# Data flow diagram (DFD)

# Dataflow Diagram (DFD)

- **Definition:**

  It is a process model used to depict the flow of data through a system and the work or processing performed by the system. Synonyms are bubble chart, transformation graph, and process model.

- It is also called process models.

- The DFD has also become a popular tool for business process redesign

# Differences Between DFDs and Flowcharts

- Processes on DFDs can operate in parallel (at-the-same-time)
  - Processes on flowcharts execute one at a time
- DFDs show the flow of data through a system
  - Flowcharts show the flow of control (sequence and transfer of control)
- Processes on a DFD can have dramatically different timing (daily, weekly, on demand)
  - Processes on flowcharts are part of a single program with consistent timing

# Why DFD

Provides an overview of

- What data a system processes
- What transformations are performed
- What data are stored
- What results are produced and where they flow
- Graphical nature makes it a good communication tool between
  -User and analyst
  -Analyst and System designer
- Structure of DFD allows starting from a broad overview and expand it to a hierarchy of detailed diagrams

# External agent

**External agent** – an outside person, unit, system, or organization that interacts with a system. Also called an *external entity*.

- External agents define the "boundary" or scope of a system being modeled.
- As scope changes, external agents can become processes, and vice versa.
- Almost always one of the following:
  - Office, department, division.
  - An external organization or agency.
  - Another business or another information system.
  - One of system's end-users or managers
- Named with descriptive, singular noun

Gane and Sarson shape

DeMarco/Yourdon shape

# Data stores

**Data store** – stored data intended for later use. Synonyms are *file* and *database*.

- Frequently implemented as a file or database.
- A data store is "data at rest" compared to a data flow that is "data in motion."
- Almost always one of the following:
  - Persons (or groups of persons)
  - Places
  - Objects
  - Events (about which data is captured)
  - Concepts (about which data is important)
- Data stores depicted on a DFD store all instances of data entities (depicted on an ERD)
- Named with plural noun

Gane and Sarson shape

DeMarco/Yourdon shape

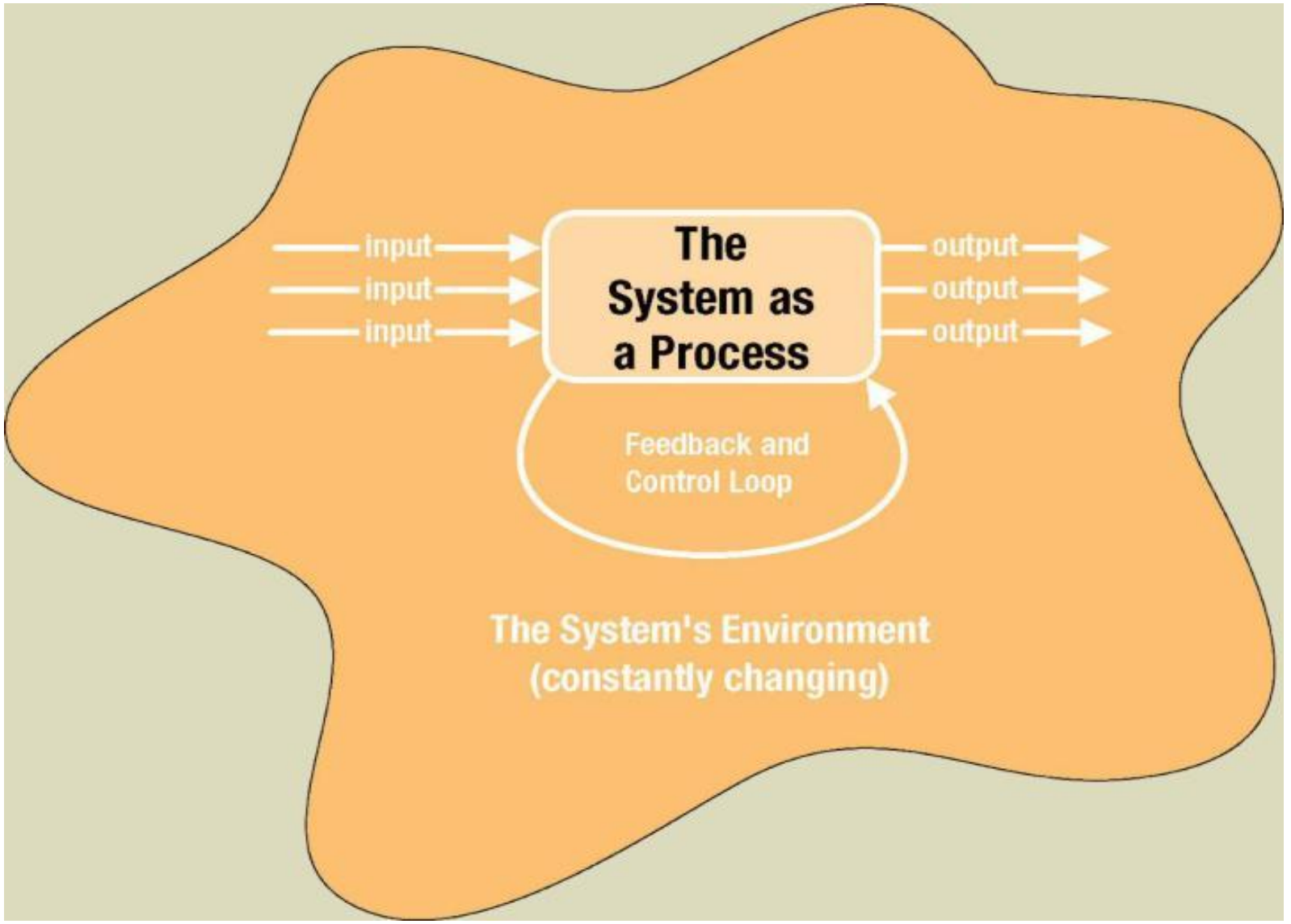
# Process Concepts

**Process** – work performed by a system in response to incoming data flows or conditions. A synonym is *transform*.

- All information systems include processes - usually many of them
- Processes respond to business events and conditions and transform data into useful information
- Modeling processes helps us to understand the interactions with the system's environment, other systems, and other processes.
- Named with a strong action verb followed by object clause describing what the work is performed on/for .

Gane and Sarson shape

# The System is Itself a Process



# Flows of data in the system can take place :

- Between 2 processes
- From a data store to a process.
- From a process to data store
- From a source to a process; and
- From a process to a sink

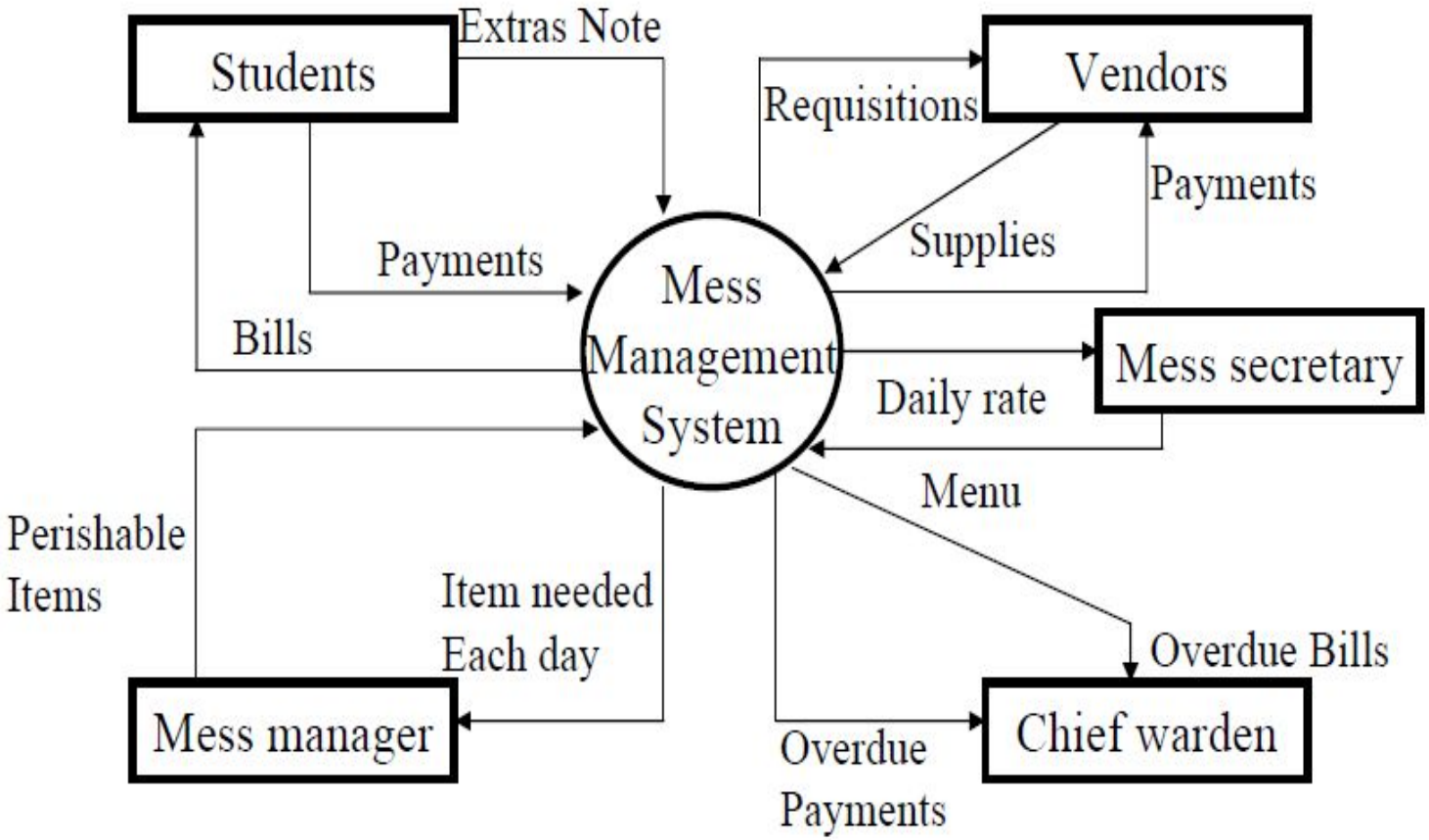
# Good Style in drawing DFD

- Use meaningful names for data flows, processes and data stores.
- Use top down development starting from context diagram and successively leveling DFD
- Data stores cannot create new data.
- Only previously stored data can be read.
- A process can only transfer input to output. It cannot create new data.

# Describing a System with DFD

- An entire system is represented by one DFD which gives the system's overview.
- It is called a context diagram.
- It gives little detail & is also known as the top level DFD

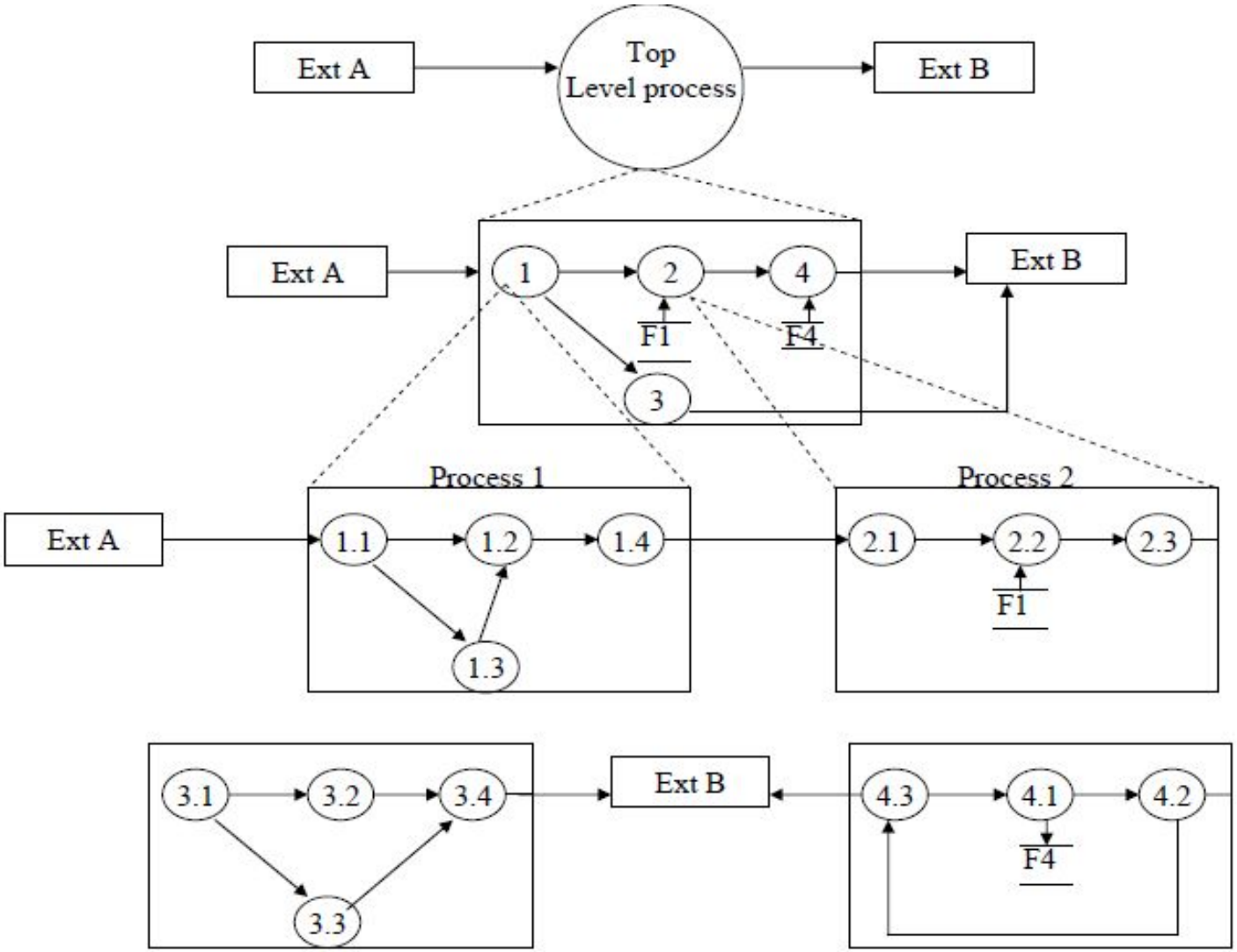
# Describing a System with DFD



# Leveling DFD

- A context diagram gives an overview
- It should be split into major processes which give greater detail.
- Each major process is further split to give more detail.

# LEVELING DFD



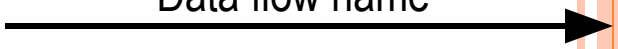
# Why Level DFD

- If a DFD is too detailed it will have too many data flows and will be large and difficult to understand.
- Start from a broad overview. Expand to details -Idea similar to using procedures and linking these with a main program.
- Each DFD must deal with one aspect of a big system

# Data Flows & Control Flows

**Data flow** – data that is input to or output from a process.

- A data flow is data in motion
- A data flow may also be used to represent the creation, reading, deletion, or updating of data in a file or database (called a data store).



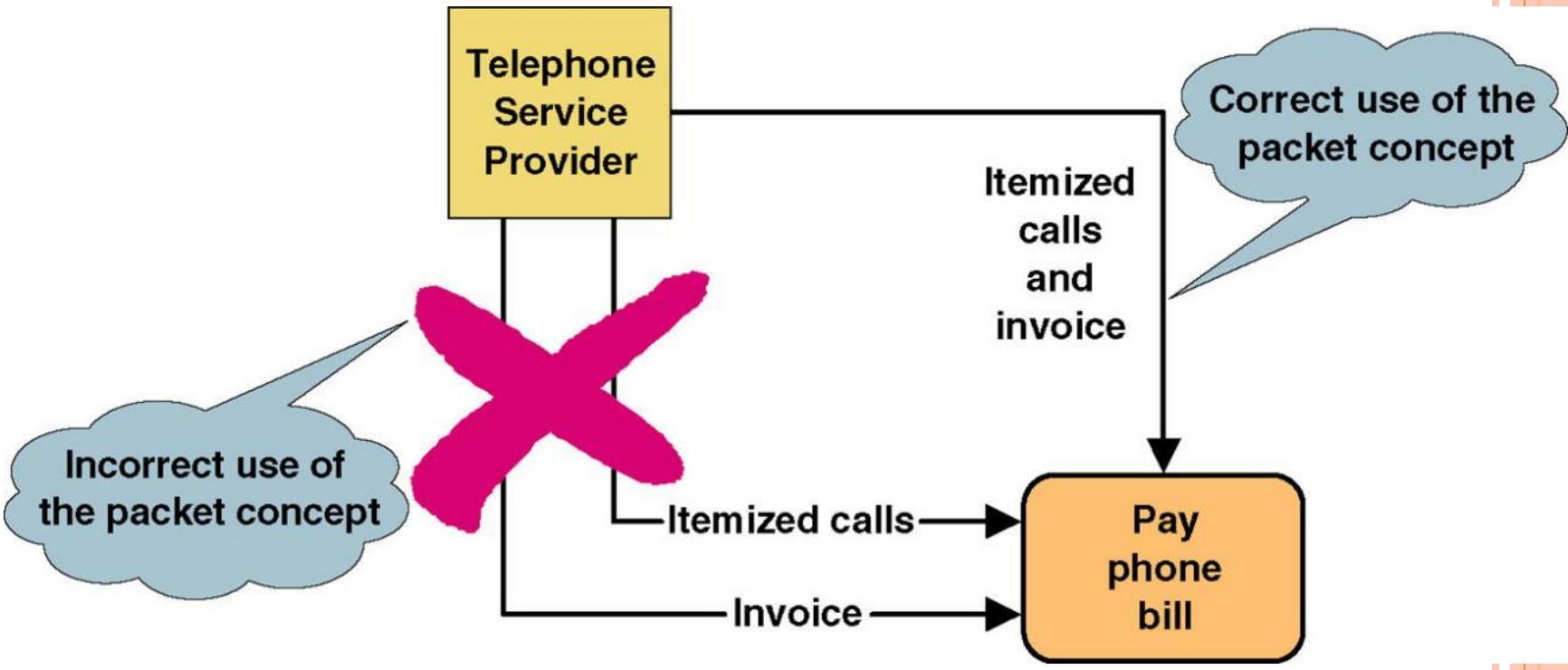

**Composite data flow** – a data flow that consists of other data flows.

**Control flow** – a condition or nondata event that triggers a process.

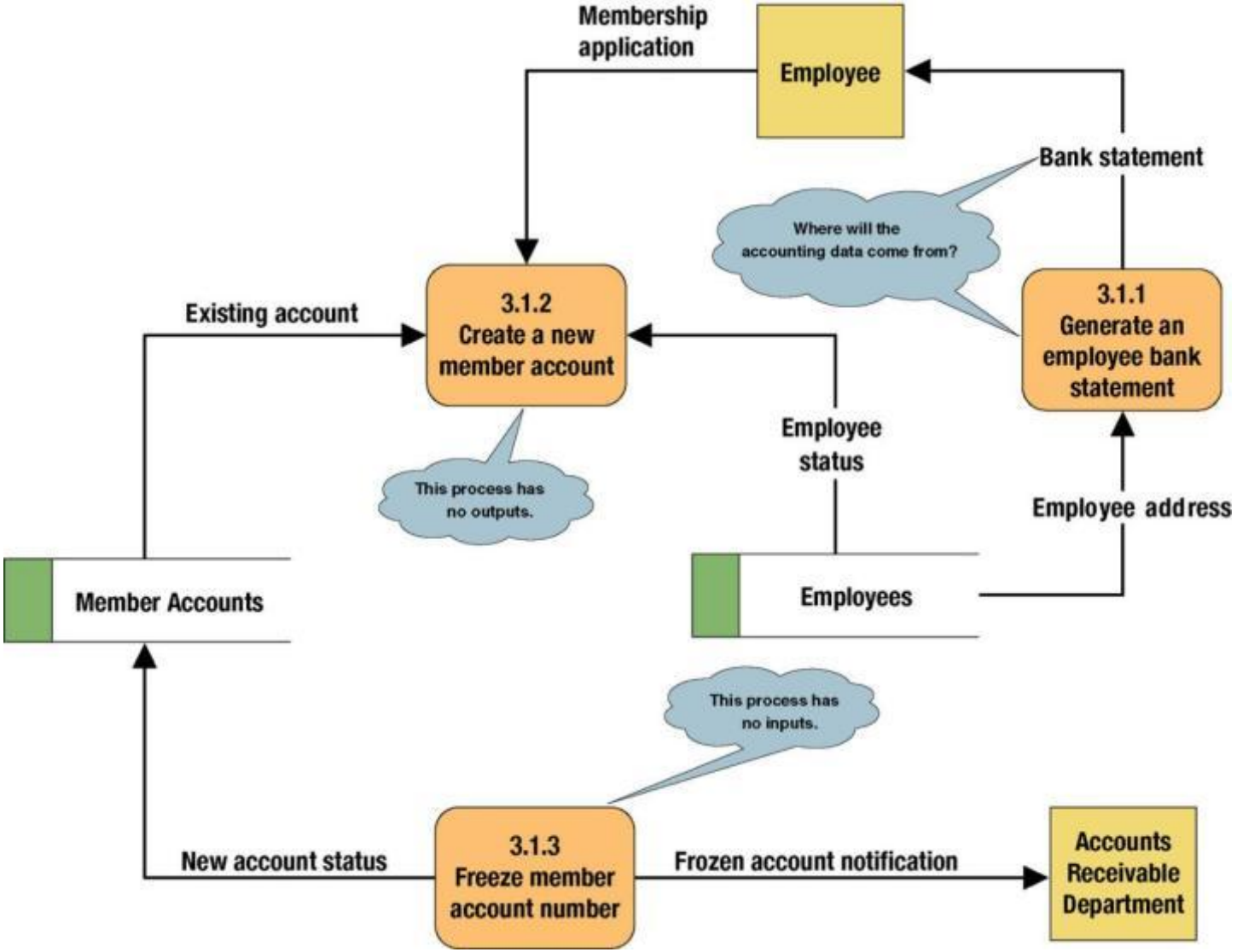
- Used sparingly on DFDs.

# Data Flow Packet Concept

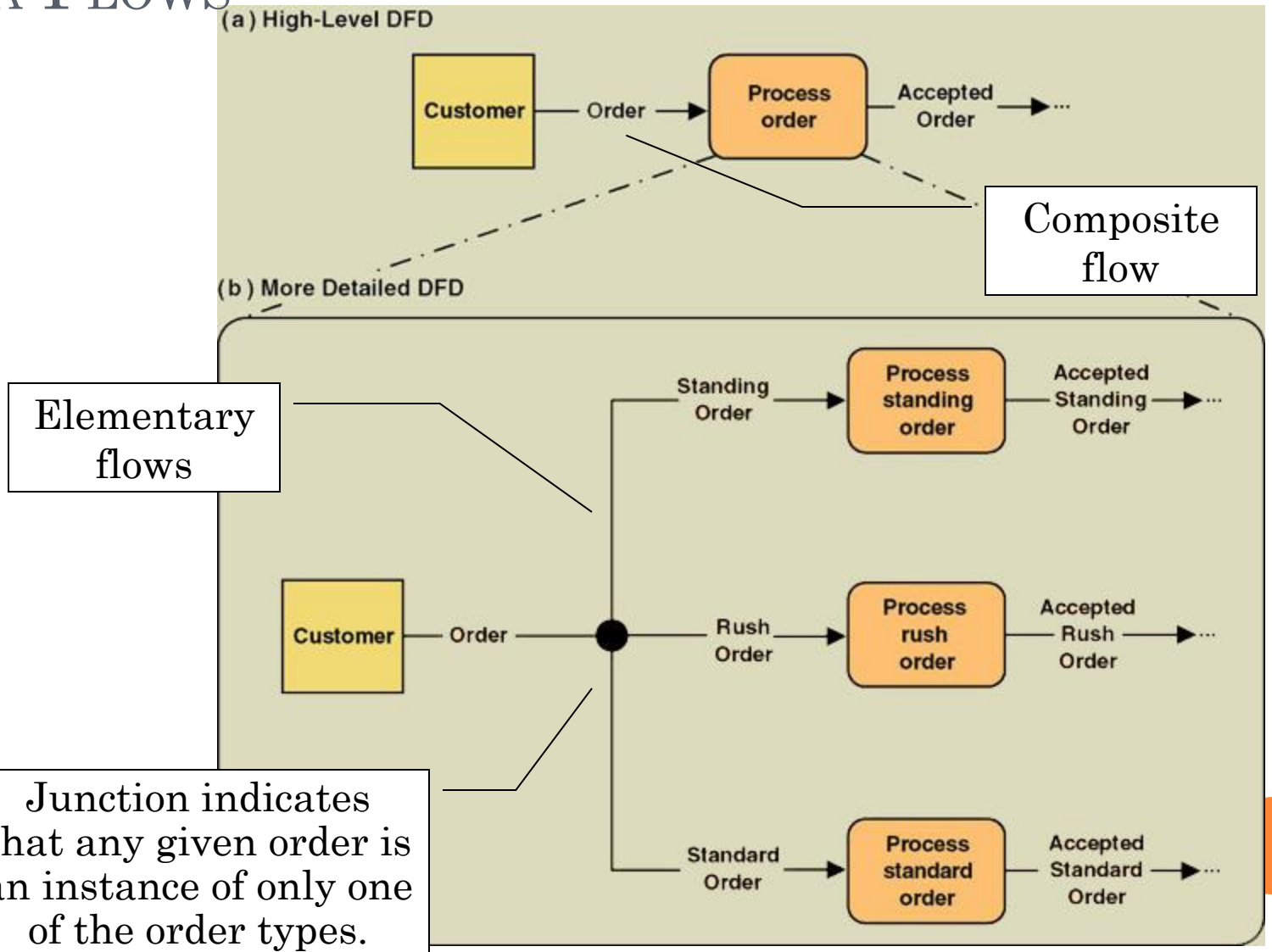
- Data that should travel together should be shown as a single data flow, no matter how many physical documents might be included.



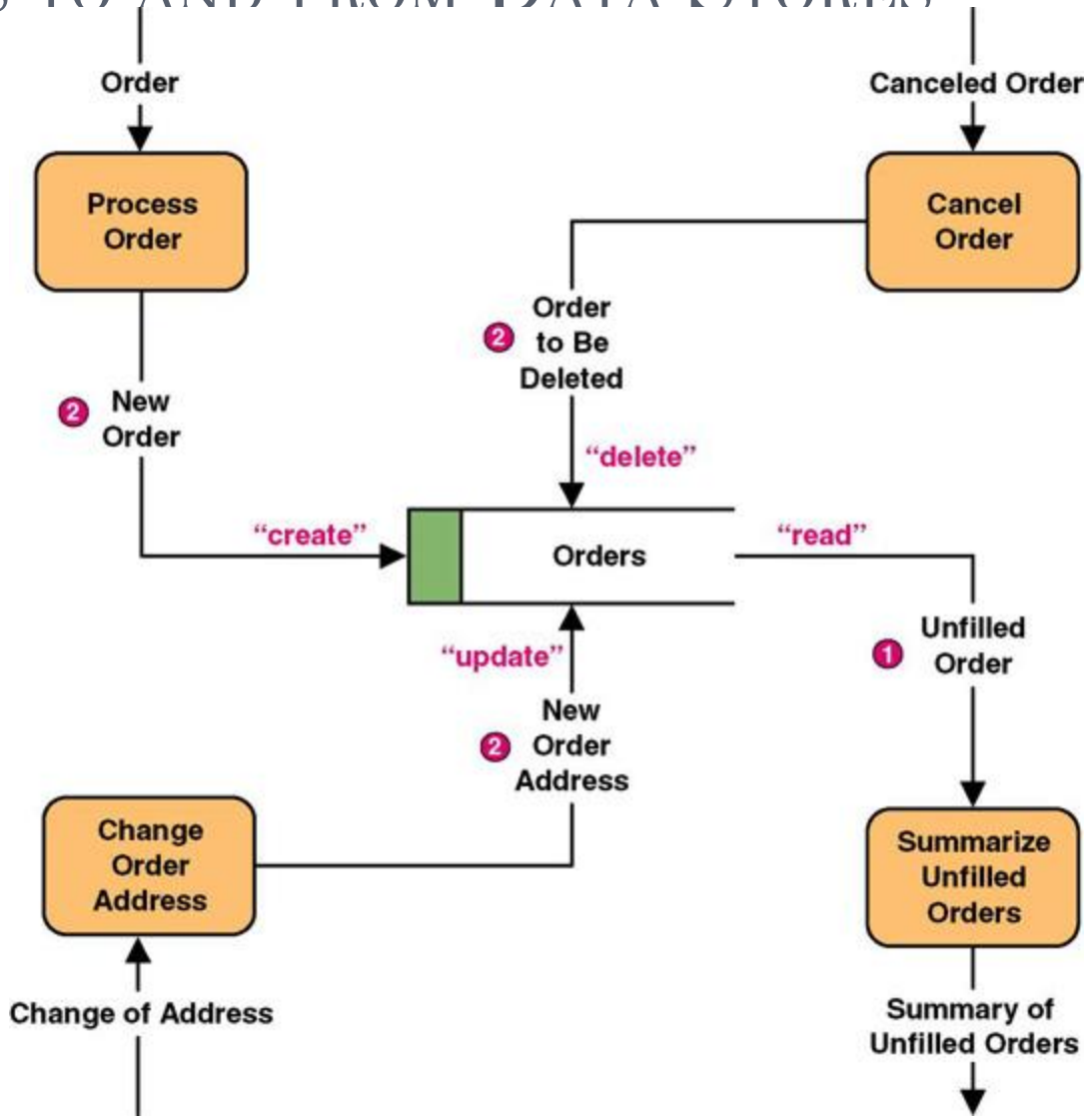
# Common Process Errors on DFDs



# Composite and Elementary Data Flows

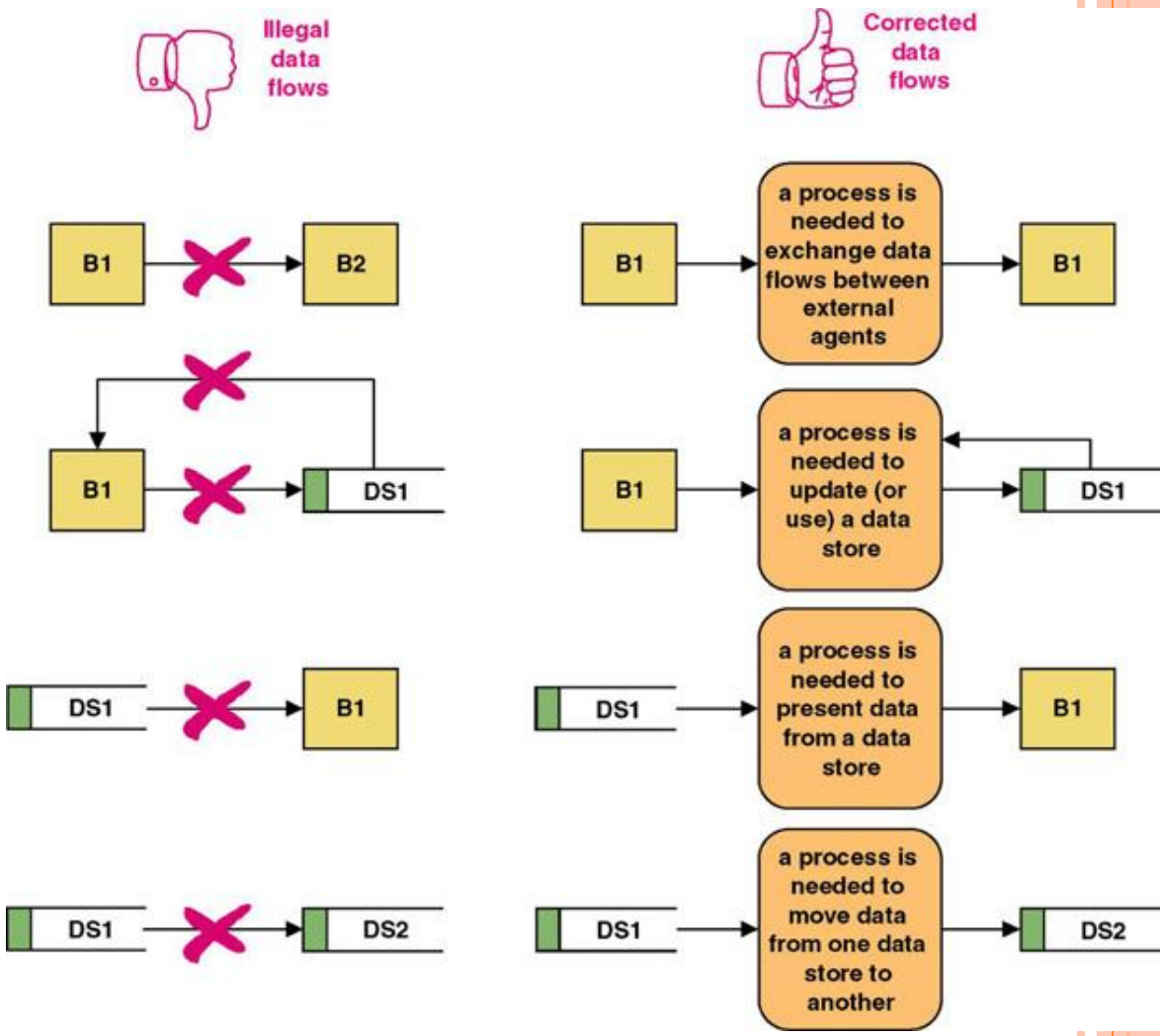


# Data Flows to and from Data Stores



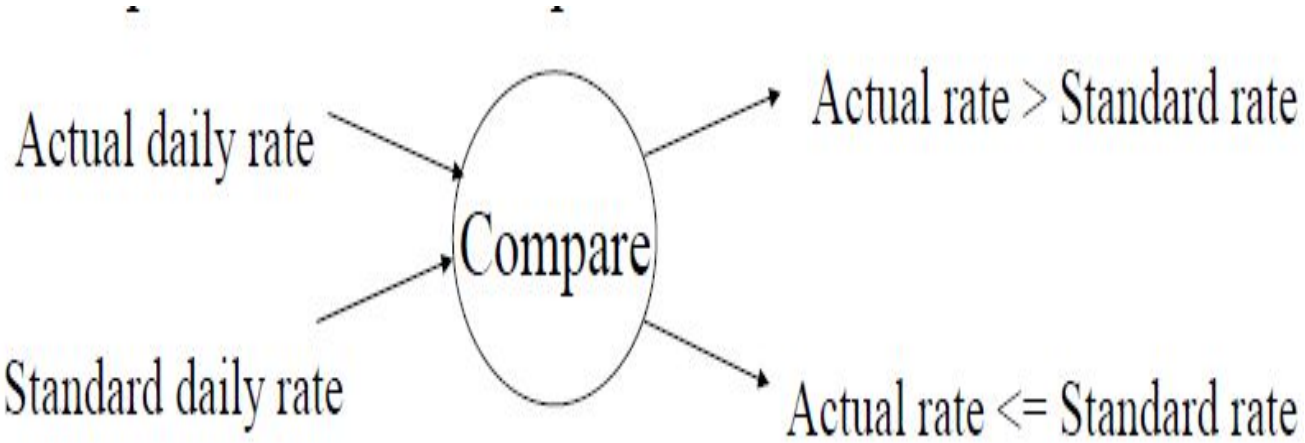
# Rules for Data Flows

- A data flow should never go unnamed.
- In logical modeling, data flow names should describe the data flow without describing the implementation
- All data flows must begin and/or end at a process.



# Illegal Constructs in DFD

- No loops are allowed in DFD
- A process cannot be a pure decision



# Illegal Constructs in DFD

- A single data flow should not be split into many flows with different labels.
- No data flow allowed between data stores.

# Diverging and Converging Data Flows

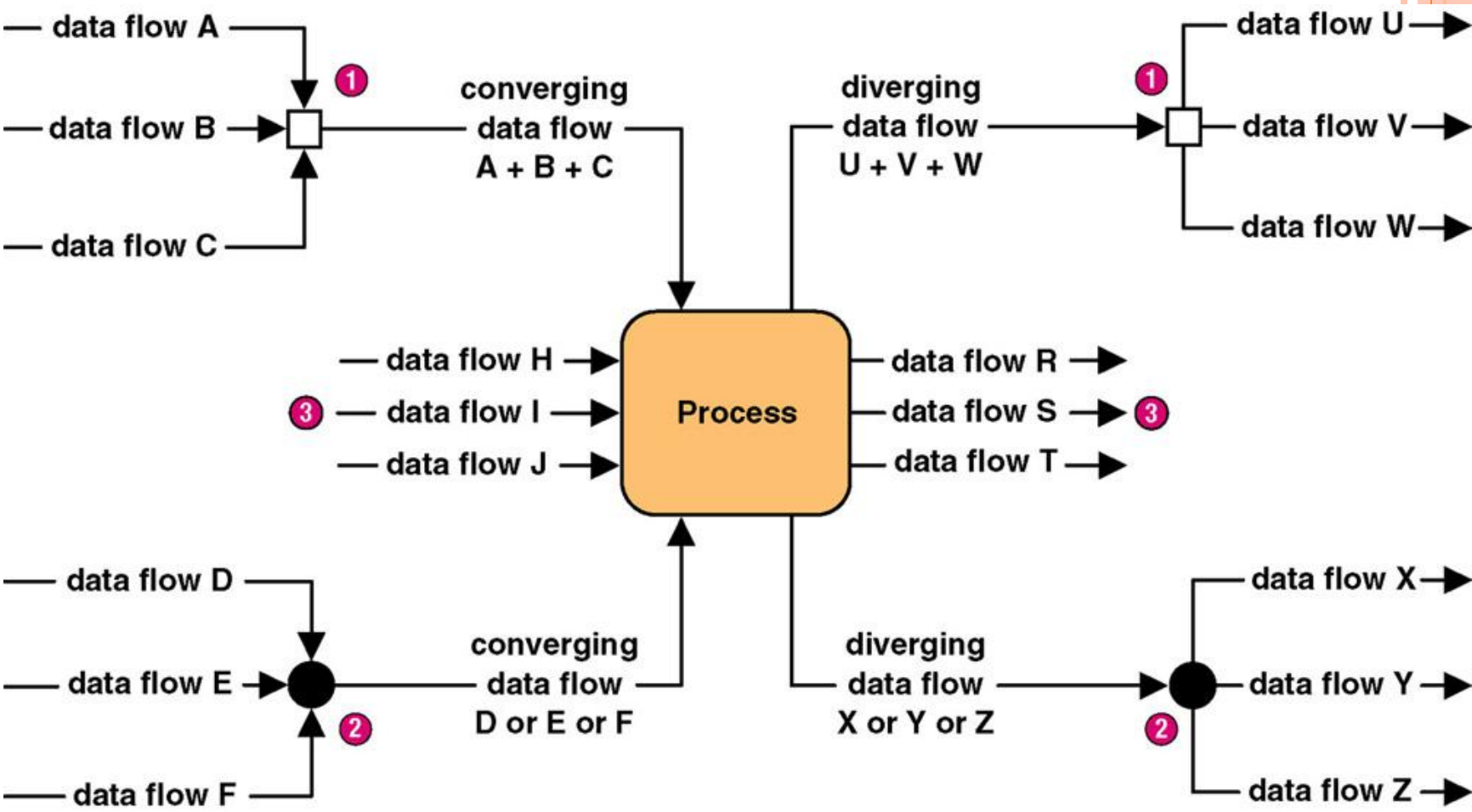
**Diverging data flow** – a data flow that splits into multiple data flows.

- Indicates data that starts out naturally as one flow, but is routed to different destinations.
- Also useful to indicate multiple copies of the same output going to different destinations.

**Converging data flow** – the merger of multiple data flows into a single packet.

- Indicates data from multiple sources that can (must) come together as a single packet for subsequent processing.

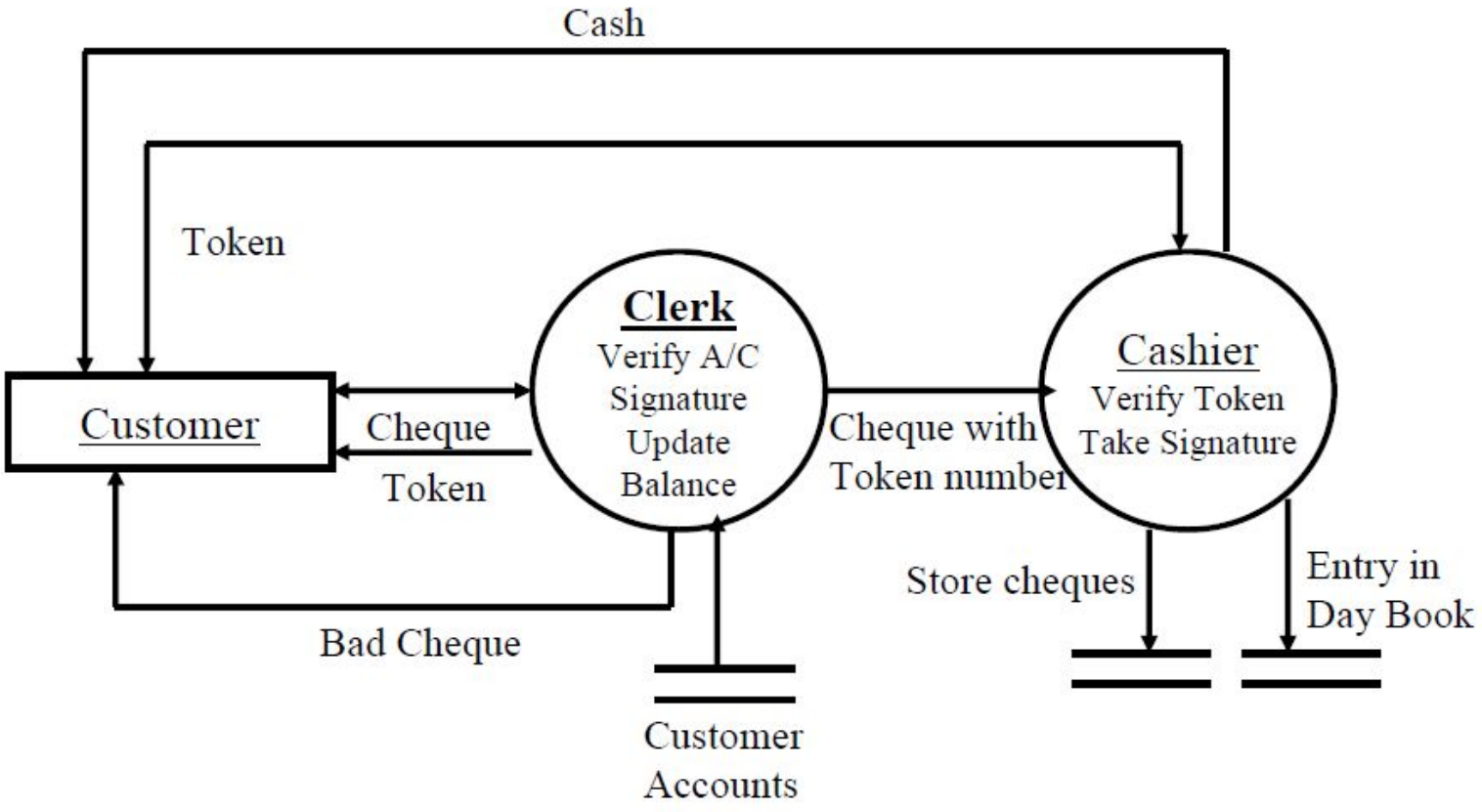
# Diverging and Converging Data Flows



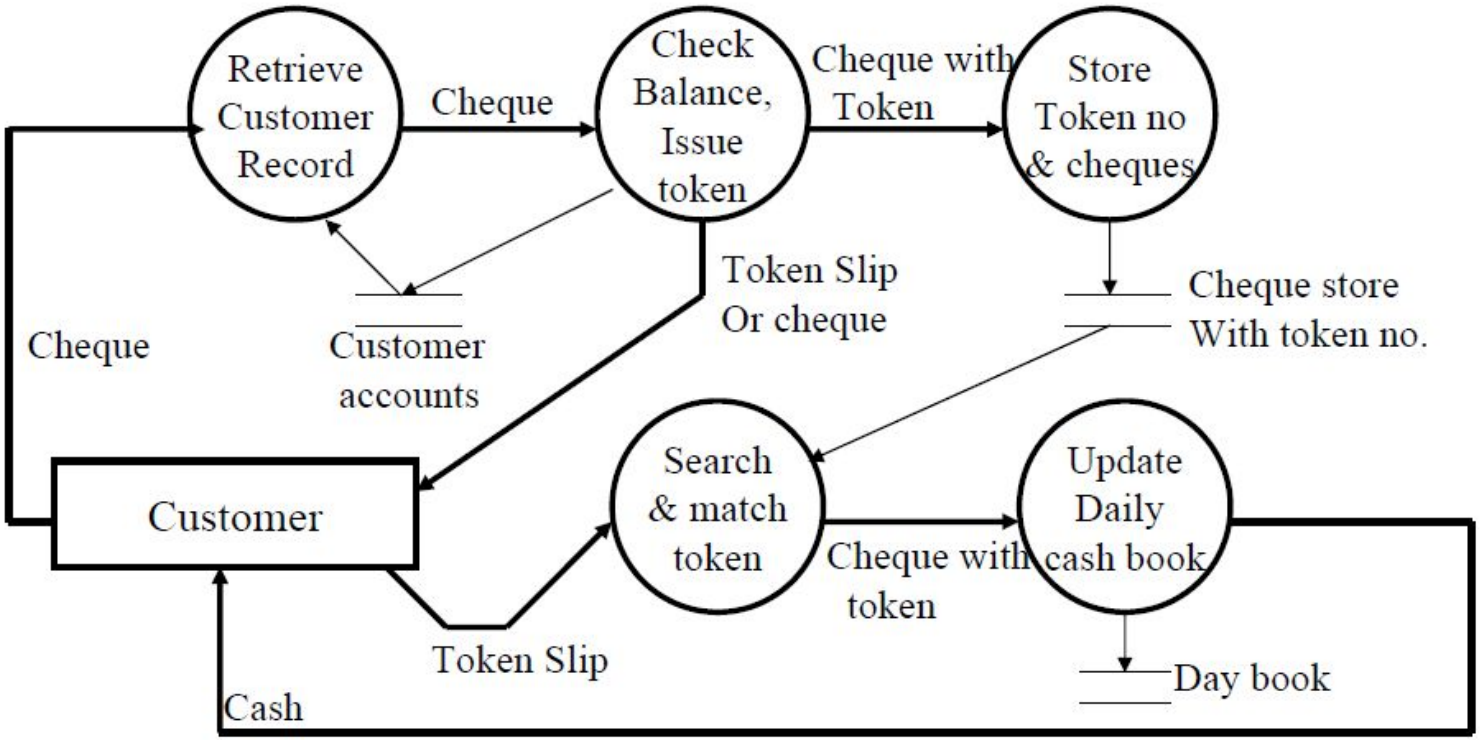
# Logical and Physical DFD

- DFD'S considered so far are called logical DFDs
- Physical DFD may depict physical movements of the goods
- A physical DFD is similar to a document flow diagram.
- It specifies who does the operations specified by the logical DFD
- A Physical DFDs can be drawn during fact gathering phase of a life cycle.

# PHYSICAL DFD



# Logical DFD


Retrieve Customer Record
Cheque
Check Balance, Issue token
Cheque with Token
Store Token no & cheques
Token Slip Or cheque
Cheque store With token no.
Cheque
Customer accounts
Search & match token
Update Daily cash book
Customer
Cheque with token
Token Slip
Day book
Cash

# Online Car Rental System

# System Requirements

**System Functions and Purpose**

The SHC Online Car Rental System should allow the customer to see available cars and rental rates, and to make online reservations. The following is a list of functions of this system:

1. Allow customers to check car availability and see car rental rates
2. Provide the customer with total rental charges for the customer's requirements
3. Reserve a car online

# System Requirements

**Inputs**

1. Customer can enter rental requirements
2. Customer can select a car
3. Customer can reserve a car

**Outputs**

1. System should provide available cars
2. System should provide total rental price
3. System should provide invoice if customer reserves a car

**Processes**

1. System should be able to check car availability as per the customer requirements
2. System should be able to calculate total rental charge for the customer's rental requirements
3. System should be able to process credit card payment through the company's bank
4. System should reserve the car for the customer by sending a notification to the garage

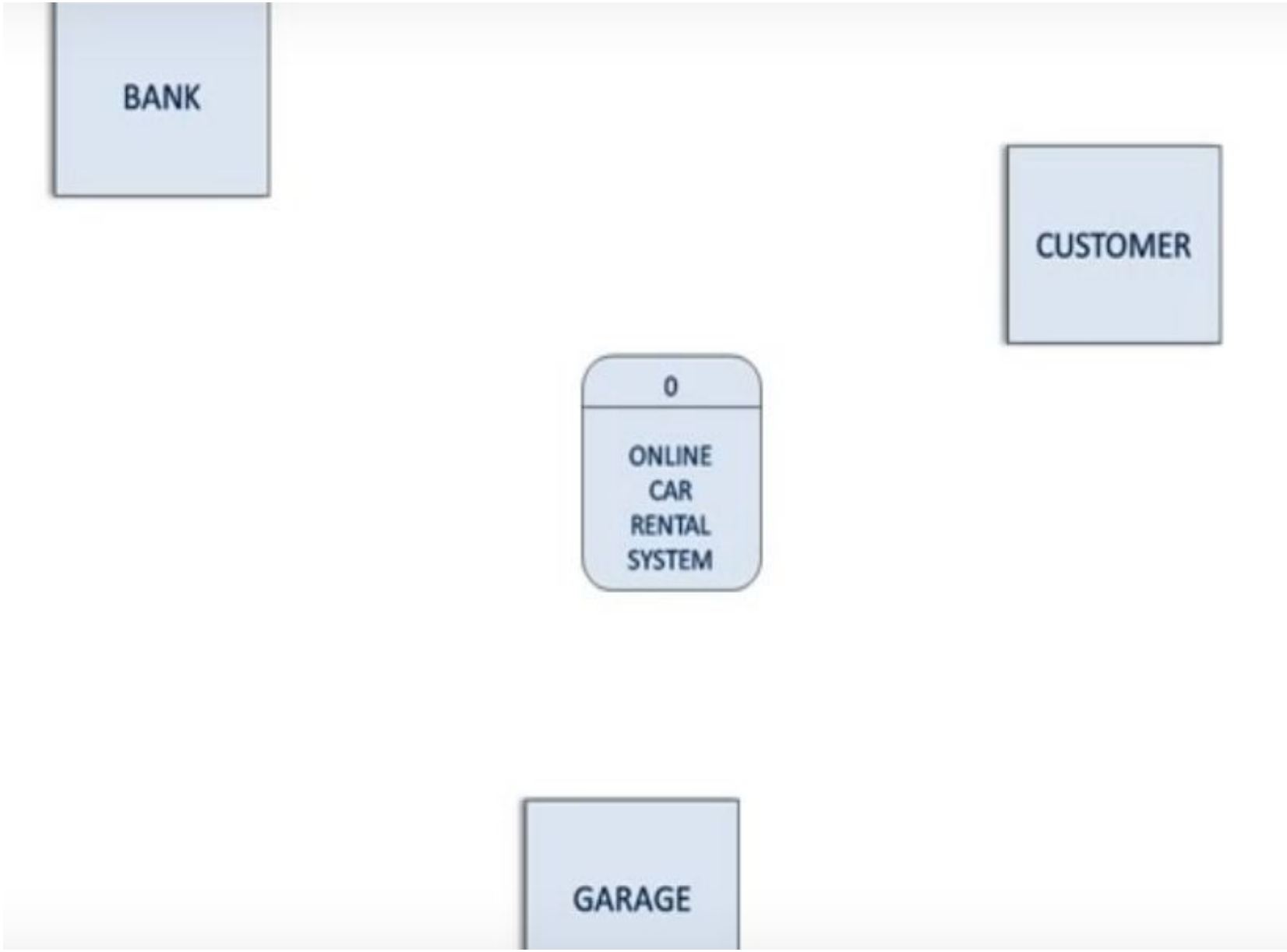
# System Requirements

**Performance**

1. Website's homepage should load in under 3 seconds
2. Car availability should take no longer than 4 seconds
3. Website should be able to handle 50,000 concurrent users

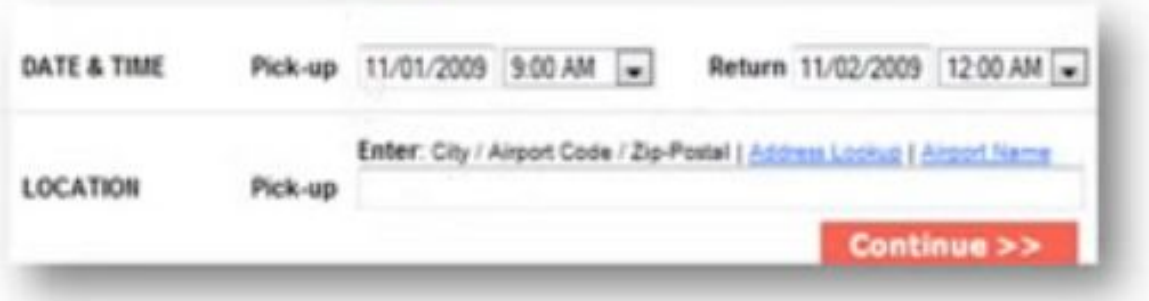
**Control**

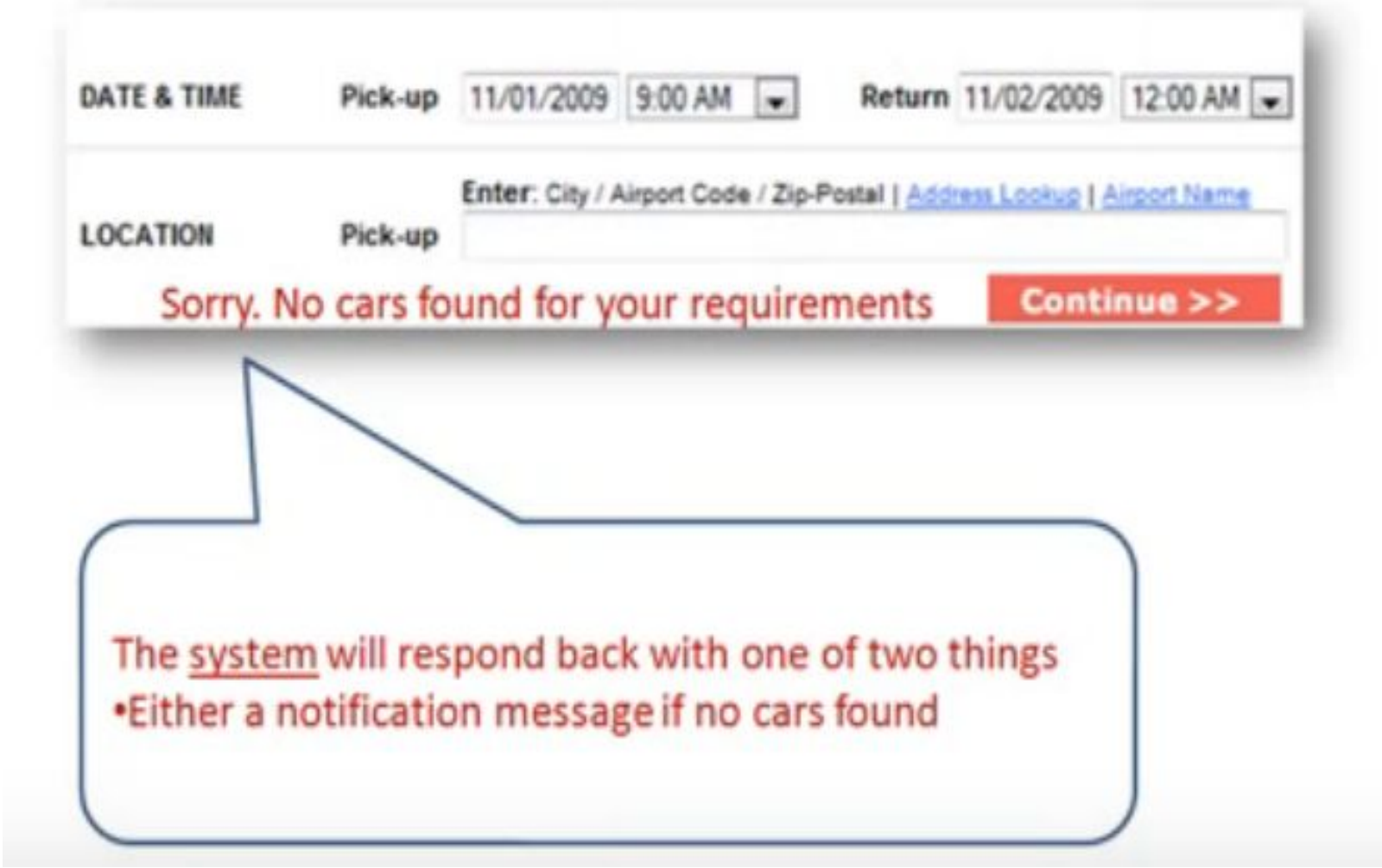
1. The website should provide strong security measures for protecting the credit card number
2. Transmission of reservation information should be secure
3. Customer private data should be protected


BANK
CUSTOMER
0
ONLINE
CAR
RENTAL
SYSTEM
GARAGE

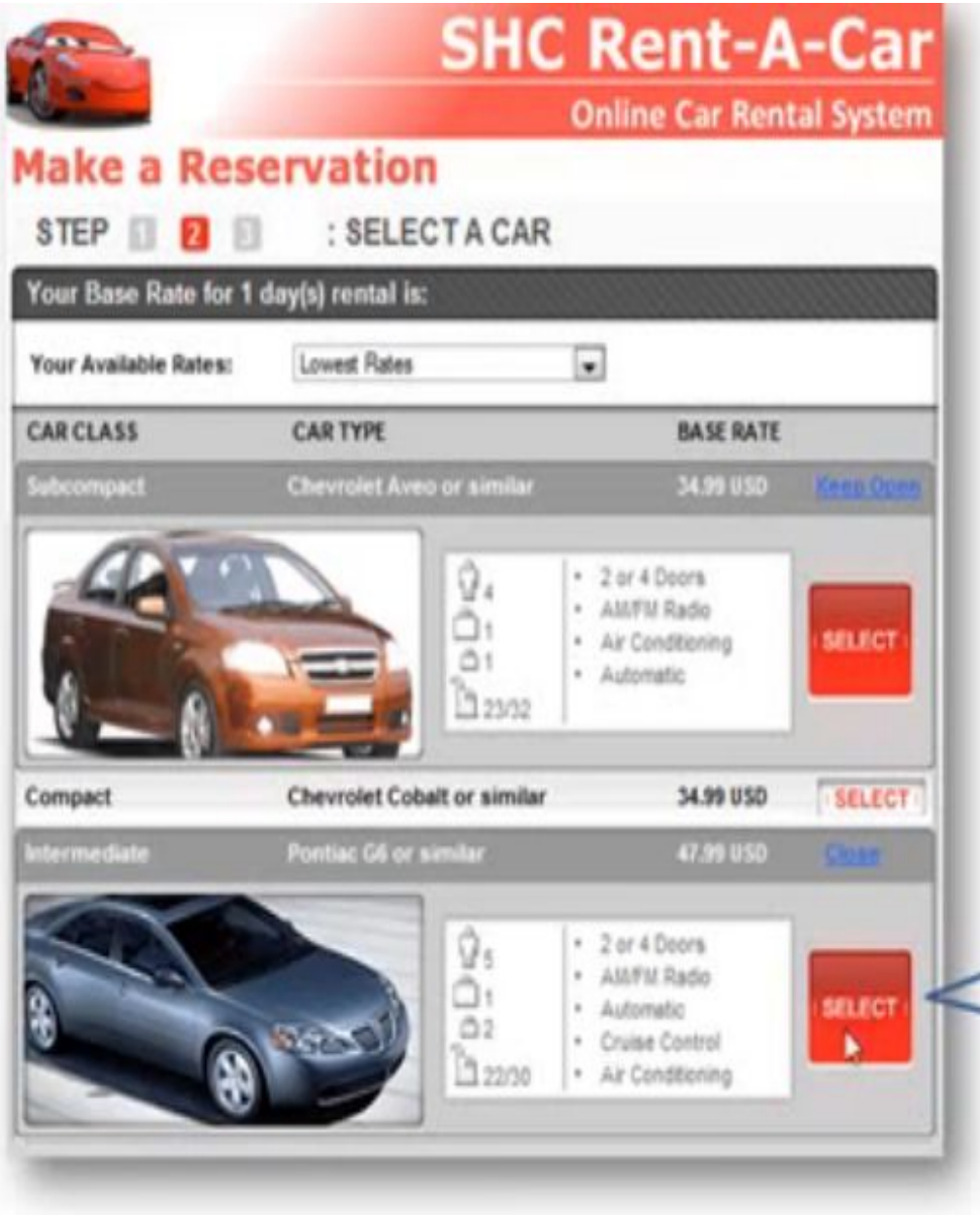
The customer provides his/her rental requirements:

- Pick-up Data & Time
- Return Data & Time
- Pick-up Location

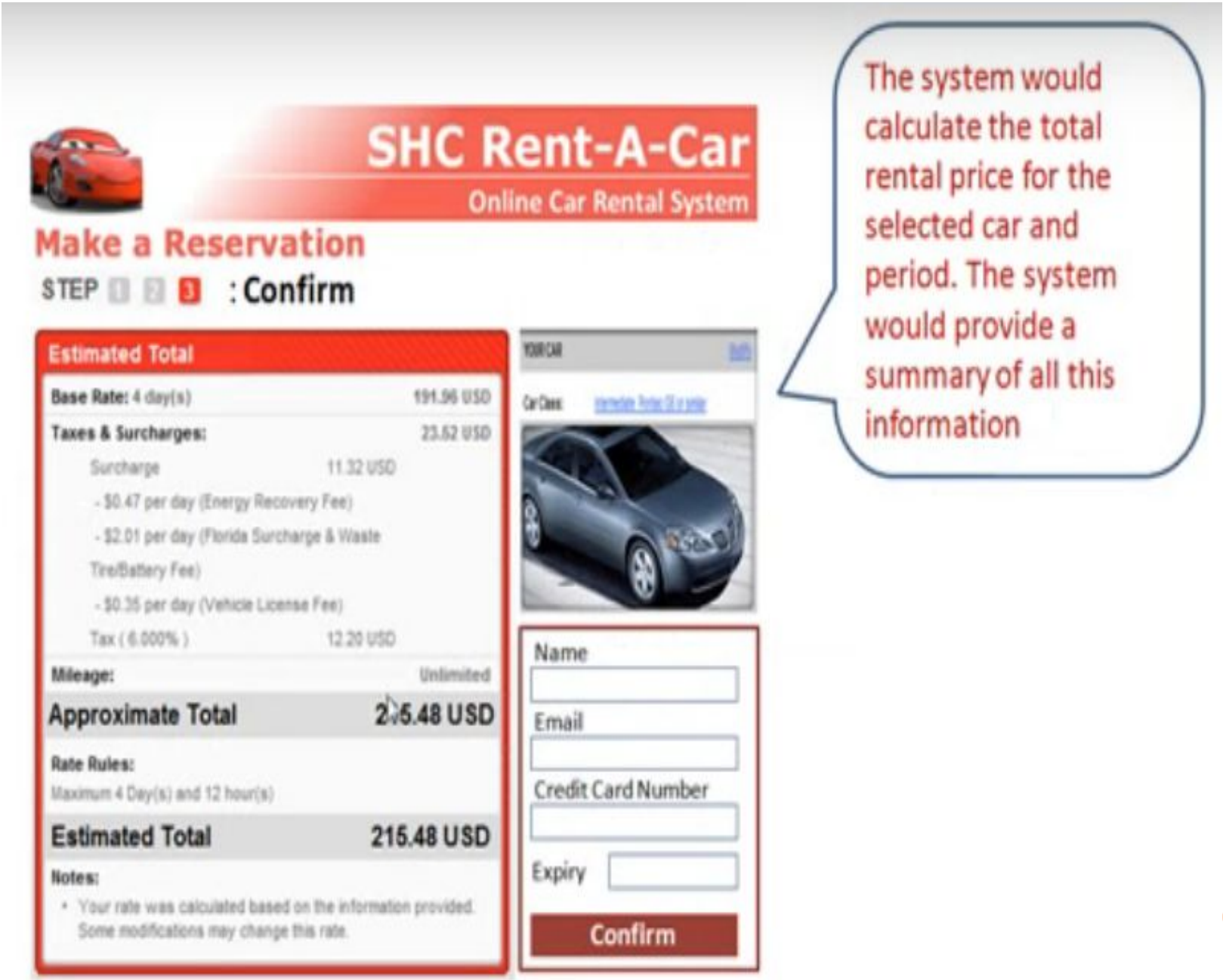



DATE & TIME
Pick-up
11/01/2009
9:00 AM
Return
11/02/2009
12:00 AM
LOCATION
Pick-up
Enter: City / Airport Code / Zip-Postal | Address Lookup | Airport Name
Sorry. No cars found for your requirements
Continue >>
The system will respond back with one of two things
•Either a notification message if no cars found

Or a list of available cars and their details




The customer can then select a car (input)


SHC Rent-A-Car
Online Car Rental System
Make a Reservation
STEP 1 2 3 : Confirm
Estimated Total
Base Rate: 4 day(s) 191.96 USD
Taxes & Surcharges: 23.52 USD
Surcharge 11.32 USD
- $0.47 per day (Energy Recovery Fee)
- $2.01 per day (Florida Surcharge & Waste Tire/Battery Fee)
- $0.35 per day (Vehicle License Fee)
Tax ( 6.000% ) 12.20 USD
Mileage: Unlimited
Approximate Total 215.48 USD
Rate Rules:
Maximum 4 Day(s) and 12 hour(s)
Estimated Total 215.48 USD
Notes:
• Your rate was calculated based on the information provided. Some modifications may change this rate.
YOUR CAR
Car Class
Name
Email
Credit Card Number
Expiry
Confirm
The system would calculate the total rental price for the selected car and period. The system would provide a summary of all this information

SHC Rent-A-Car
Online Car Rental System
Make a Reservation
STEP 1 2 3 : Confirm
Estimated Total
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Estimated Total 215.48 USD
Notes:
• Your rate was calculated based on the information provided. Some modifications may change this rate.
Name
Email
Credit Card Number
Expiry
Confirm
The customer can then confirm this reservation by providing the required information

# SHC Rent-A-Car

Online Car Rental System

## Reservation Confirmed!

### Your Invoice

| | | |
|---|---|---|
| **Base Rate:** 4 day(s) | | 191.96 USD |
| **Taxes & Surcharges:** | | 23.52 USD |
| Surcharge | 11.32 USD | |
| - $0.47 per day (Energy Recovery Fee) | | |
| - $2.01 per day (Florida Surcharge & Waste Tire/Battery Fee) | | |
| - $0.35 per day (Vehicle License Fee) | | |
| Tax ( 6.000% ) | 12.20 USD | |
| **Mileage:** | | Unlimited |
| **Total Charge** | | **215.48 USD** |

**Rate Rules:**

Maximum 4 Day(s) and 12 hour(s)

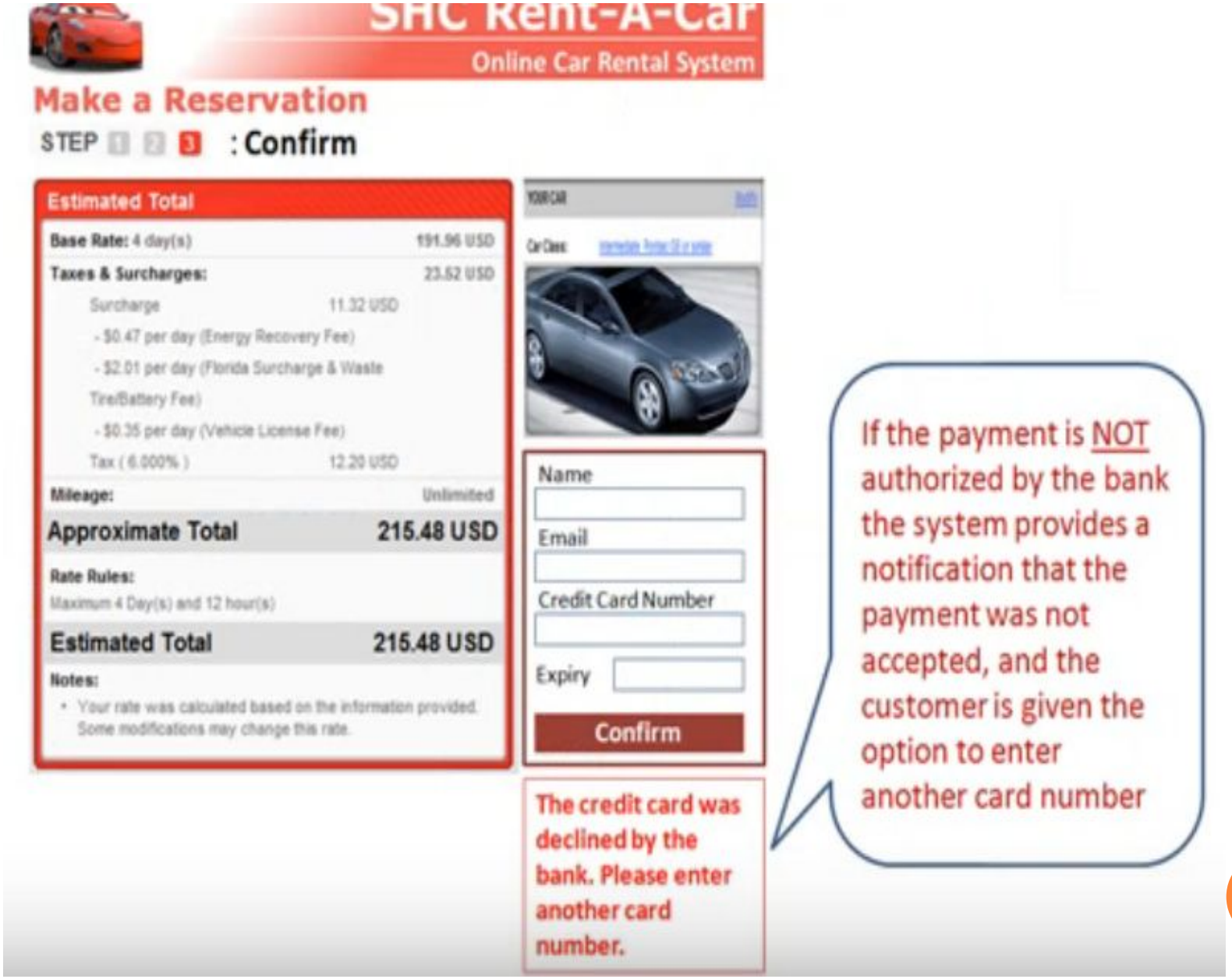
**Additional Information**

**Notes:**

- Your rate was calculated based on the information provided. Some modifications may change this rate.

Your credit card was charged for the total amount shown in this invoice. Please print and keep for your records.

If the payment is authorized by the bank, the customer sees the following invoice. Also, the garage gets a rental notification.


SHC Rent-A-Car
Online Car Rental System
Make a Reservation
STEP 1 2 3 : Confirm
Estimated Total
Base Rate: 4 day(s) 191.96 USD
Taxes & Surcharges: 23.52 USD
Surcharge 11.32 USD
- $0.47 per day (Energy Recovery Fee)
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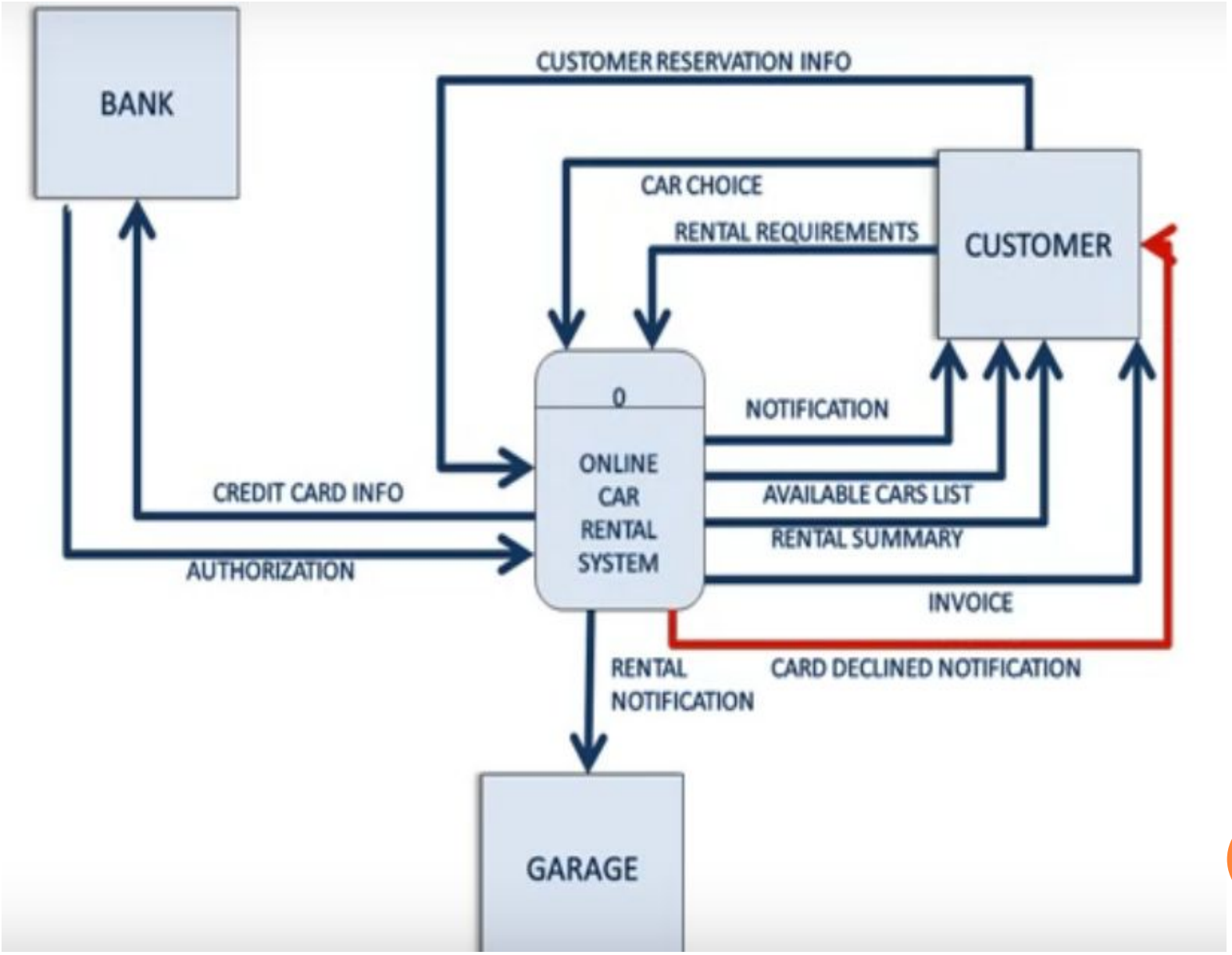
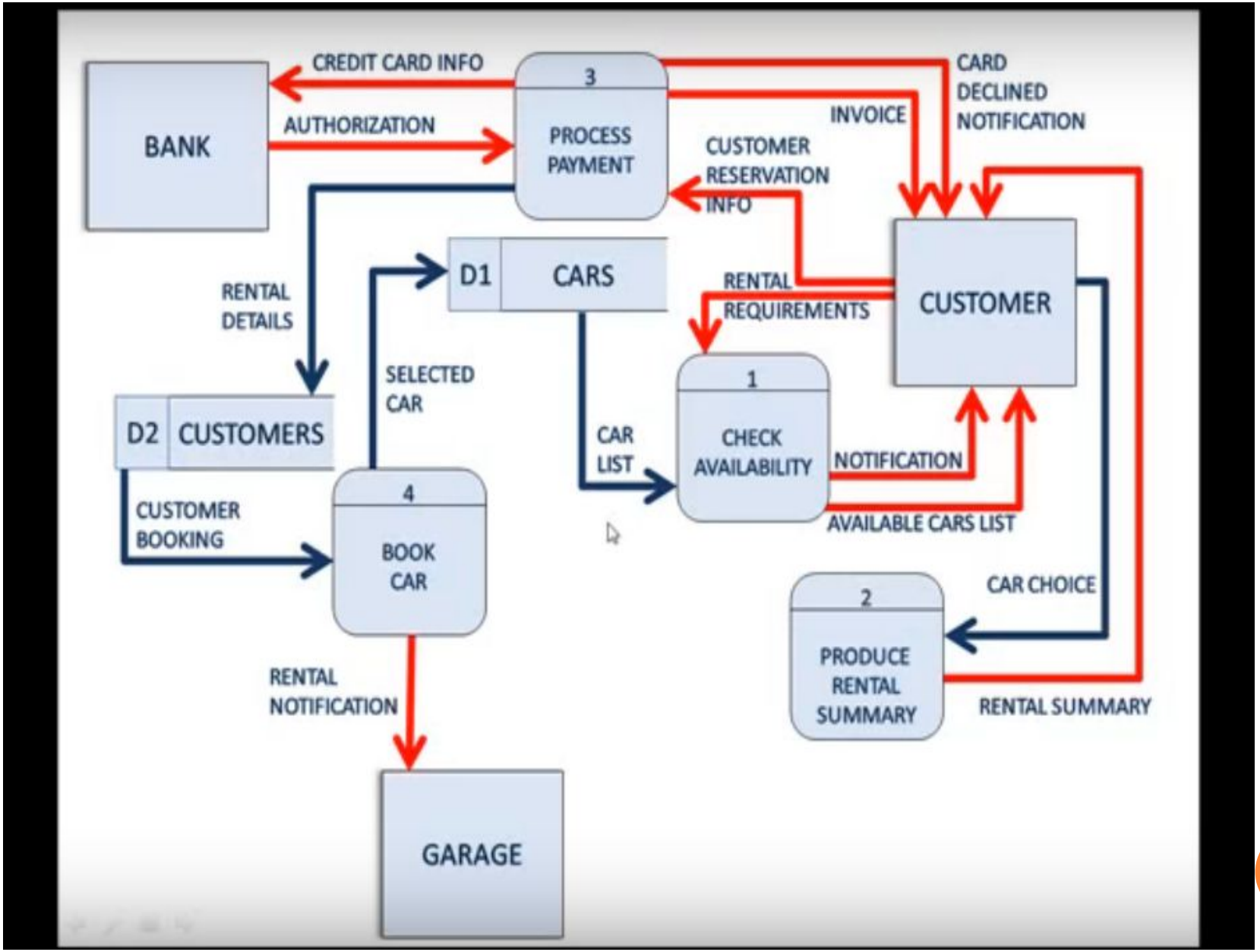
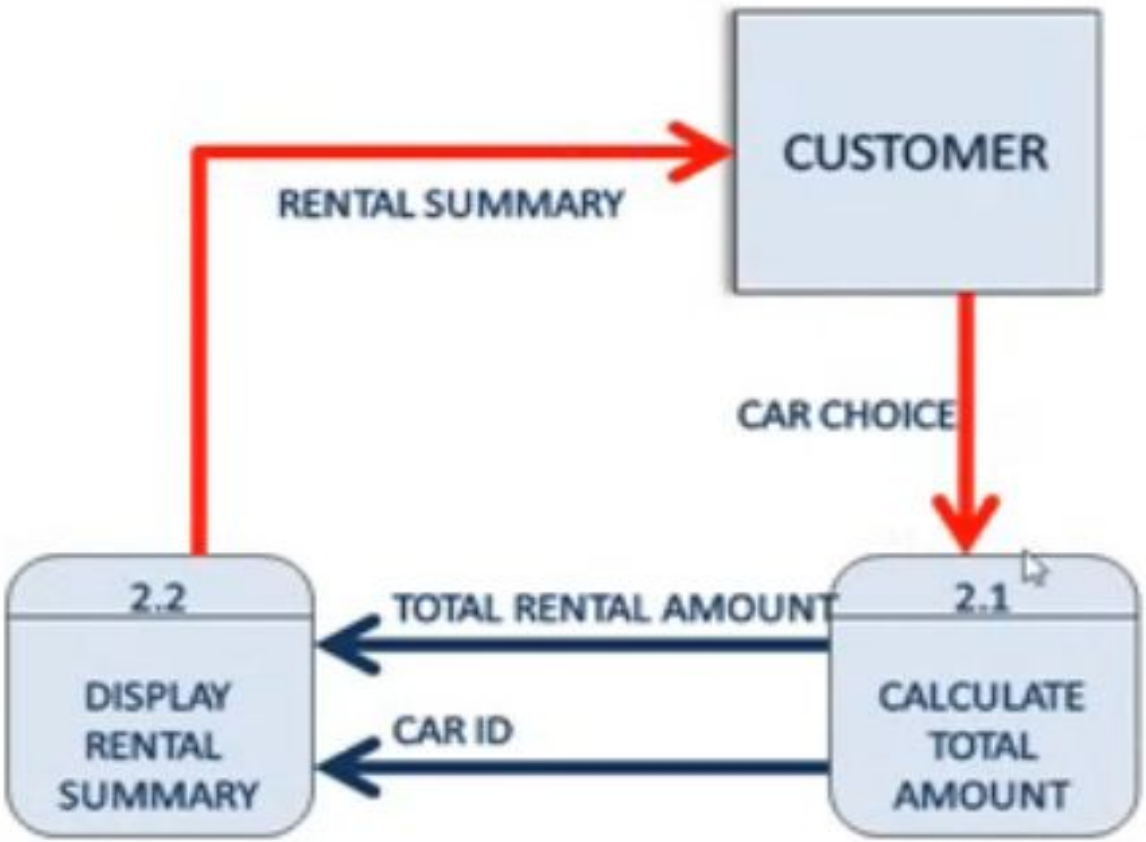
Tax ( 6.000% ) 12.20 USD
Mileage: Unlimited
Approximate Total 215.48 USD
Rate Rules:
Maximum 4 Day(s) and 12 hour(s)
Estimated Total 215.48 USD
Notes:
• Your rate was calculated based on the information provided. Some modifications may change this rate.
Name
Email
Credit Card Number
Expiry
Confirm
The credit card was declined by the bank. Please enter another card number.
If the payment is NOT authorized by the bank the system provides a notification that the payment was not accepted, and the customer is given the option to enter another card number


BANK
CUSTOMER RESERVATION INFO
CAR CHOICE
RENTAL REQUIREMENTS
CUSTOMER
0
NOTIFICATION
ONLINE
CAR
RENTAL
SYSTEM
CREDIT CARD INFO
AVAILABLE CARS LIST
RENTAL SUMMARY
AUTHORIZATION
INVOICE
RENTAL
NOTIFICATION
CARD DECLINED NOTIFICATION
GARAGE


BANK
CREDIT CARD INFO
AUTHORIZATION
3
PROCESS PAYMENT
INVOICE
CARD DECLINED NOTIFICATION
CUSTOMER RESERVATION INFO
CUSTOMER
D1
CARS
RENTAL DETAILS
RENTAL REQUIREMENTS
SELECTED CAR
D2
CUSTOMERS
1
CHECK AVAILABILITY
CAR LIST
NOTIFICATION
AVAILABLE CARS LIST
CUSTOMER BOOKING
4
BOOK CAR
CAR CHOICE
2
PRODUCE RENTAL SUMMARY
RENTAL NOTIFICATION
RENTAL SUMMARY
GARAGE

# Diagram 2


CUSTOMER
RENTAL SUMMARY
CAR CHOICE
2.2
DISPLAY RENTAL SUMMARY
TOTAL RENTAL AMOUNT
CAR ID
2.1
CALCULATE TOTAL AMOUNT

- Admission procedure in a university is as follows: An advertisement is issued giving essential qualifications for the course, the last date for receipt of application, and the fee to be enclosed with the application. A clerk in the registrar's office checks the received applications to see if mark sheet and fee are enclosed and sends valid applications to the concerned academic department. The department checks the application in detail and decides the applicants to be admitted, those to be put in the waiting list, and those rejected. Appropriate letters are sent to the Registrar's office which intimates the applicant. Draw Context Diagram and DFD. Make assumptions if needed.