Specifiche formali con Finite State Machine (FSM): esempio

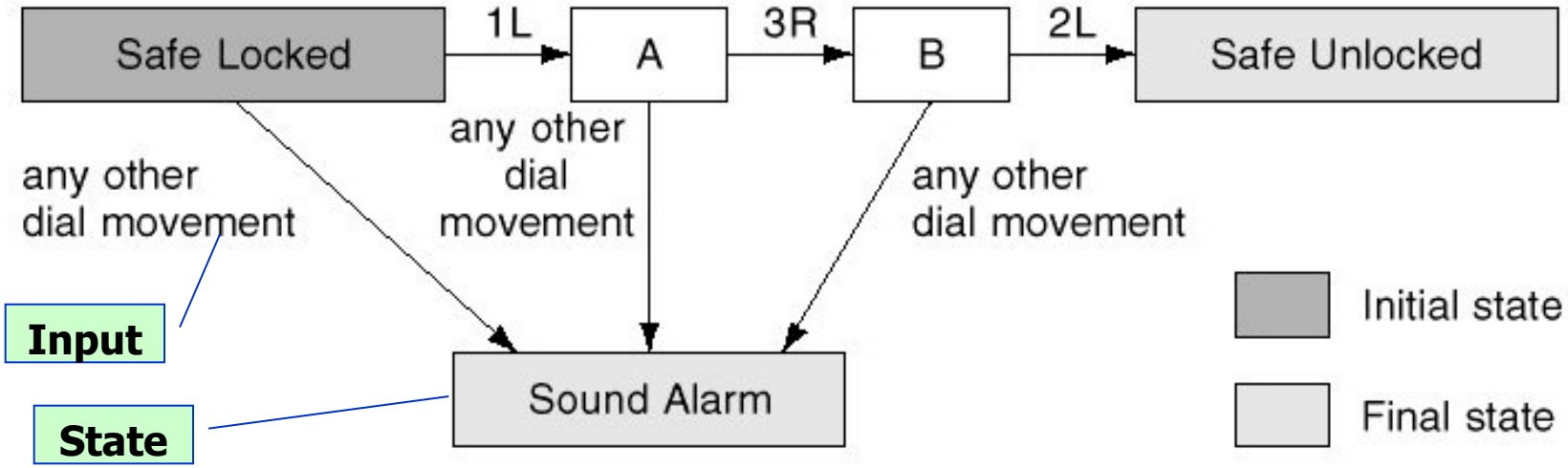
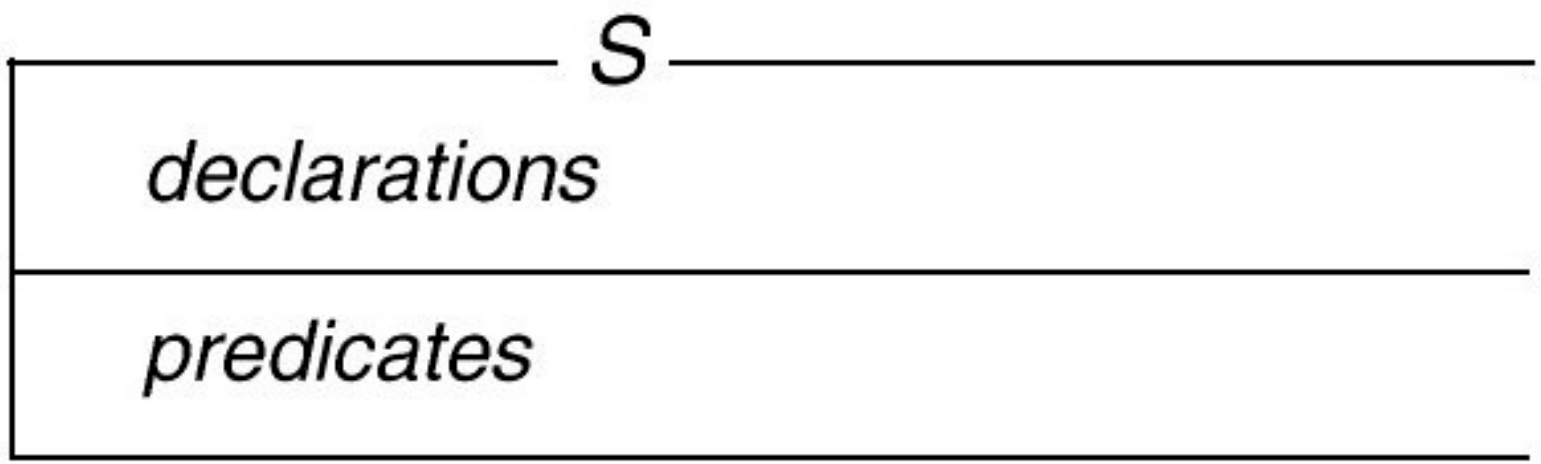


Table of Next States

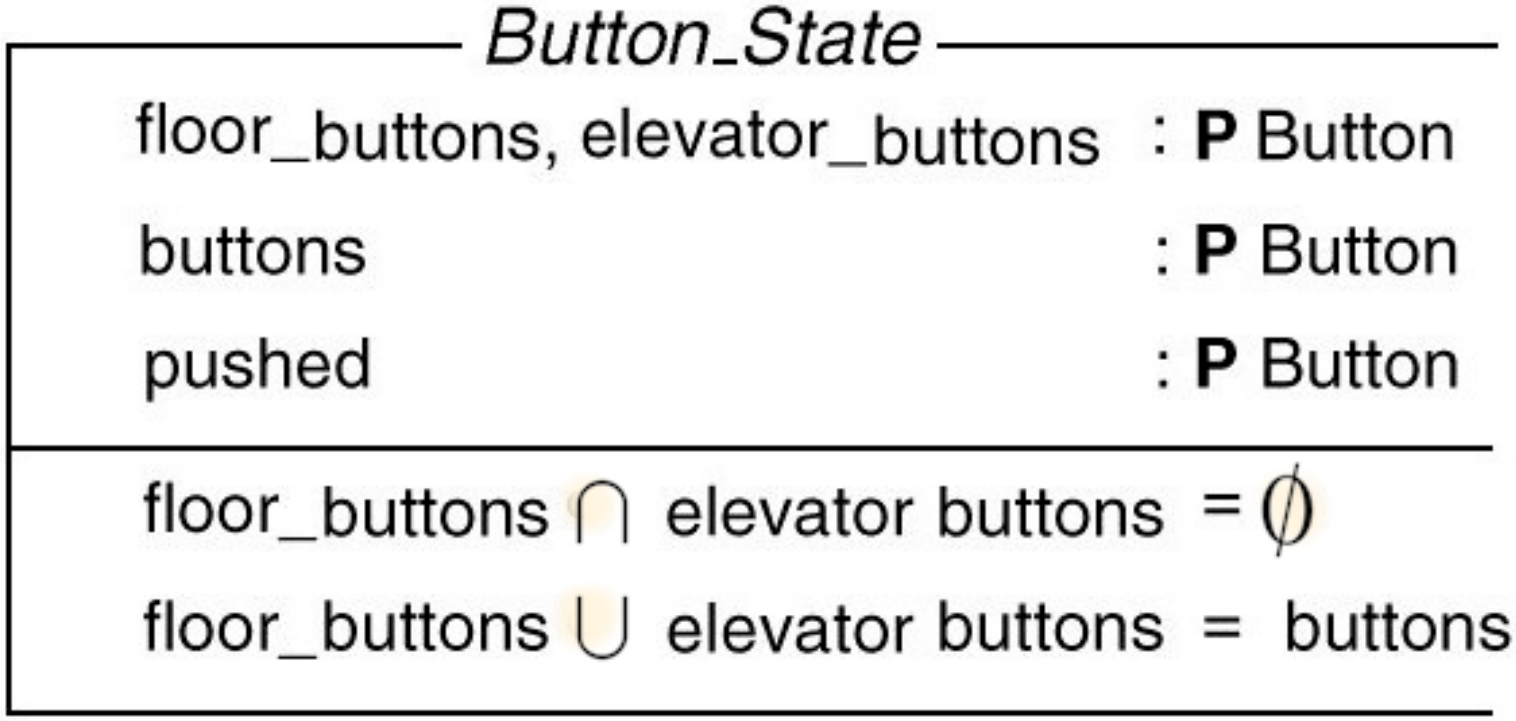
Dial movement \ Current state	Safe locked	A	B
1L	A	Sound Alarm	Sound Alarm
1R	Sound Alarm	Sound Alarm	Sound Alarm
2L	Sound Alarm	Sound Alarm	Safe Unlocked
2R	Sound Alarm	Sound Alarm	Sound Alarm
3L	Sound Alarm	Sound Alarm	Sound Alarm
3R	Sound Alarm	B	Sound Alarm

Specifiche formali con linguaggio Z

- Consiste di un set di schemi
- Ogni schema Z ha il seguente formato:



Linguaggio Z
esempio di specifica di stato



Abstract Initial State

```
Button_init := [Button_State' | pushed' = ∅]
```

Linguaggio Z
esempio di specifica di operazione

Push_Button

Δ *Button_State*

button?: Button

$$(button? \in buttons) \land$$
$$(((button? \notin pushed) \land (pushed' = pushed \cup \{button?\})) \lor$$
$$((button? \in pushed) \land (pushed' = pushed)))$$

Spec. semi-formali: modelli del sistema

- Per **modello del sistema** si intende una rappresentazione ***astratta*** del sistema che facilita la comprensione delle proprietà del sistema e delle sue caratteristiche di funzionamento, prima che il sistema venga costruito
- L'uso di modelli dei sistemi software è formalizzato all'interno di metodi di analisi dei requisiti (*specifica*) del software che fanno uso di *tecniche semi-formali*
- I metodi di analisi dei requisiti software sono di due tipi:
  - metodi di analisi **strutturata** (o **procedurale**)
  - metodi di analisi **orientata agli oggetti**
- Per descrivere completamente un sistema è necessario costruire vari modelli che rappresentino il sistema da vari punti di vista (*informazioni*, *funzioni* e *comportamento dinamico*)

Tipi di modelli del sistema

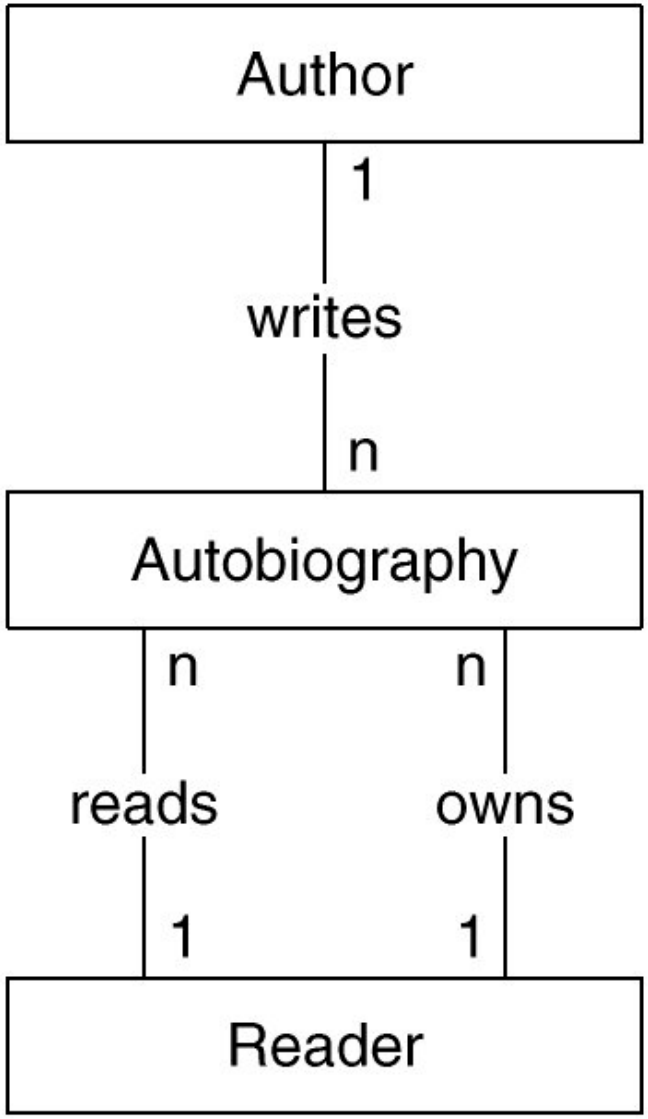
Per descrivere la specifica semi-formale di un sistema software si usano 3 tipi di modelli:

1. **modello dei dati**: rappresenta gli aspetti statici e strutturali relativi ai dati (*data requirements*)
   - *ERD (not UML)*
   - *class diagram (UML)*
2. **modello comportamentale**: rappresenta gli aspetti funzionali del sistema (*functional requirements*)
   - *data flow diagram (not UML)*
   - *use case diagram (UML)*
   - *activity diagram (UML)*
   - *interaction diagram (UML)*
3. **modello dinamico**: rappresenta gli aspetti di "controllo“ e di come le funzioni del modello comportamentale modificano i dati introdotti nel modello dei dati
   - *state diagram (UML)*

Entity Relationship Diagram (ERD)

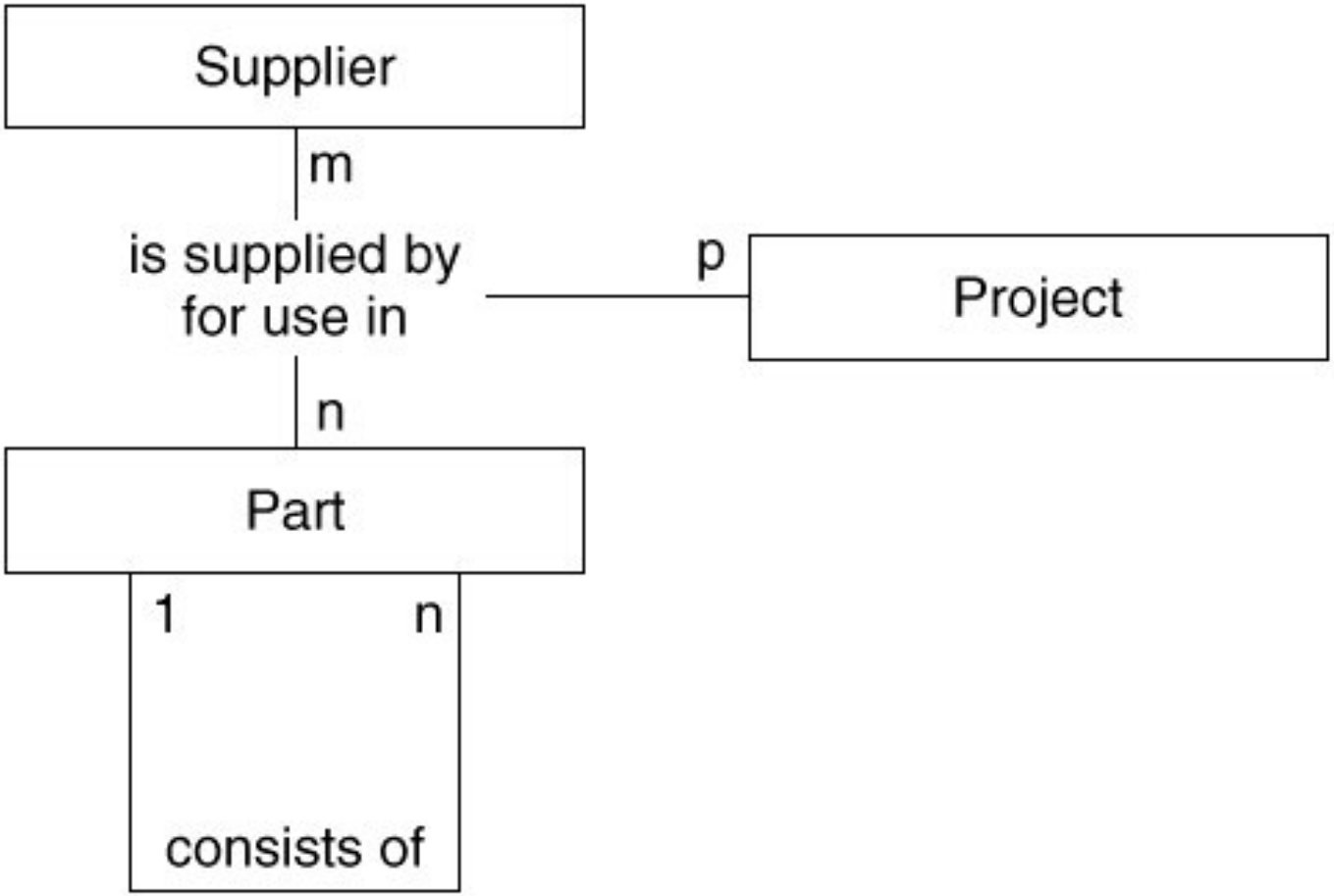
relazioni

uno-a-molti



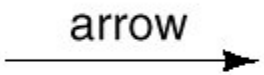
ERD

relazioni molti-a-molti

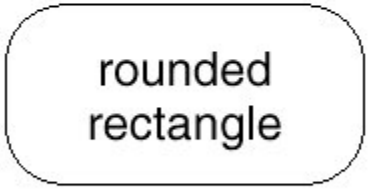


Data Flow Diagram (DFD)

Source or destination of data



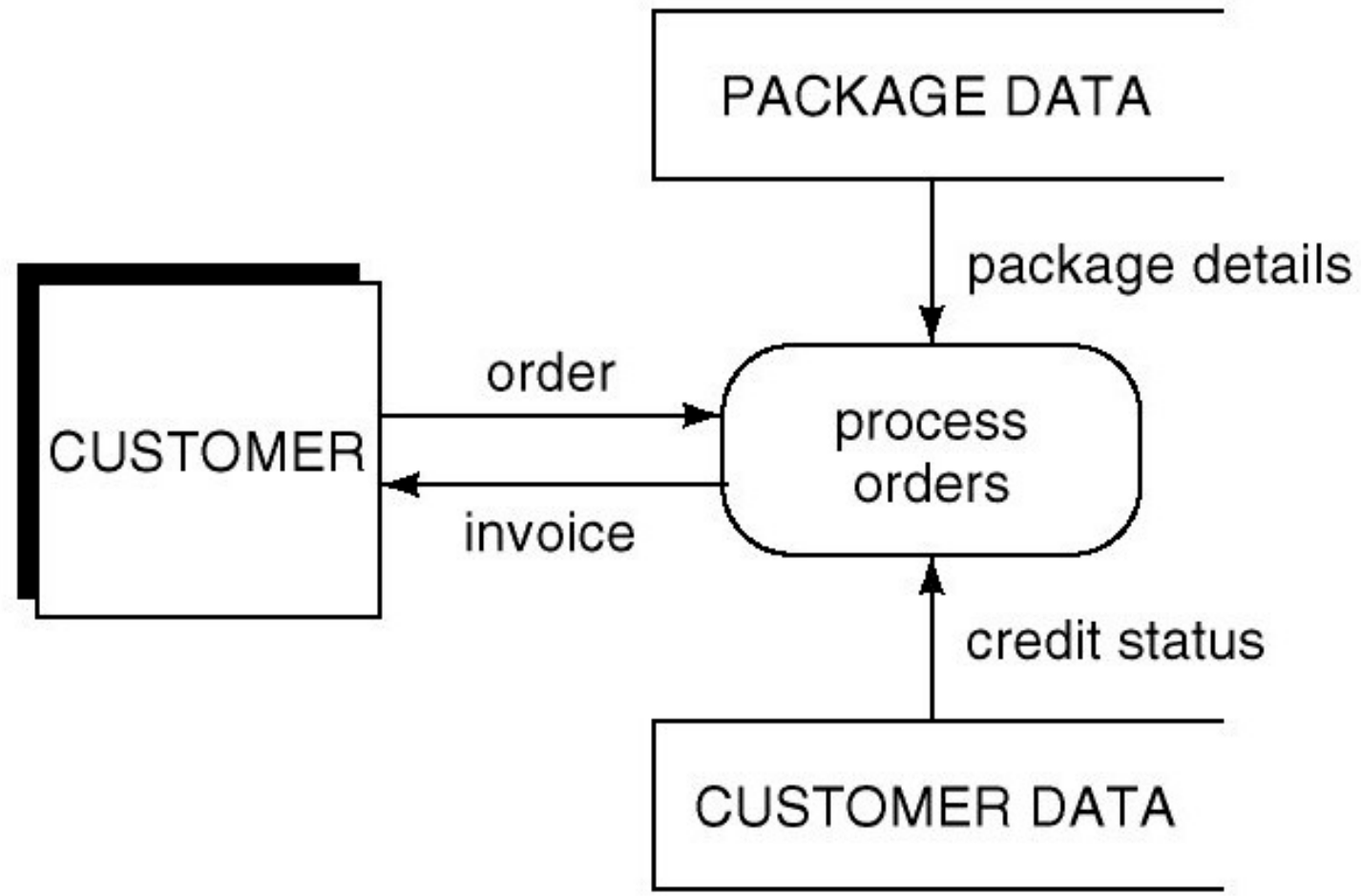
Flow of data



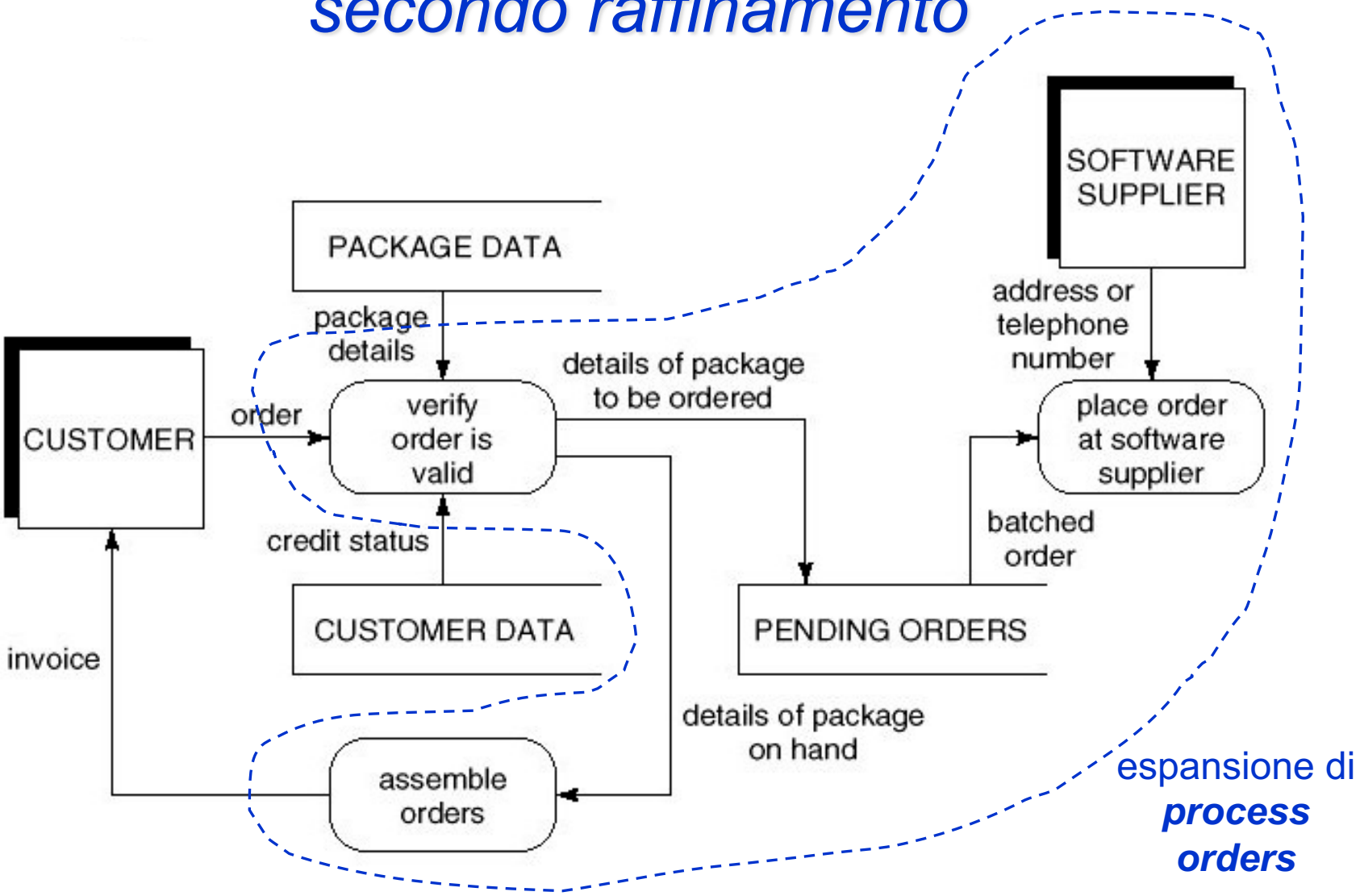
Process which transforms a flow of data

Store of data

Esempio di DFD
primo raffinamento



Esempio di DFD
secondo raffinamento



Structured System Analysis (SSA)
(metodo di analisi strutturata)

- Metodo introdotto da Gane and Sarson (1979)
- E' costituito da *9 step*
- Basato sul concetto di step-wise refinement
- Altri metodi di analisi strutturata:
  - DeMarco (1978)
  - Yourdon and Constantine (1979)

SSA – Step 1
Draw the DFD

- Use the requirements document (or the prototype) to:
  - Identify data flows
  - Identify source and destinations of data (where data flows starts and ends, respectively)
  - Identify processes that transform data
- Refine the DFD by adding new flows of data or by adding details to existing data flows

SSA – Step 2

Decide what Sections to Computerize and How

- Use cost-benefits analysis to decide which sections of the DFD to automate
- Decide how to computerize:
  - Batch operations
  - On-line processing
- Example:
  - Automate *order placement* in batch
  - Automate *order validation* online
- The next 3 steps are the stepwise refinement of data flows, processes and data stores

SSA – Step 3

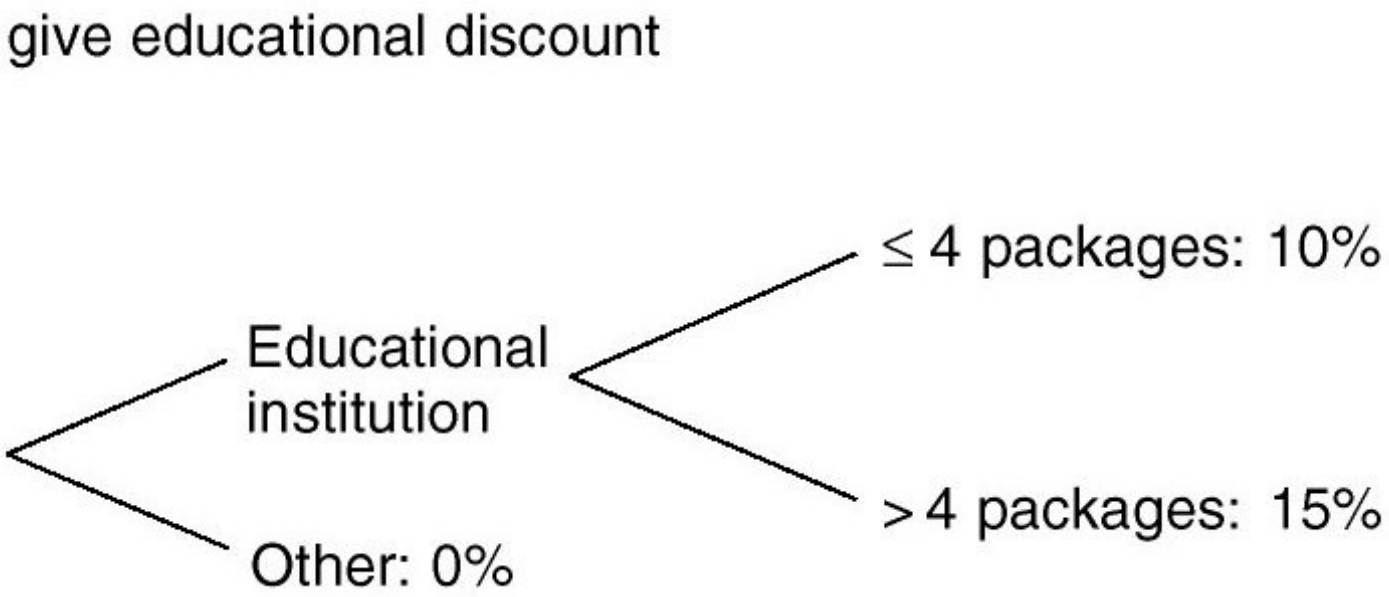
Determine the details of the data flows

- Decide what data items must go into the various data flows
- Example: the data flow *order* can be refined as follows:
  - *order_identification*
  - *customer_details*
  - *package_details*
- Then, refine each flow stepwise:
  - *order_identification* is a 12-digit integer
  - *customer_details* consists of *customer_name*, *customer_address*, etc.

SSA – Step 4

Define the logic of processes

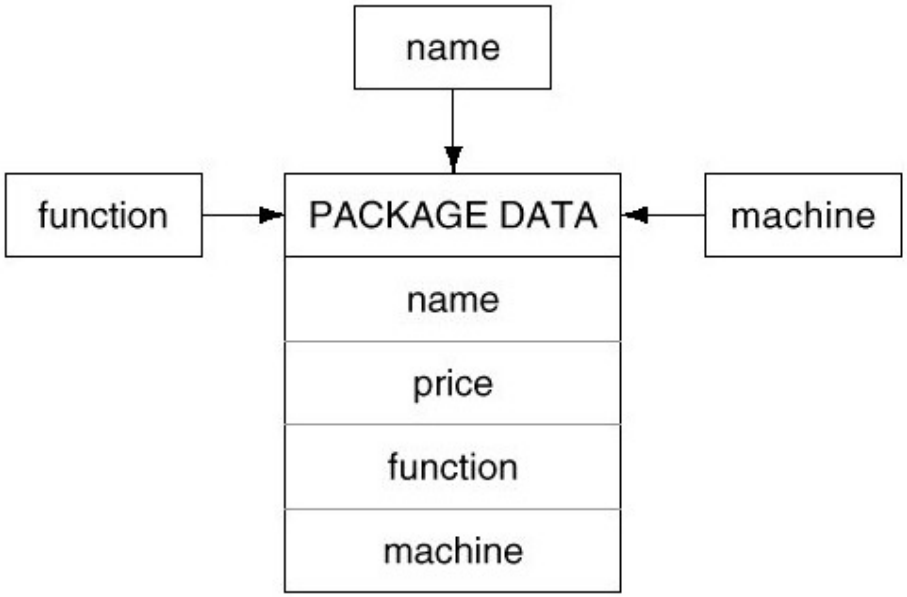
- Example: build the decision tree for a *give_educational_discount* process



SSA – Step 5

Determine the data stores

- Define the exact contents of each store and its representation (specific format in a given programming language)
- Define the level of access by use of *data-immediate-access diagram* (*DIAD*)
- Example:



SSA – Step 6

Define the physical resource

- Examples:
  - For each file, specify: file name, organization (sequential, indexed, etc.), storage medium, records, down to the field level
  - If a DBMS is to be used, then the relevant information for each table is specified

SSA – Step 7

Determine the Input/Output specifications

- The input forms must be specified (components and layout)
- The output screens must similarly be determined
- The printed output also must be specified (estimated length and details)

SSA – Step 8

Determine the sizing

- Compute:
  - volume of input (daily or hourly)
  - frequency of each printed report and its deadline
  - size and number of records that are to pass between the CPU and mass storage
  - size of each file

SSA – Step 9

Determine the hardware requirements

- From sizing information specified at step 8, determine:
  - Mass storage requirements
  - Mass storage requirements for backup
  - Characteristics of user terminals
  - Charateristics of output devices
  - Adequacy of existing hardware
  - Costs of hardware to be purchased

SSA Output

- Step 9 is the last step of SSA
- After approval by the client, the resulting specification document is handed to the design team, and the software process continues
- Drawbacks:
  - SSA cannot be used to determine response times
  - CPU size and timing cannot be determined with any degree of accuracy