

# Documentation- Introduction and Physical DFDs

## Class # 2

**Recommendation: Bring colored pencils or highlighters of about 4 or 5 different colors to class today.**

Today, we will begin our discussion of systems documentation and will continue for the next four (including today) class periods. Today we will discuss the nature of systems documentation and why we do it. In addition, you will learn how to draw physical Data Flow Diagrams (DFDs) today and I will let you try to do one on your own. In Class# 3 I plan to discuss logical DFDs and go over Flowcharting. In Class#4, we will review all three documentation techniques.

- **Why study system documentation?**

For purposes of *this* class, the study of documentation will provide us with a means of communicating about system characteristics and how systems work. Documentation performs this same task for auditors and managers. In addition, documentation of the system allows the auditor to describe (as evidence of audit work) how the data in the financial statements is generated and to assess strengths and weaknesses of the generation process. In this way the auditor can more effectively target audit tests to areas in which the “system” is weak.

- **How do we document systems?**

There are different approaches to documentation for different accounting firms. They are not mutually exclusive. Usually a firm will combine several different approaches to documenting the system. Some approaches get at how the system works and the personnel involved in running it, some get at the logical relationships between different operating units, some get at the flow of documents through the system, and some are aimed at *assessing* strengths and weaknesses of the system. Below is a list of several approaches to documentation along with an assessment of what this approach focuses on.

### Narratives

Narratives describe in regular “English” what is going on in a system - who is doing what. Usually the accountant prepares the narrative by watching the individuals doing their job, and then interviewing them about what they do. It is important that the narrative be clearly written. Usually, it is better to write in short, simple sentences in active voice (unlike the sentence you are reading). The advantage to the narrative is that it is easy for anyone to understand; the disadvantage is that there is so much information in the narrative it is difficult to get an understanding from the narrative as to what is going on. Therefore we will also rely on diagrams (of various sorts).

**Data Flow Diagrams (DFDs)** DFDs are simple diagrams (only a few different kinds of symbols) which highlight a particular aspect of the system. For example one diagram might describe the data flows between individuals in the cash receipts process, another might describe the logical sequence of things which must be

done in this system, while another might give an overview of how the system interfaces with other systems (what data comes into the system - and from where and what data goes to other entities). The advantage of DFDs is their simplicity. Almost anyone can look at a DFD and get a feel for what is going on. Their disadvantage is that they are limited in how much information can be put into a single diagram (because they *are* simple).

#### Document Flowcharts

Flowcharts (with which you are probably familiar) are diagrams which show the activities performed and the flow of documents, goods, and information from entity to entity in a single diagram. They have many symbols and are much more complex than DFDs, but they are also more complete. Most (if not all) of the detail in the narratives is included on a document flowchart.

#### Checklists

There are certain characteristics of each system which you would expect to be true if the system is reliable. From experience, auditors have compiled lists of these characteristics. And from these lists, the auditors can create checklists. Note that the checklist is a means of assessing strengths and weaknesses. It is not really a description of the system.

#### Control Matrices

Like checklists, control matrices are means of evaluating systems. The matrix typically has columns representing different control objectives of the system and rows representing characteristics of the system. Cell entries identify matchups between characteristics of the system and objectives of the system.

In this class, we unfortunately cannot go too much into how narratives are constructed. Rather, we will work from narratives and prepare DFDs and flowcharts. Control matrices will be discussed in a later point in the course. We will begin with DFDs.

### • Data Flow Diagrams (DFDs)

There are three different types of DFDs: Context, Physical, and Logical. Context DFDs are diagrams which offer an overview of the system as it relates to other systems and/or entities: who sends data or documents into the system and what documents and data are generated by the system and sent outside of the system. Physical DFDs diagram the entities (departments, people, computers) within the system and what documents and data are sent between these entities in the system. Finally, logical DFDs outline the relationships between the various processes which are performed.

We shall begin with physical DFDs. The first stage in preparing physical DFDs (from a narrative) is to identify the internal and external entities. Next, activities are identified by verbs and numbered. As a rule of thumb, every verb should indicate an activity performed by some entity. I suggest that you identify and number all activities for one entity (even if they are in disjoint parts of the narrative) before moving to the next. Then, prepare a list of the activities. From the list of activities, you can prepare the physical DFD.

On the physical DFD, external entities will be represented by squares and internal entities will be represented by circles. The circles and squares need not be numbered. Files will be represented by two horizontal lines with the name of the file between the two lines. Draw an arrow from one entity to another to represent data going from the first entity to the second. If data comes back, that should be another arrow.

For file interactions, if information is being retrieved *from* a file and the file is not updated or modified, then an arrow should be drawn from the file to the entity. If the entity is creating a new file or is “logging” information into a file and *no standing data* in the file is being changed, then an arrow should be drawn from the entity to the file. Finally, if the file is being updated, a double-headed arrow between the file and the entity should be drawn. Note that if the file is a computer file, the arrow must be to/from the computer entity. All arrows on the physical DFD should be labeled.

In the overheads packet, we will go through several narratives and prepare physical DFDs for them.

Below are some guidelines for the preparation of physical DFDs. Guidelines 7-10 are for logical DFDs and will be provided with tomorrow's lecture.

### Drawing the Context Diagram

- Guideline 1. Include within the system context (bubble) any entity that performs one or more information processing activities.
- Guideline 2. Include only normal processing routines, not exception routines or error routines, on context diagrams, physical DFDs, and level 0 logical DFDs.
- Guideline 3. Include on the systems documentation all (and only) activities described in the system narrative-no more, no less.
- Guideline 4. When multiple entities operate identically, depict only one to represent all.

### Drawing the Current Physical Data Flow Diagram

- Guideline 5. For clarity, draw a data flow into and out of a file.
- Guideline 6. If a file is logically necessary (that is, because of a delay between processes), include a file in the diagrams, whether or not it is mentioned in the narrative.

### Summary of Drawing Data Flow Diagrams

- Guideline 11. A data flow should go to an operations entity square when only operations functions are to be performed by that entity. A data flow should enter a bubble if the operations entity is to perform an information processing activity.
- Guideline 12. On the physical DFD, the computer is an internal entity if it performs any activities. In addition, all peripheral devices are considered a part of this entity (and not separate entities).

Para	Line	Text
1	1	The Causeway Company uses the
	2	following procedures to process the cash
	3	received from credit sales. The mailroom
	4	receives checks and remittance advices from
	5	customers; a clerk endorses the checks
	6	and writes the amount paid and the check
	7	number on the remittance advice.
	8	Periodically, the mailroom clerk prepares a
	9	batch total of the remittance advices and
	10	sends the batch of remittance advices to
	11	accounts receivable along with a copy of
	12	the batch total. At the same time, the
	13	clerk sends the corresponding batch of
	14	checks to the cashier.
2	15	In accounts receivable, a clerk enters
	16	the batch into an online terminal by keying
	17	the batch total, the customer number, the
	18	invoice number, the amount paid, and the
	19	check number. After verifying that the
	20	invoice is open and that the correct amount
	21	is being paid, the computer posts the
	22	payment to the accounts receivable master
	23	file. If there are any discrepancies, the
	24	clerk is notified.
3	25	At the end of each batch (or at the
	26	end of the day), the computer prints a
	27	deposit slip in duplicate on the terminal
	28	in the cashier's office. The cashier
	29	compares the deposit slip to the
	30	corresponding batch of checks and then
	31	takes the deposit to the bank.
4	32	As they are entered, the check number
	33	and the amount paid for each transaction are
	34	logged on tape. This log is used to create
	35	a cash receipts listing at the end of each
	36	day. A summary of customer accounts paid
	37	that day is also printed at this time. The
	38	accounts receivable clerk compares the
	39	reports to the remittance advices and batch
	40	totals and sends the total of the cash
	41	receipts to the general ledger office.

# FoodWays, Inc.

## Sales Entry and Cash Receipts

Below are two brief narratives which describe the processing of sales using a scanner and the receipt and processing of checks by FoodWays grocery stores, a medium-sized chain of groceries in the midwest. The narrative ignores processing of sales for cash or for debit card and also ignores the processing of non-scannable items in order to simplify the documentation. Treat the *cash register* as a part of the computer (they are the same entity).

### *Part One - Sales Entry*

1 Prior to each transaction, the cashier at FoodWays enters a  
2 code into the cash register to let the cash register *know* that  
3 a *new* transaction is being processed. The cashier then  
4 receives items from the customer and scans the items into  
5 the computer.

6 The computer reads the bar code and finds the price and  
7 description information from the inventory file. The  
8 computer displays the item description and its unit price on  
9 an LED display on the register.

10 At the end of the transaction, the cashier enters a total key  
11 which tells the computer to total the transaction. The  
12 computer computes the total and displays the total on the  
13 LED display.

## 1 **ERA Restaurant Jobbers**

2  
3 *Background:* ERA Restaurant Jobbers employs several field  
4 representatives to service client restaurants in western Oregon.  
5 The representatives travel from restaurant to restaurant filling  
6 orders for many of the staple goods such as flour, sugar,  
7 condiments, vegetables, and so forth.

8  
9 *Narrative for DFDs:* From a client restaurant a representative will  
10 pick up a signed order sheet from the restaurant manager for the  
11 quantities desired of each item sold by ERA.

12 From his (her) car, the representative connects to ERA's order  
13 processing computer package using a laptop computer and a  
14 cellular phone. The representative enters the customer number into  
15 the computer; and then enters item numbers and quantities of each  
16 item requested.

17 The computer captures the customer number and order information  
18 and then reads the accounts receivable master file to verify that the  
19 customer has sufficient credit to allow the transaction. If the  
20 transaction is allowed, the computer then displays an approval  
21 screen on the representative's computer and records the sales  
22 information in a "sales order database" and prints two copies of the  
23 sales order on a laser printer in the representative's car.

24 The representative reconciles the printed sales order to the request  
25 he keyed in and then enters a code into the computer to execute the  
26 sales transaction. When the representative enters the code, the  
27 computer updates the sales order database and the accounts  
28 receivable master file to reflect the execution. The representative  
29 takes a copy of the sales order to the manager of the restaurant.

30  
31

## Documentation

Why do auditors pay such close attention to system documentation?

- It helps to understand the system - how it works.
- The auditor's documentation of the system provides a reference as well as a justification for the subsequent testing procedures undertaken in the audit. The documentation outlines and identifies the system of internal control, which in turn will guide the approach to the audit. EXAMPLE: "Mail clerk endorses checks" - with a weakness in internal control, a test of transactions might not be helpful.

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## Documentation (ctd)

- Some approaches to documentation:
  - Narratives
  - Data flow diagrams (DFDs)
  - Check lists
  - Data Dictionaries
  - Flow Charts
  - Control Matrices (not in your notes)
- DFDs
  - Symbols
  - Type (context, physical, logical)
  - Balance

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


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## Vocabulary of DFDs

	Context DFD	Physical DFD	Logical DFD
 Bubble	The System	Internal Entity	Process
 Square	External Entity	External Entity	External Entity
	N/A	File	File
	Data Flow	Data Flow	Data Flow or "connector"

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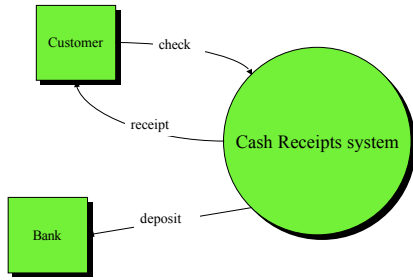
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*Context - bird's eye view*



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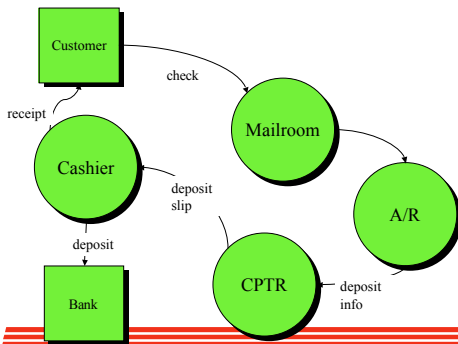
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*Physical - people*



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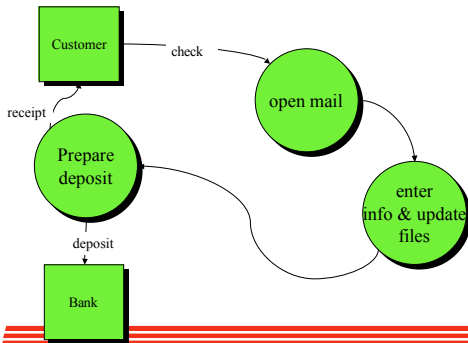
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*Logical - things you do*



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### Preparing Physical DFDs

- Identify internal and external entities
- Identify Activities
- Draw CIRCLES for internal entities and SQUARES for external entities
- Draw arrows between entities to represent data (either documents or other information going from one entity to another (or files))




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### Guidelines for DFDs

Drawing the Context Diagram

- Guideline 1. Include within the system context (bubble) any entity that performs one or more information processing activities.
- Guideline 2. Include only normal processing routines not exception routines or error routines, on all DFDs (that we will do)
- Guideline 3. Include on the systems documentation all (and only) activities described in the system narrative - no more, no less.
- Guideline 4. When multiple entities operate identically, depict only one to represent all.

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### Guidelines for DFDs

Drawing the Current Physical Data Flow Diagram

- Guideline 5. For clarity, draw a data flow for each flow into or out of a file.
- Guideline 6. If a file is logically necessary (that is, because of a delay between processes), include a file in the diagrams, whether or not it is mentioned in the narrative. DON'T worry about this one - for our class.

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## Guidelines for DFDs

### Summary of Drawing Data Flow Diagrams

Guideline 11. A data flow should go to an operations entity square when *only* operations functions are to be performed by that entity. A data flow should enter a bubble if the operations entity is to perform an information processing activity.

Guideline 12. On a physical DFD, reading computer files and writing to computer files must go through a computer bubble.



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## Table of Activities

### Entities and activities

Mailroom	1. Receives checks and remittance advices
	2. Endorses checks
	3. Annotates R/As
	4. Prepares batch total
	5. Sends batch of R/As to A/R
	6. Sends batch of checks to Cashier
Customer	
A/Rec	7. Enters the batch into online terminal (CPTR)
	8. Keys stuff into cptr
	9. Compares CPTR reports with R/As and batch totals
	10. Sends total of Cash Receipts (C/R) to G/L office
Cashier	11. Compares deposit slip with batch of cks
	12. Takes deposit to the bank
CPTR	13. Verifies open invoice and correct amt
	14. Posts payment to A/R master
	15. Notifies A/R clerk of errors
	16. Prints deposit slip
	17. Logs transactions
	18. Creates C/R listing
	19. Prints summary of cust. accts. paid
Bank	
G/L office	



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# Causeway

## Table of Activities

### Mailroom

1. Recieves checks and remittance advices
2. Endorses checks
3. Annotates R/As
4. Prepares batch total
5. Sends batch of R/As to A/R
6. Sends batch of checks to cashier

### Accounts Receivable

7. Enters the batch into an online terminal (CPTR)
8. Keys stuff into CPTR
9. Compares CPTR reports with R/As and batch totals
10. Sends total of Cash Receipts to G/L

### Cashier

11. Compares Deposit Slip with batch of checks
12. Takes deposit to the bank

### Computer

13. Verifies the invoice is open and the correct amount paid
14. Posts payment to A/R master
15. Notifies A/R clerk of errors
16. Prints deposit slip
17. Logs transactions
18. Creates C/R listing
19. Prints summary of customer accts paid

1,2,3,4,5,6,7,8,17,13,14,15,16,11,12,18,19,9,10

1.0  
Mailroom

2.0  
Accounts  
Receivable

3.0  
Cashier

4.0  
Computer

# Documentation- Logical DFDs

## Class # 3

**Recommendation: Bring colored pencils or highlighters of about 4 or 5 different colors to class today.**

Today, we will focus on the preparation of logical DFDs. Logical DFDs describe the relationships between the different processes. Basically, we take the list of activities, cross off some activities which “don’t fit” and then organize the remaining activities into groups which we will call processes. We then draw a diagram in which each bubble is a process and arrows relate to connections between the processes. An arrow can indicate that one process logically follows another or that there is some information flow from process to process.

Every external entity on the physical DFD must also be on the logical DFD. In addition, every arrow to or from an external entity on the physical DFD must also appear on the logical DFD and it should be labeled the same as in the physical DFD. Except for arrows to and from external entities, no other arrows on the logical DFD need be labeled.

Now we will go through the steps in preparing a logical DFD from a narrative and a physical DFD. Start with the list of activities prepared for the physical DFD. Cross off all activities which are sends, receives, forwards, takes, etc. because these are not activities where information is actually being processed. This does not mean that we will ignore these activities, just that we will not group them. Next, try to sort the transactions chronologically. Then try to make cuts at points where there is a logical distinction between one activity and the next in the chronologically sorted list. Try for 5-7 bubbles (3-4 for this class - since our narratives are quite a bit simpler). Draw the circles, squares, and files and draw the appropriate arrows to/from external entities and *label* them! Then connect the remaining circles and circles to files by arrows which indicate sequencing (to the extent it can be determined). Arrows to/from files should relate to the processes in which the activities are for file access (an example will really help here).

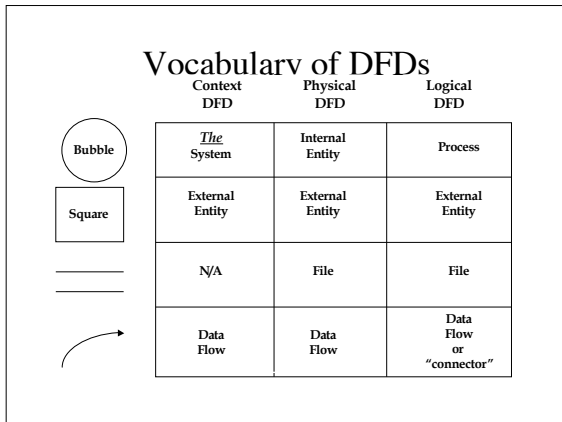
Below are the remaining guidelines for drawing logical DFDs. We will continue with the narratives from the last class period.

### Drawing the Current Logical Data Flow Diagram

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- Guideline 7. Group activities if they occur in the same place and at the same time.
- Guideline 8. Group activities if they occur at the same time but in different places.
- Guideline 9. Group activities that seem to be logically related, in order to eliminate single-activity bubbles whenever possible.
- Guideline 10. To make the DFD readable, (try to) use between five and seven bubbles.
- Guideline 13. On logical DFDs, never draw an arrow from a higher numbered bubble to a lower numbered bubble.

## Vocabulary of DFDs




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## Guidelines for DFDs

### Drawing the Current Logical Data Flow Diagram

- Guideline 7. Group activities if they occur in the same place and at the same time.
- Guideline 8. Group activities if they occur at the same time but in different places.
- Guideline 9. Group activities that seem to be logically related.
- Guideline 10. To make the DFD readable, (try to) use between five and seven bubbles. For our class, try to use between three and four bubbles.

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## Guidelines for DFDs

### Summary of Drawing Data Flow Diagrams

- Guideline 11. A data flow should go to an operations entity square when *only* operations functions are to be performed by that entity. A data flow should enter a bubble if the operations entity is to perform an information processing activity.
- Guideline 12. On a physical DFD, reading computer files and writing to computer files must go through a computer bubble.
- Guideline 13. On a logical DFD, data flows cannot go from higher to lower numbered bubbles.

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## Preparing Logical DFDs

Take the list of activities and **lightly CROSS OFF** all send and receive activities (including forward, take, etc.)  
**List activities chronologically and group activities where it feels good!**  
**CONSTRUCT** the Logical DFD!



### Three Hints:

- 1) There should be 3 to 5 bubbles.  
Likely candidates include capture, record, reconcile, update, and output. **Actually, I will give you these.**
- 2) Never have an arrow from a higher numbered bubble to a lower numbered bubble.
- 3) External entities and dataflows are exactly the same as in the physical DFD.

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## Preparing Logical DFDs

- *Crossing off sends and receives does not mean that we will ignore them. They just won't be inside a process bubble.*
- *The easiest way to group activities is to write down the activity numbers in chronological order and find natural "breaks" in the process.*

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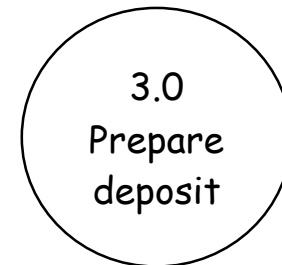
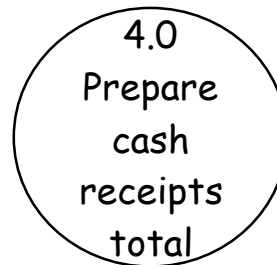
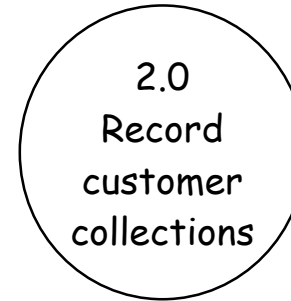
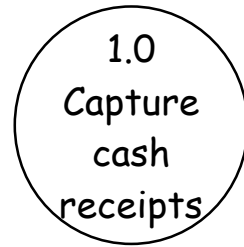
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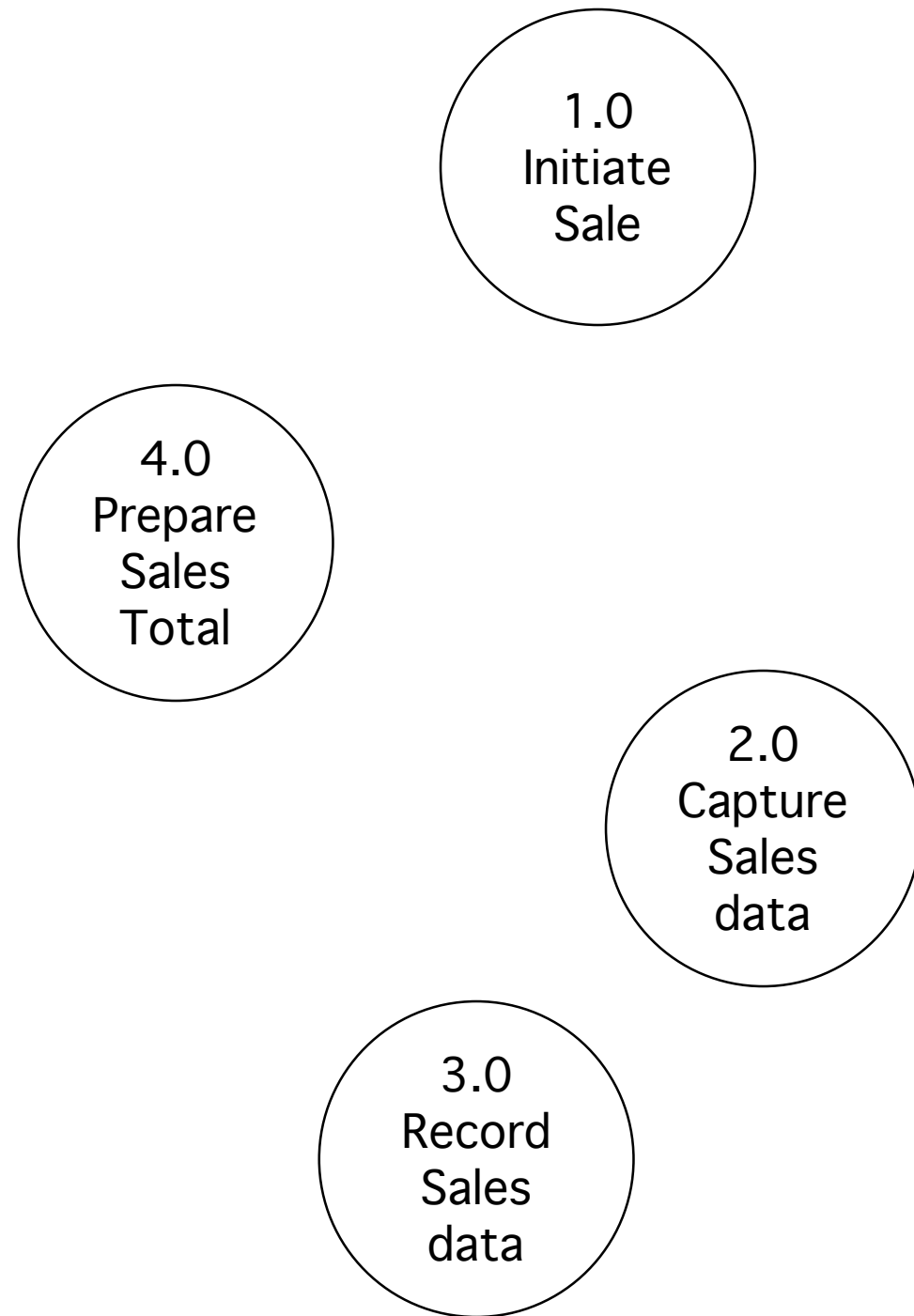
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Causeway  
Logical  
DFD

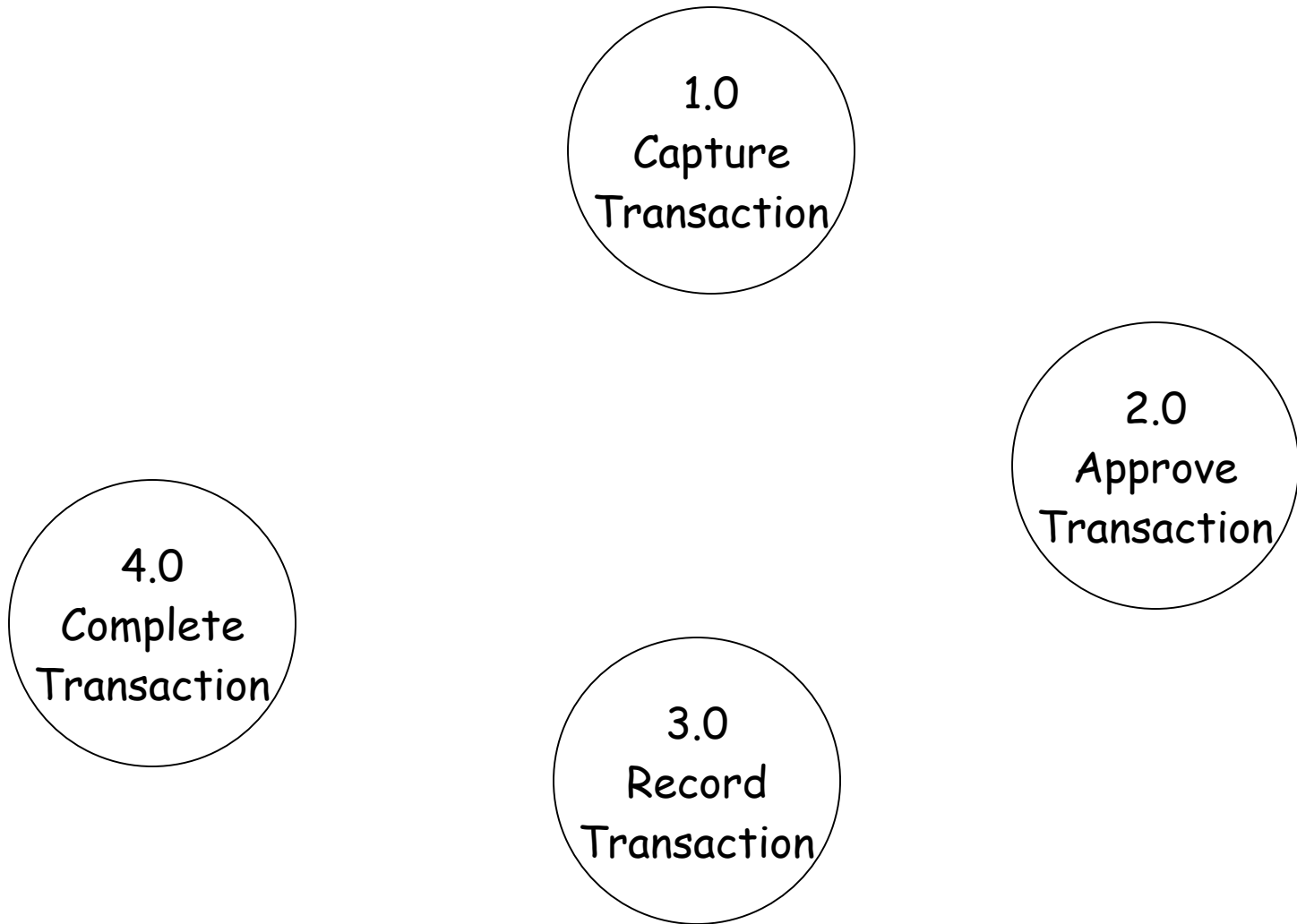




Foodways 1  
Logical  
DFD



ERA I  
Logical  
DFD



# Documentation- Flowcharts

## Class # 4

**Recommendation:** Bring colored pencils or highlighters of about 4 or 5 different colors to class today (just in case - they aren't really necessary for flowcharts).

Today, we will go through the preparation of flowcharts from narratives, physical DFDs and logical DFDs. Using the method outlined in class this activity is really quite simple.

Begin by drawing the flowchart grid. That is one line across at the top of the page and vertical lines to separate each *internal entity*. In other words, you must create a *column* for each internal entity. Label the column with the name of the internal entity above the horizontal line (*Hint: look at the list of activities. If an entity has a lot of activities, give it a fat column; if it only has a few activities, give it a skinny column*). Every activity in your list of activities for the logical DFD which was not crossed off must either have one of three symbols: a trapezoid if a person is doing it, a rectangle if a computer is doing it, or a keyboard if it is keyboard input into a computer **or** it must be a data flow to or from a file.

Every document which is prepared should appear and, if it is sent to another entity, it must appear in *both* places.

It is frequently helpful (I do it all the time) to use “on-page connectors” rather than drawing lines all over the diagram.

Symbols are connected with arrows which typically travel only horizontally and vertically (never at angles if you can help it). All file interactions should have heads on the arrows. In addition, if the arrow ever travels up or to the left, it must have a head on it. Otherwise, it makes a cleaner diagram to not put arrow heads on the arrows.

The rest of flowcharting is best presented by the lecture (and overhead) materials.




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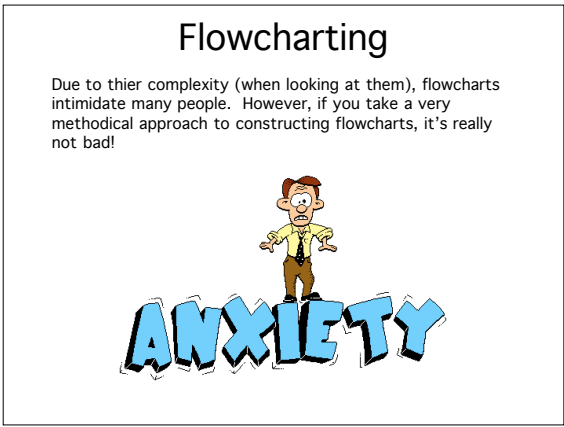
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### Flowcharting methodical approach

**Step One:** For each *INTERNAL ENTITY* in your physical DFD, create a heading and flowchart column.

Note that there is one column created for each of the internal entities in the Causeway narrative

Mailroom      Acct. Rec      CPTR      Cashier

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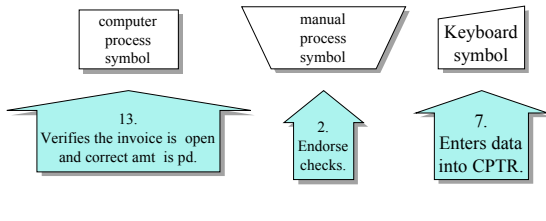
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## Flowcharting methodical approach

**Step Two:** Flowchart each *activity* - one by one! For each activity (other than a send or receive) draw a computer process symbol rectangle, a manual process symbol trapezoid, or a keyboard for "keyed" in information.




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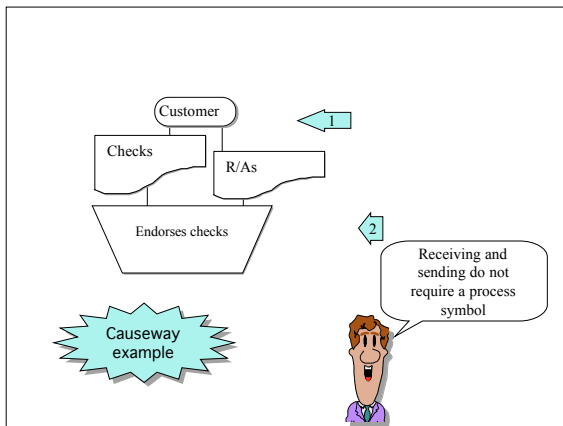
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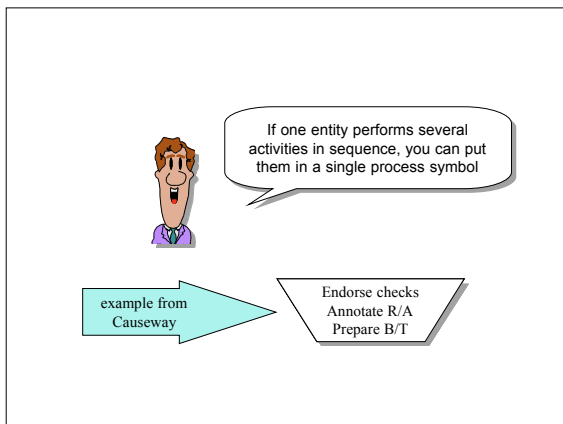
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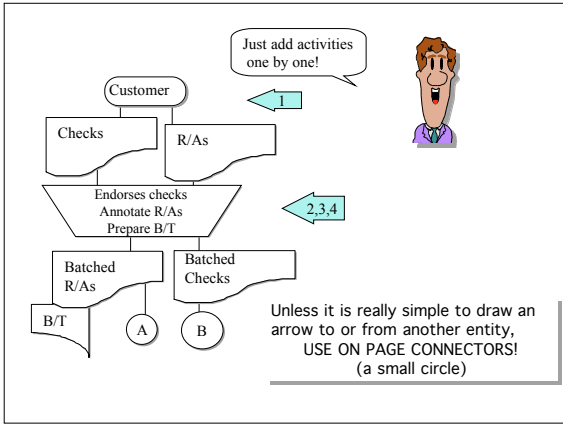
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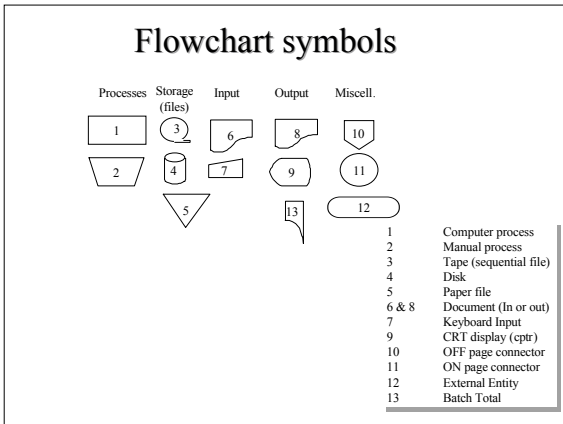
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Mailroom

1. Receives checks and remittance advices
2. Endorses checks
3. Write amt paid and ckt# on R/A
4. Prepare B/T
5. Send batch of R/As and B/T to *Acct Rec* clerk
6. Send batch of cks to *Cashier*

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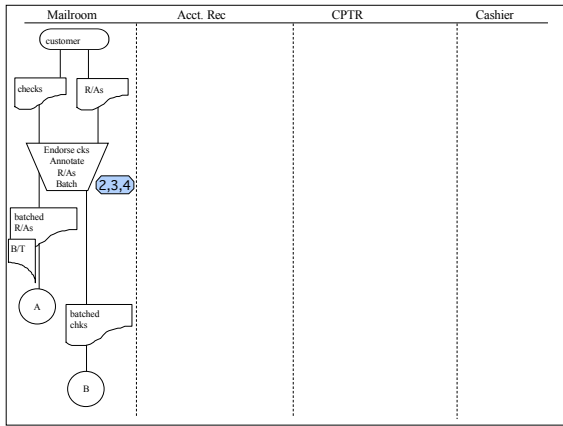
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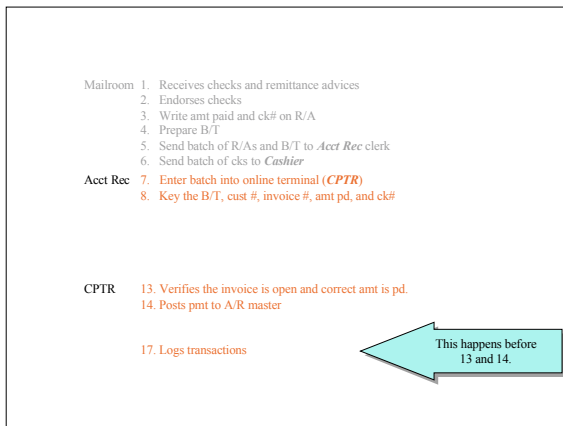
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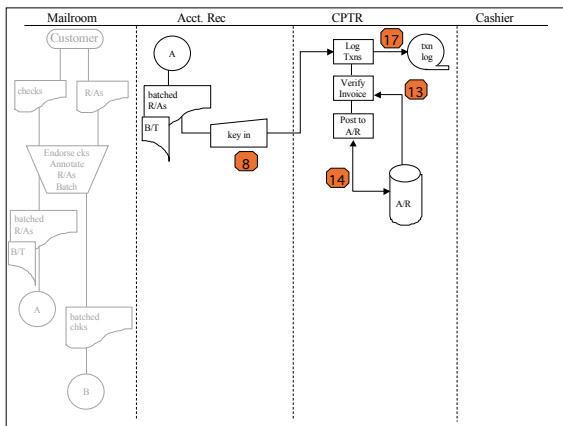
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- Mailroom**
  1. Receives checks and remittance advices
  2. Endorses checks
  3. Write amt paid and ck# on R/A
  4. Prepare B/T
  5. Send batch of R/As and B/T to *Acct Rec* clerk
  6. Send batch of cks to *Cashier*
- Acct Rec**
  7. Enter batch into online terminal (*CPTR*)
  8. Key the B/T, cust #, invoice #, amt pd, and ck#
- Cashier**
  11. Compares deposit slip w/ batch of cks
  12. Takes deposit to the bank.
- CPTR**
  13. Verifies the invoice is open and correct amt is pd.
  14. Posts pmt to A/R master
  16. Prints deposit slip (at printer in *Cashier* office)
  17. Logs transactions

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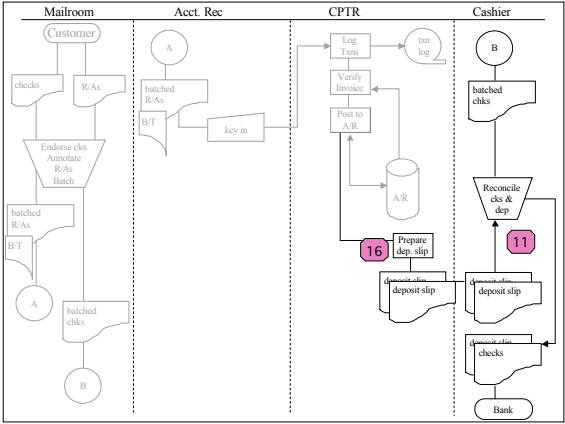
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- Mailroom**
  1. Receives checks and remittance advices
  2. Endorses checks
  3. Write amt paid and ck# on R/A
  4. Prepare B/T
  5. Send batch of R/As and B/T to *Acct Rec* clerk
  6. Send batch of cks to *Cashier*
- Acct Rec**
  7. Enter batch into online terminal (*CPTR*)
  8. Key the B/T, cust #, invoice #, amt pd, and ck#
  9. Compare CPTR reports w/ R/As & B/T
  10. Send total of C/R to G/L office
- Cashier**
  11. Compares deposit slip w/ batch of cks
  12. Takes deposit to the bank.
- CPTR**
  13. Verifies the invoice is open and correct amt is pd.
  14. Posts pmt to A/R master
  16. Prints deposit slip (at printer in *Cashier* office)
  17. Logs transactions
  18. Creates C/R listing
  19. Prints summary of customer accts paid

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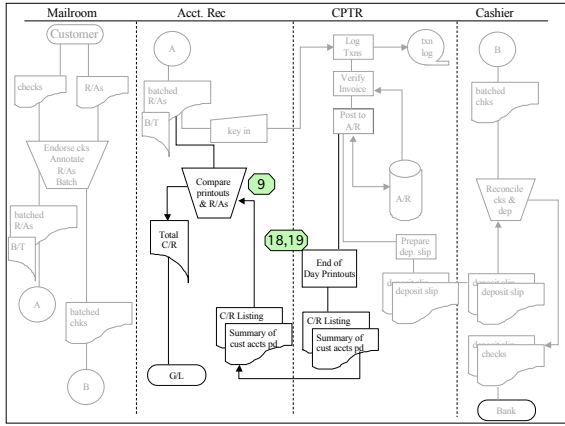
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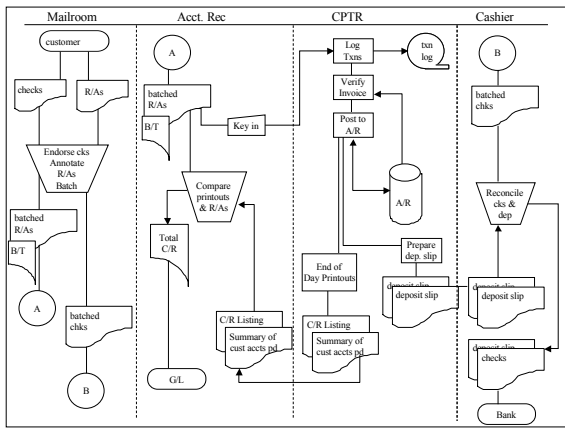
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## **AmeriComp**

### *Background*

AmeriComp industries manufactures specialized PC components and sells them to other businesses. Customers may send Purchase Orders using either the Web or the regular mail. AmeriComp processes these identically. The following narrative describes their order-entry process.

### *Narrative*

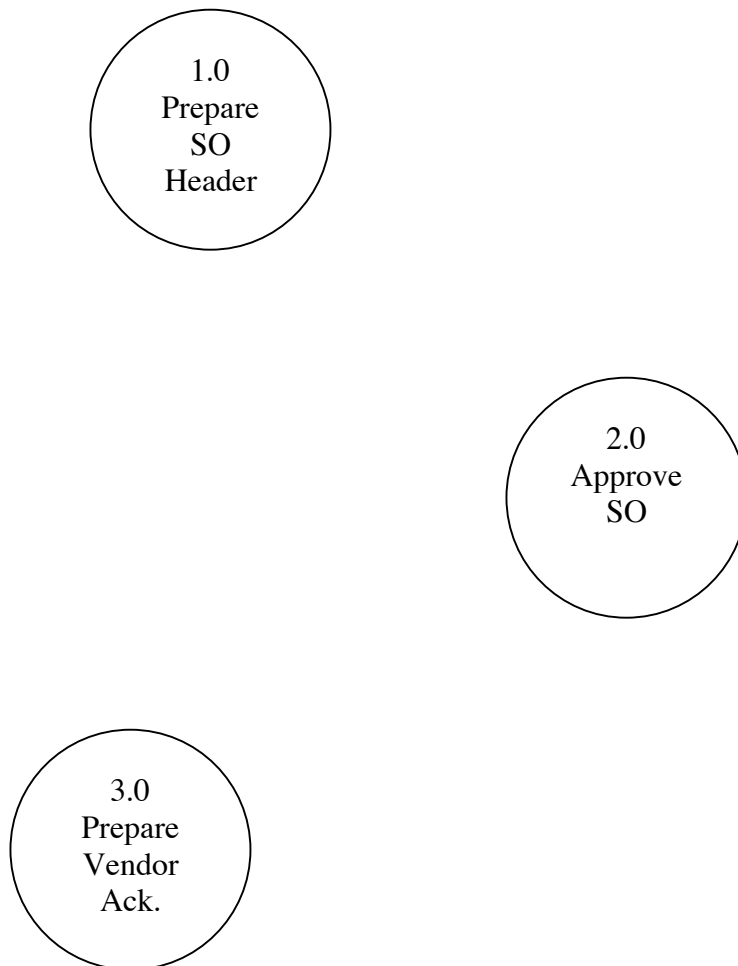
The order-entry clerk at AmeriComp receives a purchase order (PO) from a customer. The clerk enters the customer number into an online terminal. The clerk then enters the quantity and item numbers requested. The computer checks the inventory file and prints a Sales Order Header on the printer in the order-entry clerk's office. The order entry clerk reconciles the Sales Order Header to the PO and forwards the Sales Order Header to Accounts Receivable.

The clerk in Accounts Receivable reviews the Sales Order Header and checks the customer file. The Accounts Receivable clerk then approves the Sales Order Header (by initialing the approval box - the approved Sales Order Header is now called a Sales Order).<sup>1</sup> The Accounts Receivable clerk copies the approved Sales Order and forwards the copy to the Shipping department. The Accounts Receivable clerk forwards the original Sales Order to the order-entry clerk. The order-entry clerk prepares a vendor acknowledgement and sends it to the customer. The clerk then files the Sales Order and Purchase Order together in a Sales-Pending File.

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<sup>1</sup> Don't diagram the information in the parentheses.

## Logical DFD for AmeriComp



## ERA II

Each day, the computer at ERA reads the Sales Order Database, checks the inventory master file for availability, and prints a copy of each sales order in the sales manager's office, a picking ticket in the warehouse, a sales order notification in the accounts receivable office, and a packing slip in the loading dock.

The warehouse clerks then use the picking ticket to pick the goods and record the amount picked on the picking ticket. The warehouse clerk then sends the goods and the picking ticket to the loading dock where the shipping clerk reconciles the picking ticket and packing slip and prepares a bill of lading. The shipping clerk then attaches a packing slip to the goods and ships the goods via a common carrier. The shipping clerk then keys in the sales order number on a terminal at the loading dock and enters a code to indicate that the goods have been shipped. The computer then notifies the Inventory management (the Inventory system) and Accounts Receivable (the BARCR system) departments of the shipment and updates the Sales Order Database to reflect the shipment.

Logical DFD for ERA II

