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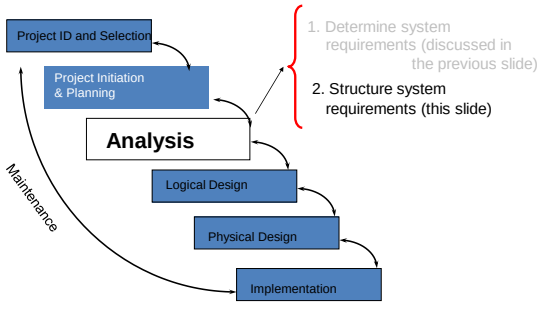
CSE3203 - Software Engineering and Information System Design

Chapter 8

– Structuring System Requirements

SDLC - Where are we?



Chapter Outline

- Process Modeling
- DFD
  - 0-Level DFD
  - n-Level DFD
  - Primitive DFD
  - DFD Decomposition
  - DFD Balancing,
- Steps in Building DFDs
- Context Diagram of Food Ordering System

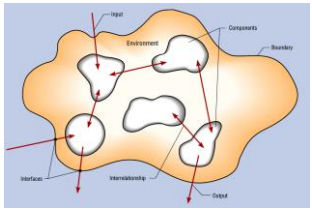
Lecture 15

Structuring System Requirements

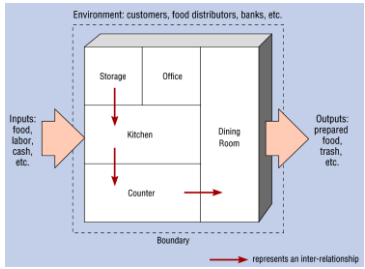
- Process Modeling
- DFD
  - 0-Level DFD
  - n-Level DFD
  - Primitive DFD
  - DFD Decomposition
  - DFD Balancing
- Steps in Building DFDs
- Context Diagram of Food Ordering System

Process Modeling

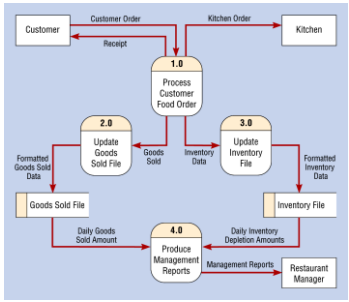
- Data flow diagramming
  - Graphical depiction of a system
  - Show how data flows through your system and what is being done to it along the way



A Fast Food Restaurant as a System



A Fast Food Restaurant's Customer Order Information System Depicted in a Data Flow Diagram

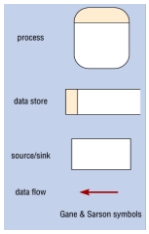


Data Flow Diagrams (DFD)

- DFDs describe the flow of data or information into and out of a system
  - what does the system do to the data?
- A DFD is a graphic representation of the flow of data or information through a system

Data Flow Diagram Symbols

- Process: The work or actions performed on data so that they are transformed, stored or distributed
  - Verb phrase name, e.g., Update, Calculate, Verify
- Data source: Data at rest, which may take the form of many different physical representations, e.g., - Database, Files, Folder
- Source/sink: The origin and/or destination of data, sometimes referred to as external entities. e.g. - Clients, Employees, Bank, Inland Revenue
- Data flow: Data in motion, moving from one place in the system to another. eg. - Invoice, Receipt, Enrolment form

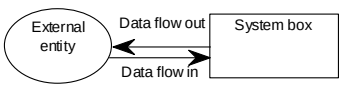


Levelled DFDs

- Even a small system could have many processes and data flows and DFD could be large and messy
  - use levelled DFDs - view system at different levels of detail
  - one overview and many progressively greater detailed views

Level 0 - Context Diagram

- models system as one process box which represents scope of the system
- identifies external entities and related inputs and outputs
- Additional notation - system box



Level 1 - overview diagram

- gives overview of full system
- identifies major processes and data flows between them
- identifies data stores that are used by the major processes
- boundary of level 1 is the context diagram

Level 2 - detailed diagram

- level 1 process is expanded into more detail
- each process in level 1 is decomposed to show its constituent processes
- boundary of level 2 is the level 1 process

Rules for DFDs

1. Numbering
2. Labelling
3. Balancing

1. Numbering

- On level 1 processes are numbered 1,2,3…
- On level 2 processes are numbered x.1, x.2, x.3… where x is the number of the parent level 1 process
- Number is used to uniquely identify process **not** to represent any order of processing
- Data store numbers usually D1, D2, D3...

2. Labelling

- Process label - short description of what the process does, e.G. Price order
- Data flow label - noun representing the data flowing through it e.G. Customer payment
- Data store label - describes the type of data stored
- Make labels as meaningful as possible

3. Balancing and data stores

- Balancing
  - any data flows entering or leaving a parent level must by equivalent to those on the child level
- Data stores
  - data stores that are local to a process need not be included until the process is expanded

Home Work

Joe's Yard

Joe's builders' suppliers has a shop and a yard. His system is entirely manual. He has a stock list on the wall of his shop, complete with prices. When a builder wants to buy supplies, he goes into the shop and picks the stock items from the list. He writes his order on a duplicate docket and pays Joe, who stamps the docket as paid. The builder takes the duplicate docket and he goes to the yard and hands it to the yard foreman. The yard foreman gets the ordered items from the yard and gives them to the builder. The builder signs the duplicate docket and leaves one copy with the foreman and takes one copy as a receipt. Every week, Joe looks around the yard to see if any of his stock is running low. He rings up the relevant suppliers and reorders stock. He records the order in his order book, which is kept in the yard. The yard foreman takes delivery of the new stock and checks it against what has been ordered. He pays for it on delivery and staples the receipt into the order book. At the end of every month, Joe goes through all the dockets and the order book and produces a financial report for the shareholders.

Draw a context level DFD and a level-1 DFD for this system.

Context Diagram

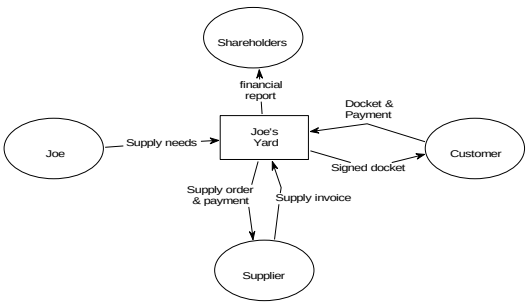
- Find the people who send data into the system
  - Often data is part of a PHYSICAL transaction
  - When handing a bar of chocolate to a shopkeeper, you are handing him/her a barcode.
- Find the people who get data out of the system.
  - The only data you need is data that is transformed or sent completely out of the system – not data that is handled by an operator within the system.

Joe's Yard

Joe's builders' suppliers has a shop and a yard. His system is entirely manual. He has a stock list on the wall of his shop, complete with prices. When a **builder** wants to buy supplies, he goes into the shop and picks the stock items from the list. He writes his order on a duplicate docket and pays ***Joe***, who stamps the docket as paid. The builder takes the duplicate docket and he goes to the yard and hands it to the yard ***foreman***. The yard foreman gets the ordered items from the yard and gives them to the builder. The builder signs the duplicate docket and leaves one copy with the foreman and takes one copy as a receipt. Every week, Joe looks around the yard to see if any of his stock is running low. He rings up the relevant **suppliers** and reorders stock. He records the order in his order book, which is kept in the yard. The yard foreman takes **delivery** of the new stock and checks it against what has been ordered. He pays for it on delivery and staples the receipt into the order book. At the end of every month, Joe goes through all the dockets and the order book and produces a financial report for the **shareholders**.

Draw a context level DFD and a level-1 DFD for this system.

Context diagram



Level-1 DFD processes

Joe's builders' suppliers has a shop and a yard. His system is entirely manual. He has a stock list on the wall of his shop, complete with prices. When a builder wants to buy supplies, he goes into the shop and picks the stock items from the list. He writes his order on a duplicate docket and pays Joe, who stamps the docket as paid. The builder takes the duplicate docket and he goes to the yard and hands it to the yard foreman. The yard foreman gets the ordered items from the yard and gives them to the builder. The builder signs the duplicate docket and leaves one copy with the foreman and takes one copy as a receipt. Every week, Joe looks around the yard to see if any of his stock is running low. He rings up the relevant suppliers and reorders stock. He records the order in his order book, which is kept in the yard. The yard foreman takes delivery of the new stock and checks it against what has been ordered. He pays for it on delivery and staples the receipt into the order book. At the end of every month, Joe goes through all the dockets and the order book and produces a financial report for the shareholders.

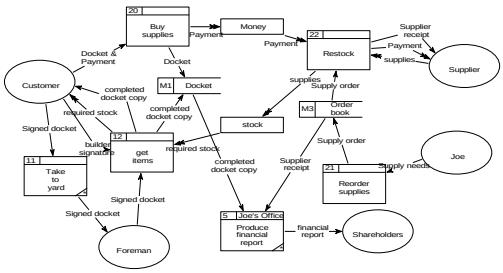
Verbs from script

- Has (passive)
- Buy supplies
- Picks stock items
- Writes order
- Pays joe
- Stamps docket
- Takes docket to yard
- Hands it to foreman
- Gets items
- Gives them to builder
- Builder signs docket
- Takes copy as receipt
- Looks around yard and reorders
- Records order in order book
- Foreman takes delivery – checks
- Foreman pays supplier
- Staples receipt to order book
- Produces financial report

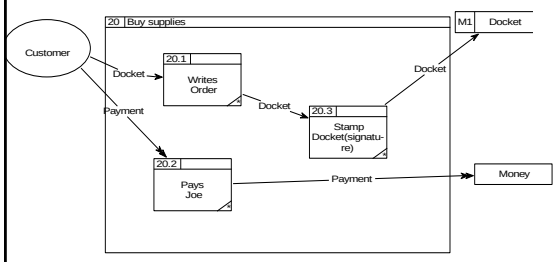
Remove passive verbs and queries

- Passive: has stock list
- Buy supplies
  - Picks stock items (views list)
  - Writes orders
  - Pays joe
  - Stamps docket
- Customer then
  - Takes docket to yard
  - Hands it to foreman
- Gets items
  - Gives them to builder
  - Builder signs docket
  - Takes copy as receipt
- Joe then
  - Looks around yard and reorders
  - Records order in order book
- Foreman
  - takes delivery – checks
  - Foreman pays supplier
  - Staples receipt to order book
- Joe
  - Produces financial report

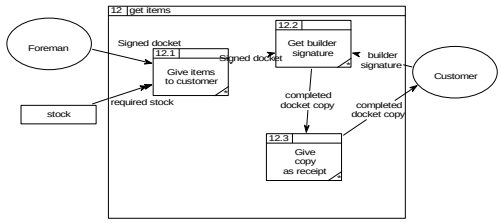
Level 1 current physical



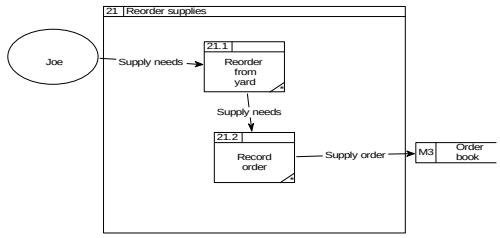
Buy Supplies



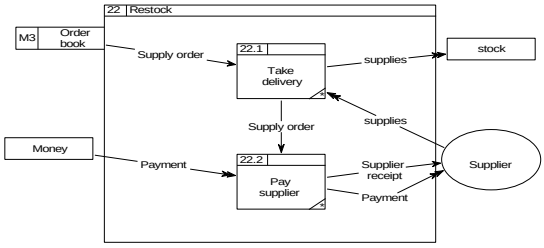
Get Items



Reorder supplies



Restock



Lecture 16

Structuring System Requirements

- Process Modeling
- DFD
  - 0-Level DFD
  - n-Level DFD
  - Primitive DFD
  - DFD Decomposition
  - DFD Balancing
- Steps in Building DFDs
- Context Diagram of Food Ordering System

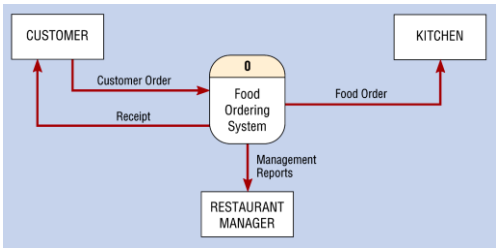
Steps in Building DFDs

- Build the context diagram
- Create DFD fragments
- Organize DFD fragments into level 0
- Decompose level 0 DFDs as needed
- Validate DFDs with user

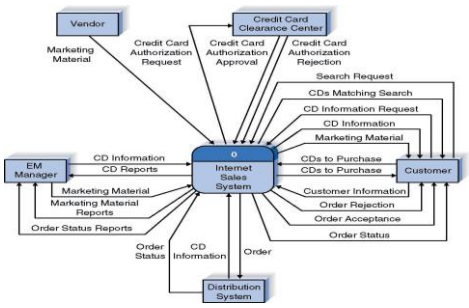
Context Diagram

- Shows the context into which the business process fits
- Shows the overall business process as just **one** process
- Shows all the outside entities that receive information from or contribute information to the system

Context Diagram of Food Ordering System



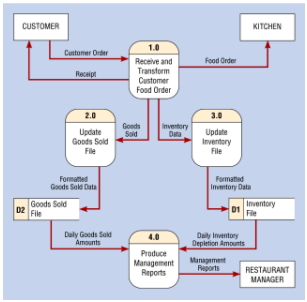
- One process only
- Single process (0) represents entire system

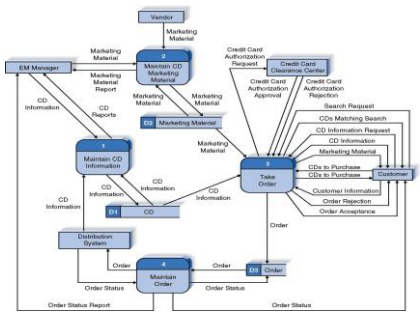


Level 0 Diagram

- Shows all the processes that comprise the overall system
- Shows how information moves from and to each process
- Adds data stores

Level-0 DFD of Hoosier Burger's Food Ordering System





Decomposition of DFDs

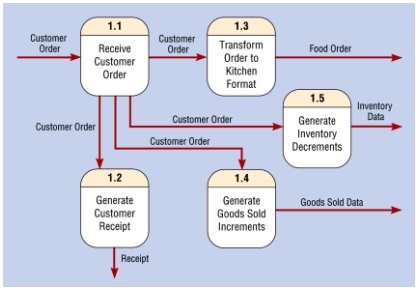
- Functional Decomposition
  - iterative process of breaking down the description of a system into finer and finer detail
  - keep going until point where process can no longer be logically broken down
  - creates a series of exploding charts

→ **Level-*n* diagram**

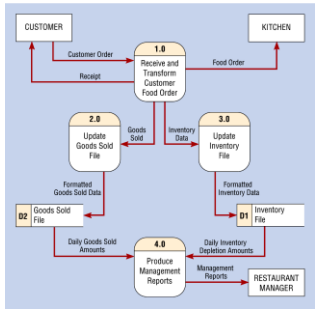
Level 1 Diagrams

- Shows all the processes that comprise a single process on the level 0 diagram
- Shows how information moves from and to each of these processes
- Shows in more detail the content of higher level process
- Level 1 diagrams may not be needed for all level 0 processes

Level-1 Diagram Showing Decomposition of Process 1.0 from the Level-0 Diagram



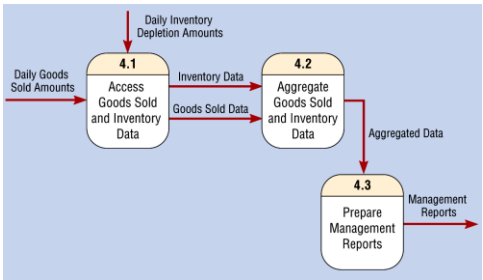
Level-0 DFD of Food Ordering System



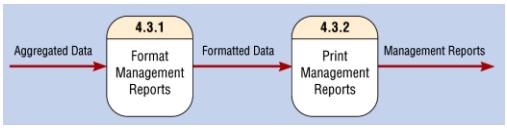
Level 2 Diagrams

- Shows all processes that comprise a single process on the level 1 diagram
- Shows how information moves from and to each of these processes
- Level 2 diagrams may not be needed for all level 1 processes
- Correctly numbering each process helps the user understand where the process fits into the overall system

Level-1 Diagram Showing the Decomposition of Process 4.0 from the Level-0 Diagram



Level-2 Diagram Showing the Decomposition of Process 4.3 from the Level-1 Diagram for Process 4.0



Data Flow Splits and Joins

- A data flow split shows where a flow is broken into its component parts for use in separate processes
- Data flow splits need not be mutually exclusive nor use all the data from the parent flow
- As we move to lower levels we become more precise about the data flows
- A data flow join shows where components are merged to describe a more comprehensive flow

Balancing DFD's

- Balancing involves ensuring that information presented at one level of a DFD is accurately represented in the next level DFD.

Validating the DFD

- Syntax errors
  - Assure correct DFD structure
- Semantics errors
  - Assure accuracy of DFD relative to actual/desired business processes
- User walkthroughs
- Role-play processes
- Examine lowest level DFDs
- Examine names carefully

THANK YOU