

Assignment 4: Functional-Hierarchical Decomposition

Course ISE 323: Information Systems Engineering 1

Due January 24, 2010; **Extended to March 1, 2010 at 11:59pm**

In class we have spent a lot of time talking about Functional-Hierarchical Decomposition (FHD). In this assignment you will use some of the tools and skills we have been developing on your own.

1 Background

During several recitations we have used a running example of a window factory. So far we have worked on the portion relating to the receipt of requests from customers and their processing. In this assignment you will develop artifacts to reflect the next two sections of the system - **Order Management** and **Standard Window Management**.

The description of the system is included below for your reference.

2 What to do

You may work in groups of up to four (4) students.

Your job is to develop the following artifacts for the system description:

1. Hierarchical Data Flow Diagrams (DFDs) for the story covering all aspects of the story
 - You may use standard DFDs or OO-DFDs
2. A Data Dictionary (you may use the Excel format from the recitation) with the following information:
 - Functions Dictionary - including a structured language description of the logic of each simple function
 - External, Real Time, and Time Entity Dictionary
 - Data Source Dictionary
 - Data Elements Dictionary
 - Data Flow Dictionary - to save time, you may show **only flows between simple functions and data sources/classes**.
3. A single (normalized) database schema which reflects all of the data sources/objects from the Data Dictionary and using the data elements dictionary as you defined it

I will place a copy of the Visio DFDs that we have made together in recitation and the (partial) data dictionary that we have developed together on Telem. You may use these files as a beginning for your work or develop them new on your own.

3 What to turn in by January 24, 2010; Extended to March 1, 2010

You must turn in the above artifacts by 11:59pm on January 24, 2010; Extended to March 1, 2010 at 11:59pm:

- The hierarchical DFDs - drawn by hand, electronically, or scanned
- The Data Dictionary as an Excel file
- The database schema on paper or in an electronic file

You may turn the above materials:

- in person
- via fax 04-665-3661 (attention Michael May)
- via Telem
- in my drawer in the Engineering School office (with Bili)
- via email at `ise323@gmail`

4 Window Management Story

4.1 Window Factory Description

4.1.1 Company Description

The company makes custom vinyl windows as well as standard sizes. They also make specialty “bay windows” which are higher priced and have more involved assembly. The vinyl windows are produced in several stages along different manufacturing lines for practical considerations:

1. A vinyl extrusion line produces the vinyl sides and frame for the windows.
2. A glass cutting line which takes large sheets of glass and cuts them with a knife or laser to the required size
3. An assembly line to put together the vinyl pieces into frames and hanging sides.
4. A specialized sealing line which takes the frames, the glass, puts them together, puts a layer of insulating gas between the two, and seals them.

Since the company makes standard size as well as custom windows, there is a mix of parts, vinyl pieces, and glass which must be manufactured. Custom windows need to be made to size and have specially cut glass to fit them.

The company has limited storage space and very fragile materials, so it wants to keep partially finished pieces around as little as possible.

The company receives orders for not single windows, but collections of windows. Installation costs make it worthwhile to do installations all at once for an entire house or building, not just one window. That means that orders should be assembled and produced all at once to minimize storage needs and prevent mixups.

4.1.2 The Role of the Information System

Aside from the scheduling problem, which is very hard to get right on its own, the coordination of the different manufacturing lines is essential. The goal of the information system is to allow the day's schedule of production to be coordinated such that the vinyl and glass parts are available at about the same time and so that the glass sealing line works on similar jobs as much as possible. The glass sealing machinery must be calibrated for different size jobs, so it makes sense to do similar ones in a row. Extruding vinyl parts is also something best done by type since the machines to do the extrusion need to be warmed up, calibrated, and tested before producing materials.

Each manufacturing line has its own main computer which controls the line as a whole as well smaller computers which run each machine.

The information system needs to supply the schedule for the day to each manufacturing line and keep track of how they are progressing. Machine failures, material breakage, and errors are an inherent part of the daily work. Workers enter information about breaks, errors, and problems into their central computer. If the computer sees that a job is being held up at a specific point in the manufacturing line, it will try to preempt the problem by adjusting the daily schedule to get some work out of the parts that can.

The window factory produces windows of several kinds based on orders or catalog requests. There are several important parts and processes that the window factory does:

4.1.3 Customer Request Management

Customers can express interest in purchasing windows from the company by calling the company's toll free number, sending an email, or sending a request by mail. When a request is received, the potential customer indicates whether he wants to receive a catalog by mail, have a phone consultation, or have a sales representative arrive at his house. Each expression of interest is stored in a CRM database along with the requested method of contact.

Catalog requests are handled every morning at 10am. Outstanding requests for catalogs are retrieved from the database, the catalogs are packaged and mailed based on the contact information, and the outstanding request database is updated. Requests for phone consultations include a preferred time for contact.

Two sales representatives take care of all phone consultations based on the outstanding requests. They start each day by looking at the outstanding requests, arranging a schedule for themselves based on them, and updating the outstanding requests database as appropriate.

Home consultations are handled by two window sales professionals who are able to measure buildings for windows quickly and explain the different options to customers. Home visits are all scheduled for Thursdays or Fridays, times when people are likely to be home. The scheduling is done one week ahead so the window sales professionals know their schedules ahead of time. Once an outstanding request has been scheduled, it is indicated a "in process" until the actual home visit is concluded at which point it is updated to "concluded."

To follow up on sales consultations and catalog requests, managers can generate reports about outstanding requests, concluded requests, and orders. Customers who have not placed orders after receiving their catalog, phone consultation, or home consultation are included on the report which is forwarded to the sales staff for follow up phone calls.

4.1.4 Order Management

Customers can send orders to the factory either based on information from a consultation or directly without initial consultation. This includes contractors who resell the factory's windows and send detailed requests for specific quantities of windows.

Customer orders arrive by fax, phone, mail, or email. Sales representatives can also enter in customer orders if they receive them during phone sales calls or during home visits.

When an order arrives, it is sorted into one of two categories: (1) requests for one or more standard window sizes or (2) requests for custom sized or shaped windows. In case of orders which include both kinds, the order is divided into two, with the standard sized windows placed in a secondary order request.

Order information is correlated with requests for customer information to see whether the customer (if not a contactor) had requested information previously.

Standard window requests are stored in a database separately from custom windows since they are handled differently by the factory.

The order databases are managed by the stock manager and manufacturing manager and updated as will be detailed below.

At the end of each day, the computer generate a report about which orders have been fulfilled that day. Orders which contain both standard and custom sizes are not considered finished until both parts are completed. When an order is finished being produced, a notice is sent to the customer's contact information and a request is also sent to the customer to set up a payment schedule. Once the schedule has been established by the customer, the order will be released for shipment to the customer's home or building.

Each day the system prepares three reports:

1. A list of all orders completed that day
2. A list of all orders sent out to customers that day
3. A list of all orders which have been completed more than 10 days ago for which the customer has not set up a payment schedule

The second report is looked at by the production manager and then sent to the sales department. The sales department will then contact the customers on the list to remind them to set up a payment schedule.

4.1.5 Standard Windows Management

Standard sized windows orders are processed in two phases.

At 8am the stock room manager receives a list of outstanding standard window orders.

First, the factory stock room is examined to see whether there are sufficient standard sized windows in stock to satisfy the orders. If yes, the orders are all marked "completed" and the quantity needed for each order is deleted from the database of available windows. If there are not sufficient windows for all of the orders, the manager must decide which orders will be marked as "completed" first and which will be delayed.

For the delayed orders, the manager must decide whether to set aside windows to partially complete them (and mark them as "in process") or to wait for more windows to arrive from the factory floor to fill them. The manager may choose to do the second option if the order is large and he wants to keep a quantity available for smaller orders which may arrive soon.

After going over the outstanding orders, the manager uses the system to calculate the number of windows he needs to fulfill all of the outstanding orders and adds them to the **outstanding requests database**.

Since the factory floor produces standard sized windows whenever they have free time, the stock room only sends a special request to the factory floor when the number of outstanding requests for windows is greater than 30. When that happens, the manager creates a manufacturing request for the factory floor, sends it to them, and marks the relevant orders as "in process."

At the end of each manufacturing day (around 4:30pm) the stock room workers note what new standard size window parts have been delivered to the stock room. They generate a report which is then sent to the manager. The manager examines the report against the outstanding standard window orders to see which ones can be marked as "completed" and be released for payment or delivery.

Normally orders are fulfilled in a first-in-first-out order. However, if an order consists of both standard and custom windows and the custom portion of the order has already been finished (meaning that the standard size windows are holding up the release of the order), he will give the order priority over others. After making the decisions about order completion, the stock room manager updates the orders database, the available stock database, and sends a notice to the payment and delivery department telling them which orders have been finished and may proceed for payment and delivery.