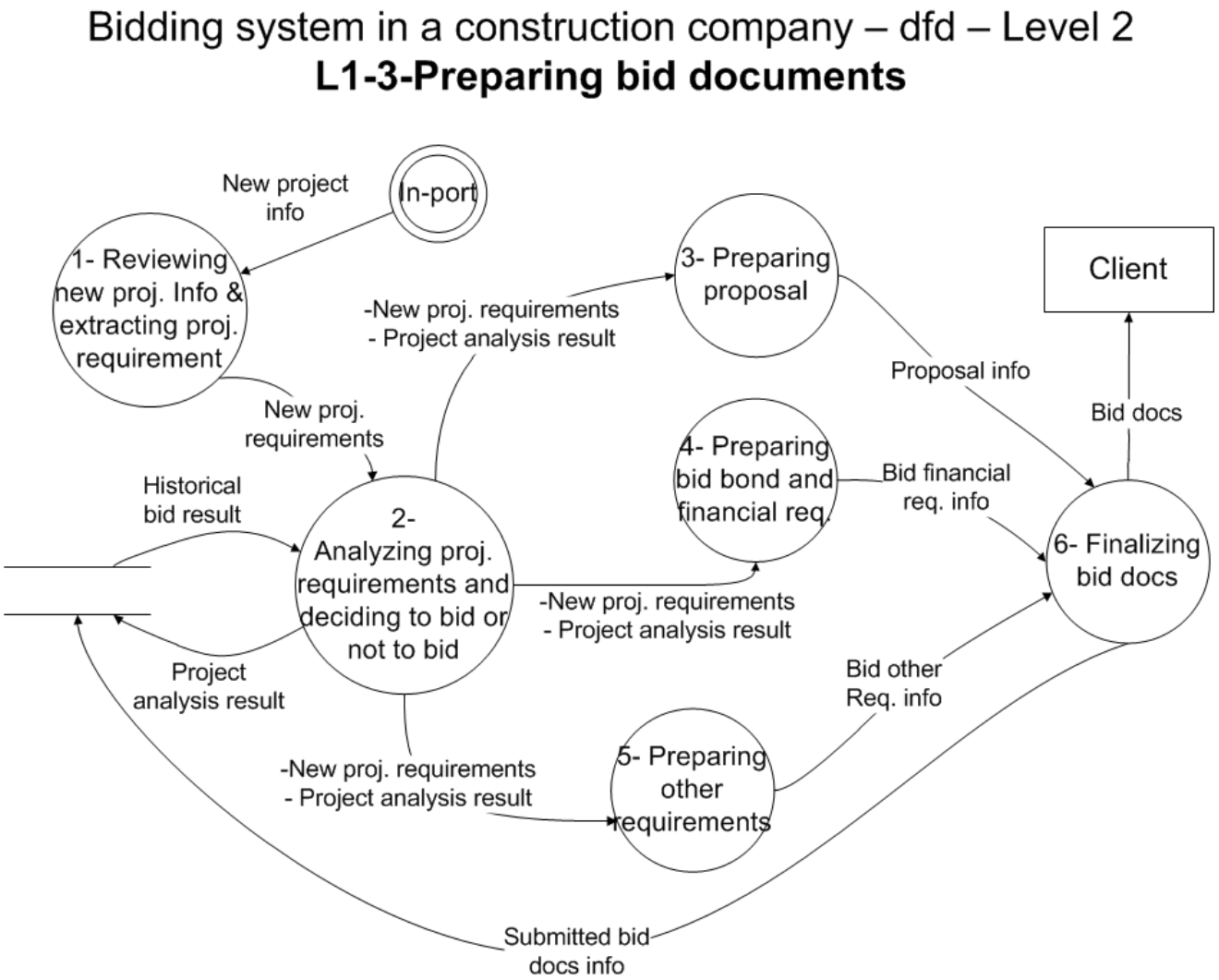
Dfd example (bidding system)

- Identify all sub-processes in the level



Dfd example (bidding system)

- Identify in/ out data to each sub-process. Start from the processes which logically come first!



Home assignment 1

Consider current course training system of your University. Every semester students are going to register courses, students may change the courses during remove and add period, they may withdraw, successfully pass, or fail the courses. During your program you need to take different types and number of the courses to graduate. Recognize different parts of the University course training system for your study level (i.e., BSc., MSc. Or Ph.D.). A) Outline different parts of the system in a textual report (Maximum of ten pages). (50 Marks) B) Present your recognition in Dfd format (Contex Level, Level one, and at least two level 2 diagram of your choice) (50 Marks)

in two weeks

CASE Tools

CASE tools

- Computer-aided software engineering (CASE) refers to methods for the development of information systems (or IT development in general) with the aid of computer software packages used in the development process.
- CASE tools are a class of software packages that facilitate/ assist many of the activities involved in various life cycle phases (e.g., recognition, analysis, design and implementation) of information system development (or IT development in general).
- CASE tools may range from software packages simply providing graphical representations of the computer information system development tools to highly integrated and automated software packages which generate program codes and link graphical representations of the models together.
- Data flow diagram (dfd) is one of the models usually provided by case tools.

CASE tools

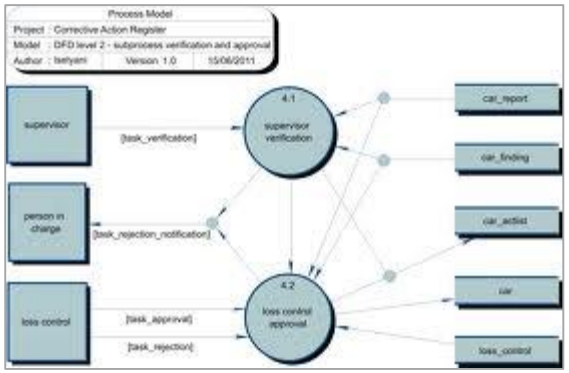
- Examples:

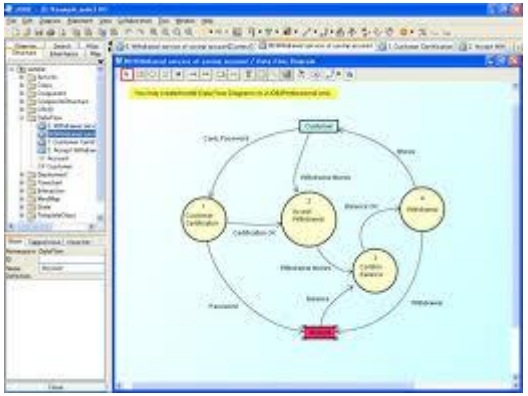
casewise

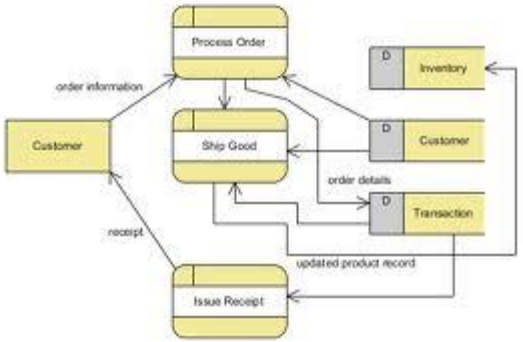
SYBASE PowerDesigner®

Oracle® Designer/2000

Excel Software
Software Development Tools







Introduction to M.S. Visio

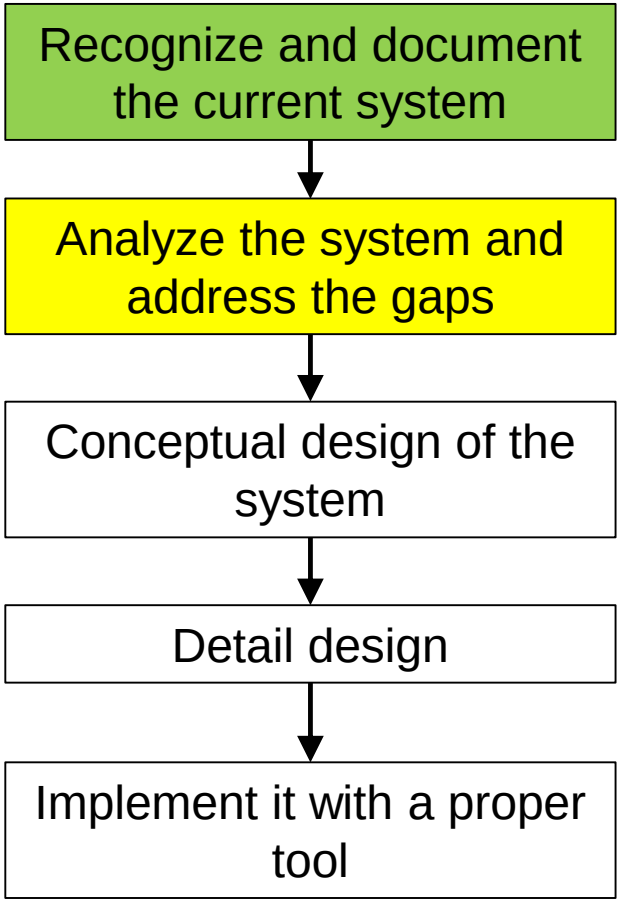
- M.S. Visio is a 2D-object drawing application and is part of the Microsoft Office suite.
- M.S. Visio is not a real CASE tools but it provides many types of diagrams used in the development of information system (including flowchart and dfd).

Hands on software (Visio):

- Finding data flow diagram shapes
- Drawing dfd

System Analysis

MIS development phases



System analysis

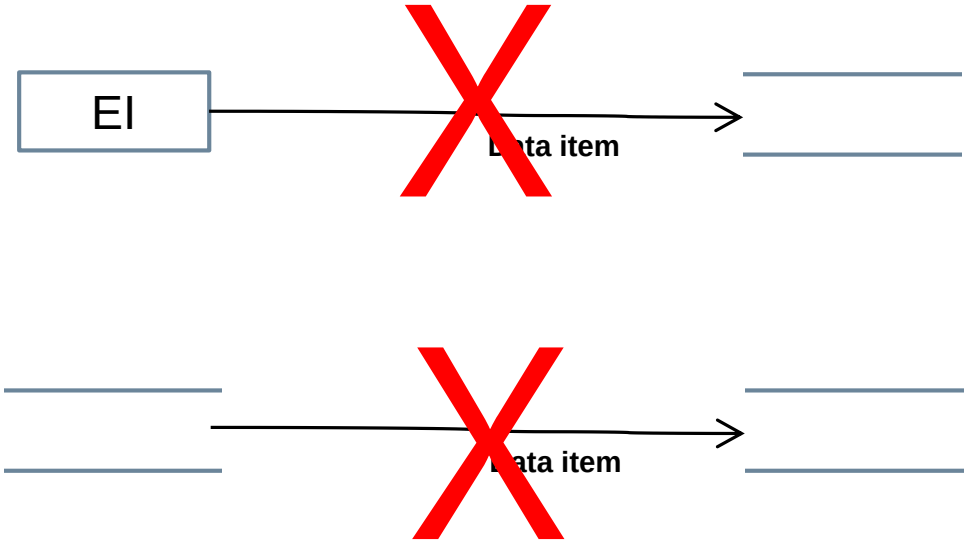
- After system recognition completion we could have a dfd document which represents current situation of the system.
- For every single data transaction organization is spending money, any redundant data transaction is an extra cost to the organization
- People in an organization need information to properly do their jobs, any missing information contributes to the wrong decisions made!
- We need to run a system analysis:
  - To find and remove wrong data flows
  - To find and create missing data flows
  - To find and resolve disconnected data flows

Data flow diagram – rule

- **Dfd Rule 1-** No external interactor should be directly connected to data store.

Two data stores are not directly connected!

Why?

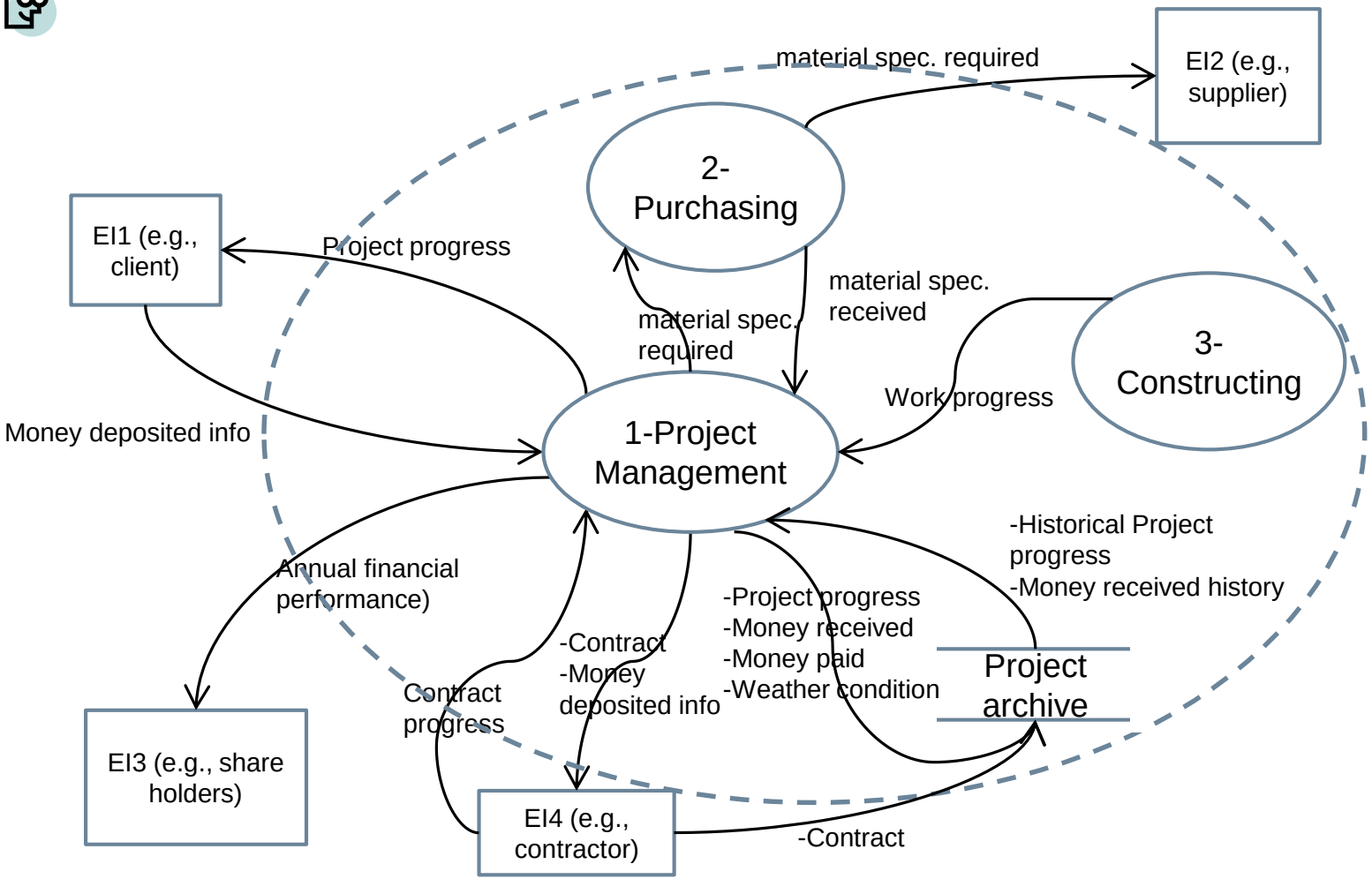


Data flow diagram – More rules

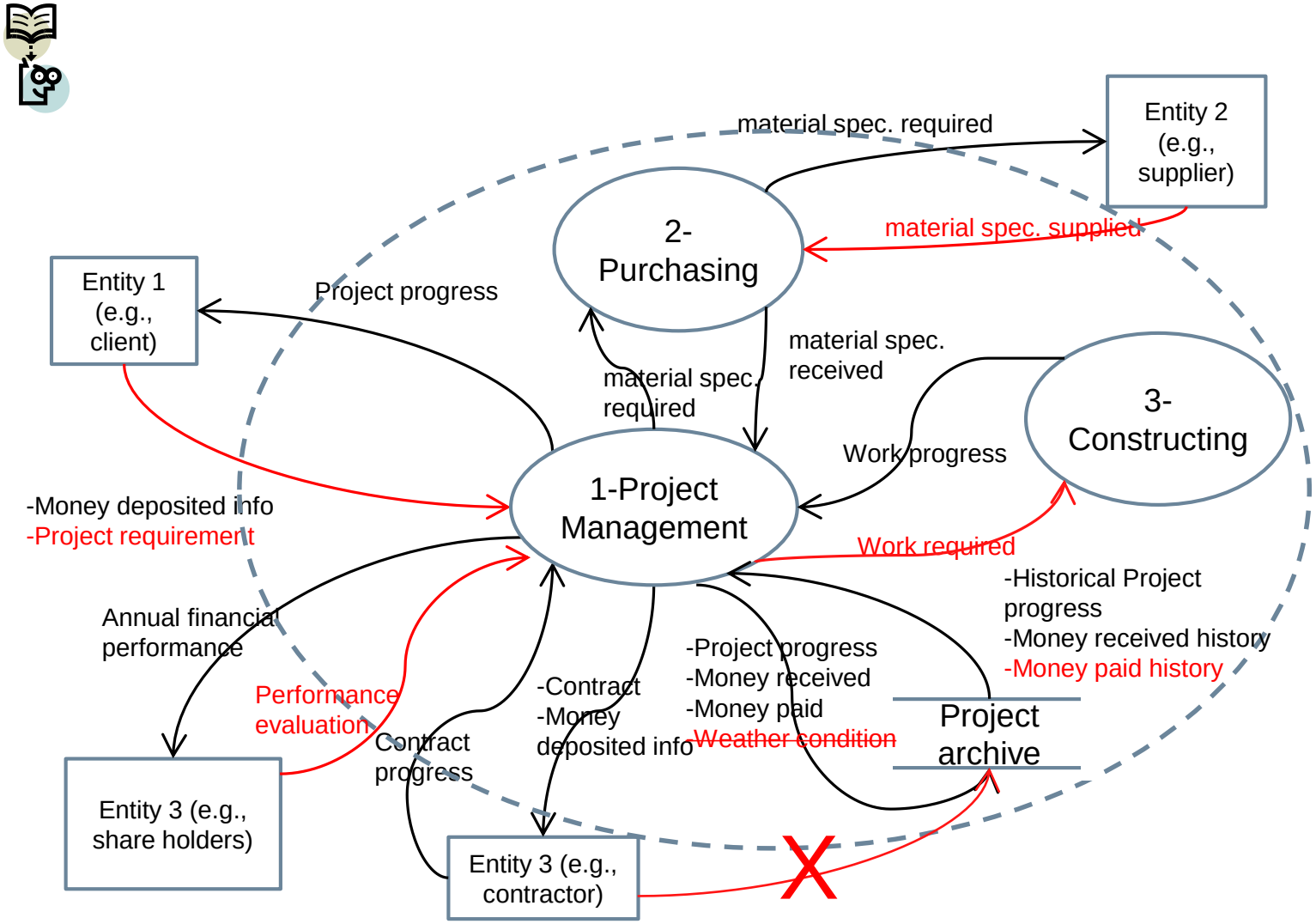
- **Dfd Rule 2-** System should be able to create all data external interactors required!
- **Dfd Rule 3-** Do not store data items with no future use as data inputs for any processes. Each data store must have at least one data flow going into it and one data flow leaving it.
- **Dfd Rule 4-** Make sure data flows are not discontinued and all input data contribute to create outputs of the process. In other word a data flow out of a process should have some relevance to one or more of the data flows into a process. Each process must have a minimum of one data flow going into it and one data flow leaving it.

In class practice 3 – dfd rule

What are dfd rule violations in the dfd in below?



In class practice 3 – dfd rule



Ideal vs Current System

- When an organization starts its work, there is no current system to recognize.

How are we going to analyze and then design a system when there is no current system?

  - We need to have a holistic view to the system integration and stick to the best practices!

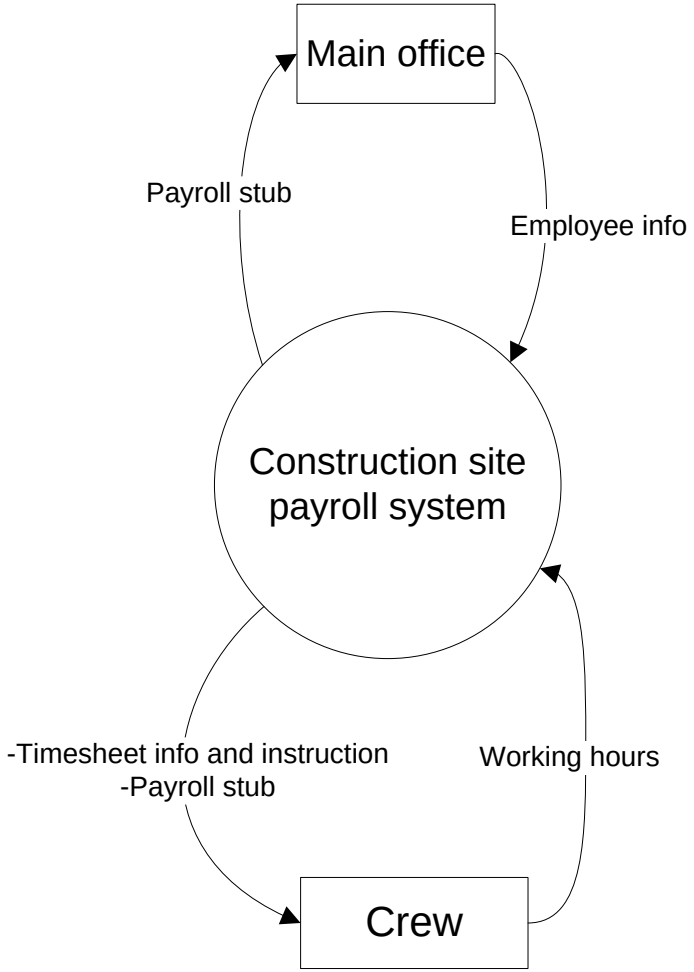
In class practice 4

You are going to help your on-site payroll admin to improve the payroll process by documenting and analyzing current payroll process using dfd (context level and level 1). According to the payroll admin these are current sub-processes/ activities taken for the payroll:

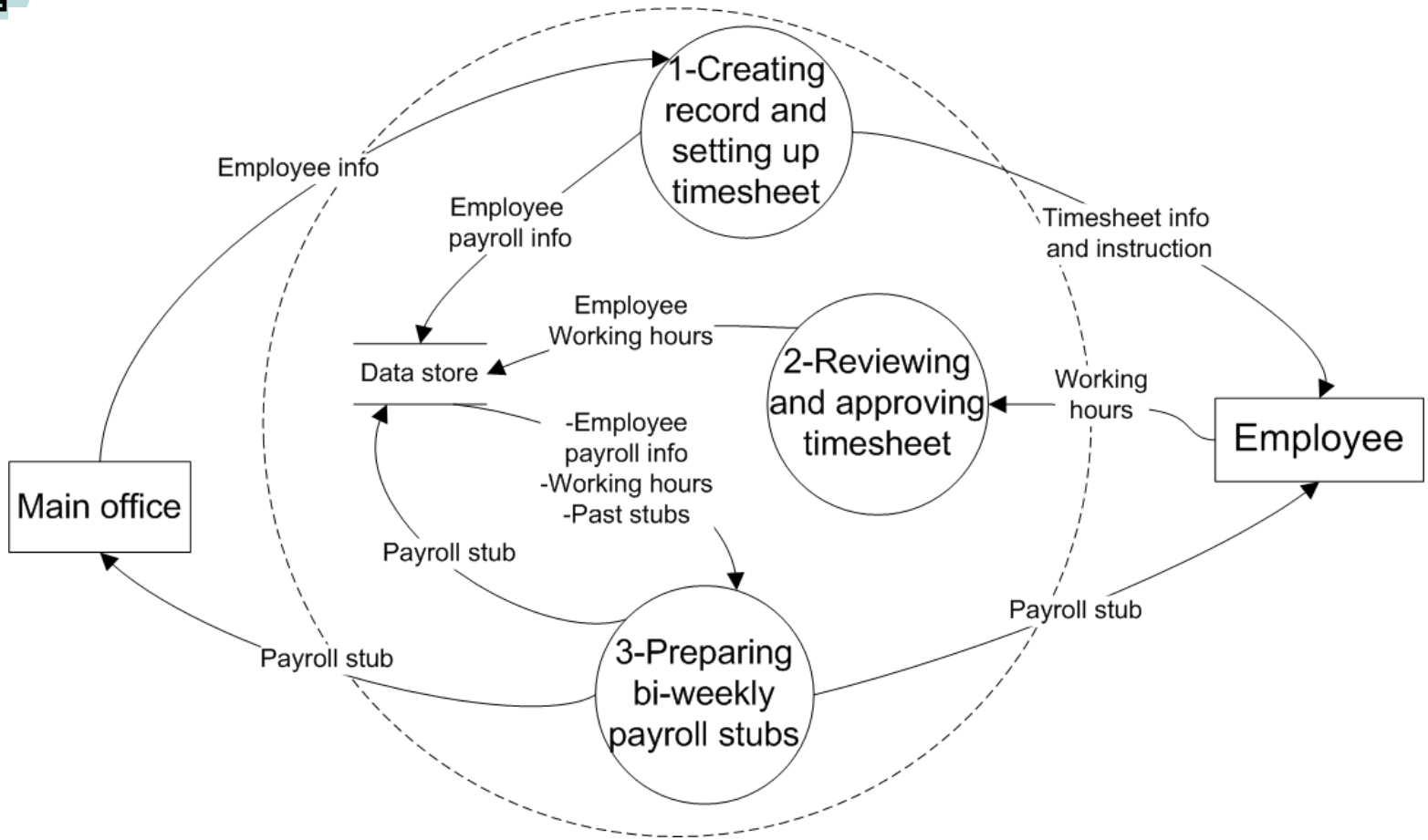
- When a crew is employed, a copy of his/her contract is sent to the site from main office
- Payroll admin creates a record and sets up a timesheet form for him/her
- Every day a worker fills in a timesheet and gives it to the supervisor, supervisor approves the timesheets and pass them to payroll admin
- Payroll admin enters timesheet data into employee's record and archives the sheets
- On bi-weekly basis admin reviews employees' records and generate payroll stubs, a copy is sent to the main office payroll to arrange the payment, a copy is given to the employee and a paper copy is archived.

For the rest of process, if required, make your own assumptions!

In class practice 4



In class practice 4



Home assignment 2

As a construction project manager you are assigned the development of a project planning and control MIS system for your construction company. In this MIS system you are going to define new projects, set a baseline for the project, collect different project's progress information and report different project's progress standing to the management. Since there is no current project planning and control system in the company (OMG!), at your first phase of MIS system development you are going to develop and document an ideal MIS system with dfd modeling tool! Develop dfds at context level, level 1 and at least two dfds at level 2. (**in one week**)

Thank you!