# Views on Information Systems

https://bit.ly/PolitoSIA

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http://softeng.polito.it

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## Licensing Note

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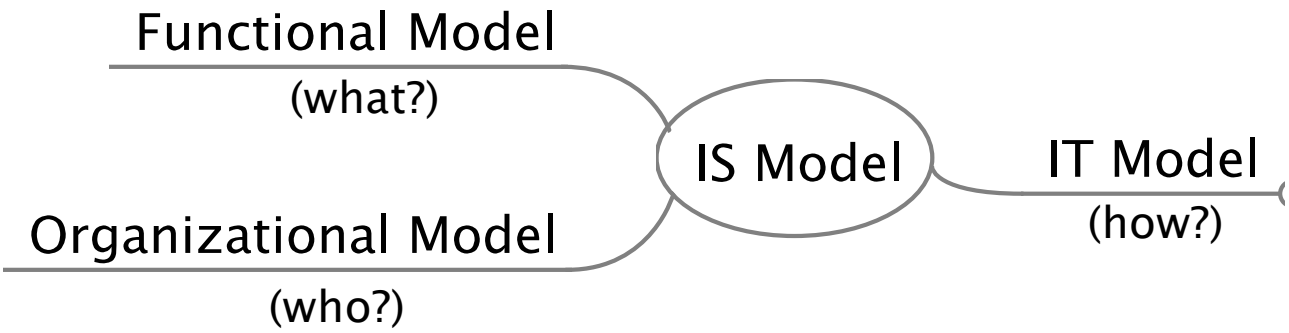
# View points on IS

- There are several view points in the analysis and design of IS
  - Evolutional: how to follow the evolution of technologies and of the organization
  - Technological: tech components, architectures, performance, etc.
  - Functional: which applications for which business function
  - Organizational: how it affects organization, processes, individual competencies, etc.

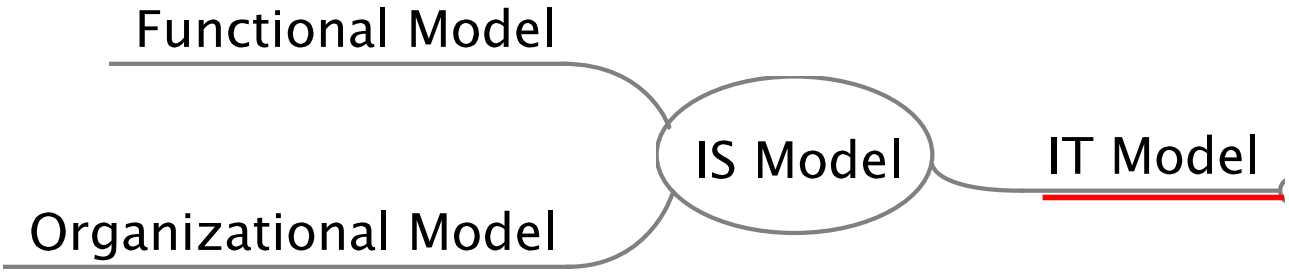
# View points on IS

- Design: how to design and implement IS
- Transactional: how to manage economic transactions (internal and to outside)
- Economical: effects on the structure of costs and / or on the productivity
- Decisional: support tool for decisional processes
- Management: who is in charge and how it is located in the organiztion, how investments are planned and realized.

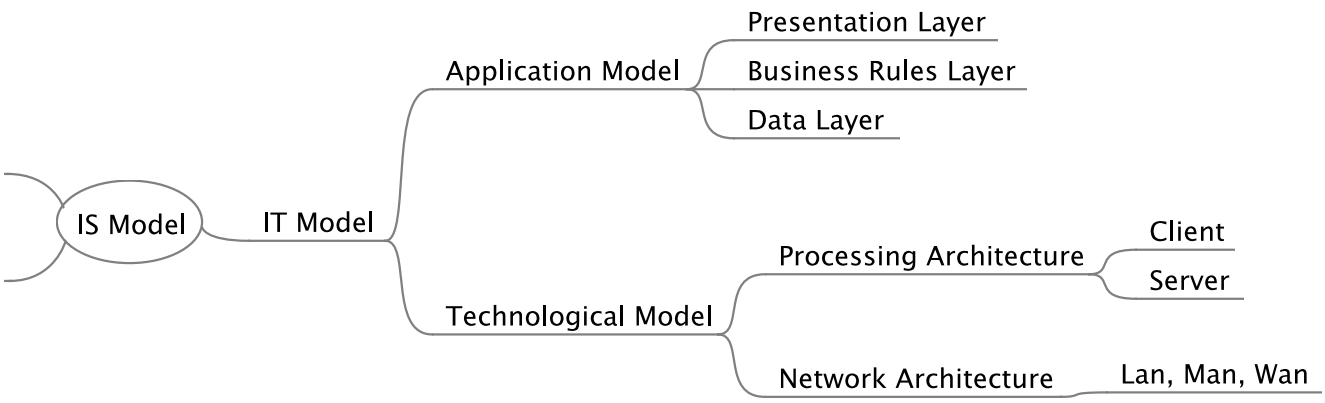
# Analysis model for IS




# IT model



# IT Model




# IT Model: how the IS is built

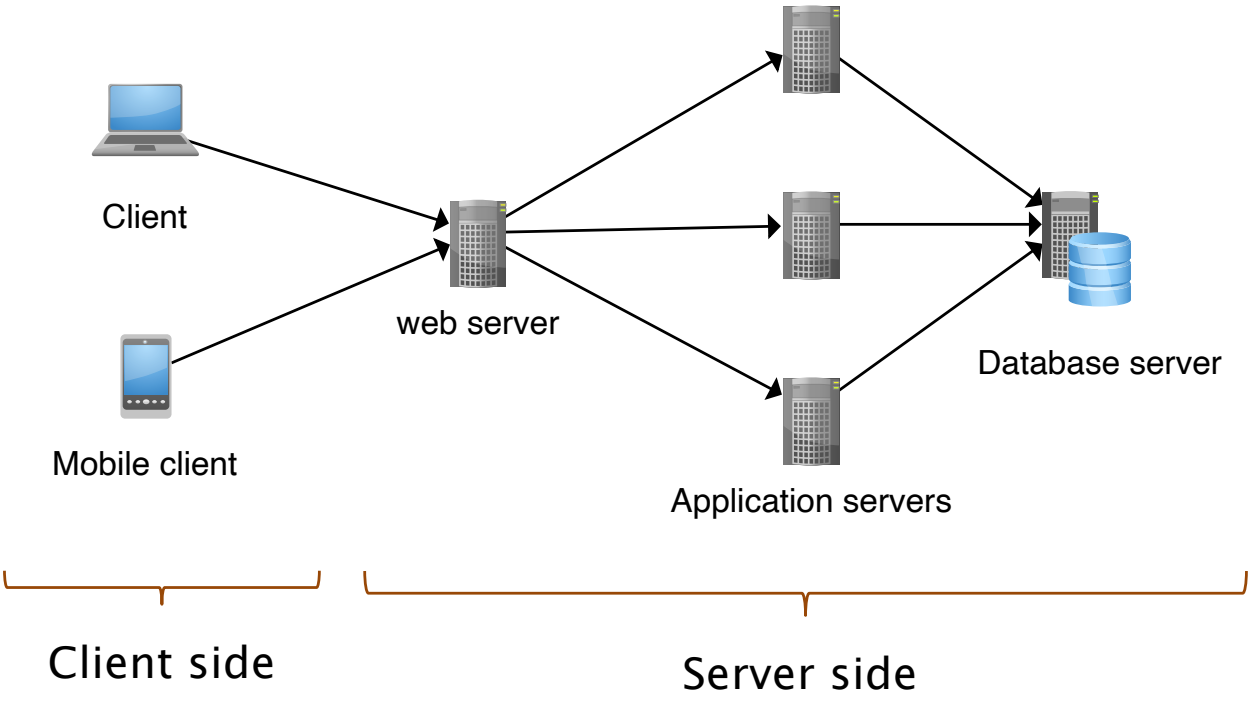
- Two main models:
  - Technological Model: describes the hardware architecture
  - Application Model: describes the software architecture

# Technological model

- IS as hardware systems and their network connections
- Client server architectures
  - Two tiers
    - Data + application server;
  - Three tiers
    - Data server, application server (business rules), web server
  - …



# Tiered architecture



# Cloud Computing

- Ubiquitous, cheap, on-demand access to a shared pool of configurable computing resources
- It relies on sharing of resources to achieve coherence and economies of scale
- Shift model from CAPEX to OPEX
  - Third party infrastructure

# Network architectures

The distinct systems of a processing architecture communicate by means of networks that transmit digital information

Network taxonomies

- By extension
- Hierarchical levels
- Working mode

# Network levels

According to the level they can be:

- Access
- Backbone
- MAN

# Network extension

- LAN *(Local Area Network),* range few km, bandwidth 10–100 M bps
- MAN (*Metropolitan Area Network),* urban area range, bandwidth 100 M – 1 G bps
- WAN *(Wide Area Network),* regional or national range, bandwith 1 T bps.

# Network working mode

Three main working modes:

- Internet
- Intranet: private network within an organization, used to share information inside it
- Extranet: portion of intranet that a company open to customers and external users

# Application Model

- IS as software at application level,
- Typically with three layers
  - Presentation
    - Interaction with end user via GUI (or character based forms)
  - Business rules
    - Algorithms and rules to process, control and extract data
  - Data
  - cfr. three tier architecture in technological view

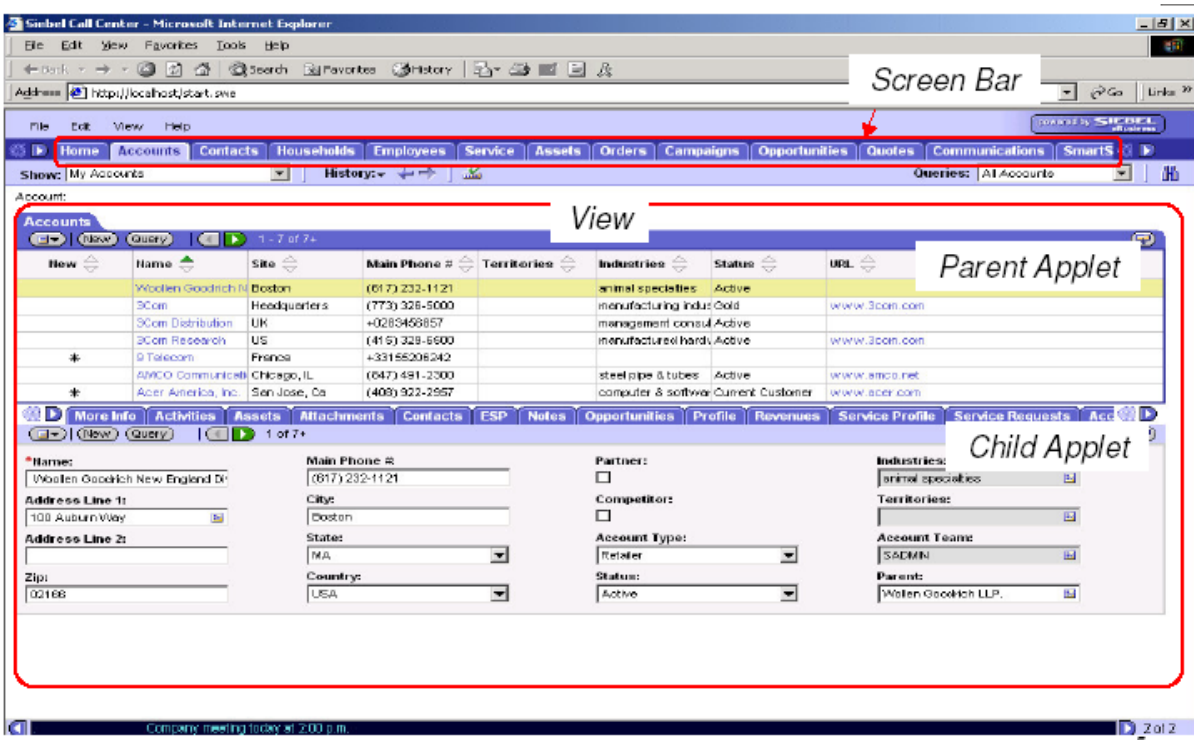
# Example

| Presentation layer | Rule layer | Data layer |
|---|---|---|
| Show GUI screen "Withdrawal request": Acquire data entered by the customer | IS the required amount between the valid thresholds | Access to data tables and read thresholds |
| Show a message "Correct/Cancel"; Acquire data from customer | If the request is not valid require to correct or cancel; if then the input is cancel, stop processing, otherwise read the value of the account | Access to data tables and read values |
| Show a message; Acquire data from cclient | If the request is greater than the account ask to correct or cance and re-read the value; if then the choice is to cancel stop processing, otherwise update the account value | Access to data tables and change values |

# Presentation layer

- An interactive application communicate with the user through a GUI (Graphical User Interface) and different inputs (e.g. keyboard, mouse)
- GUI both show and record data
- The form of the interface should reflect the needs and functions of each individual user

# Ex: presentation, customer data






# Business Rules Layer

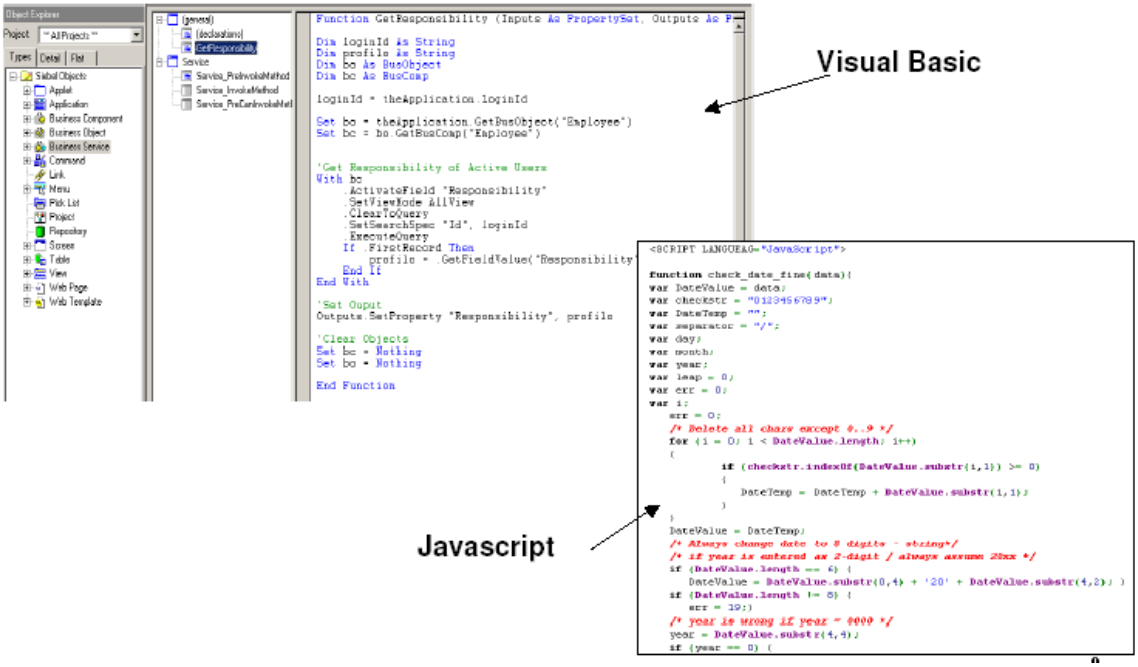
Rules consitute the logic driving the processing of data entered in the IS through the Presentation layer

Rules interact with the presentation and/or the data layer

Rules may include:

- Computations (eg. computing the average)
- Logical operations (eg. comparison)
- Data analysis (eg. a chronological list)

# Ex: business rules






# Data layer

- The data base is a permanent storage of data organized according to a schema
  - E.g. Oracle, MySQL, Access
- The selection of data to be stored is linked to the organizational needs and may imply various costs

- Question: how to select the database technology?

# Processing architecture

- Mainframe + dumb terminals
  - Until 80s
- Client server
  - Current mainstream
- Peer to peer
  - Not much widespread in IS

# Mainframe

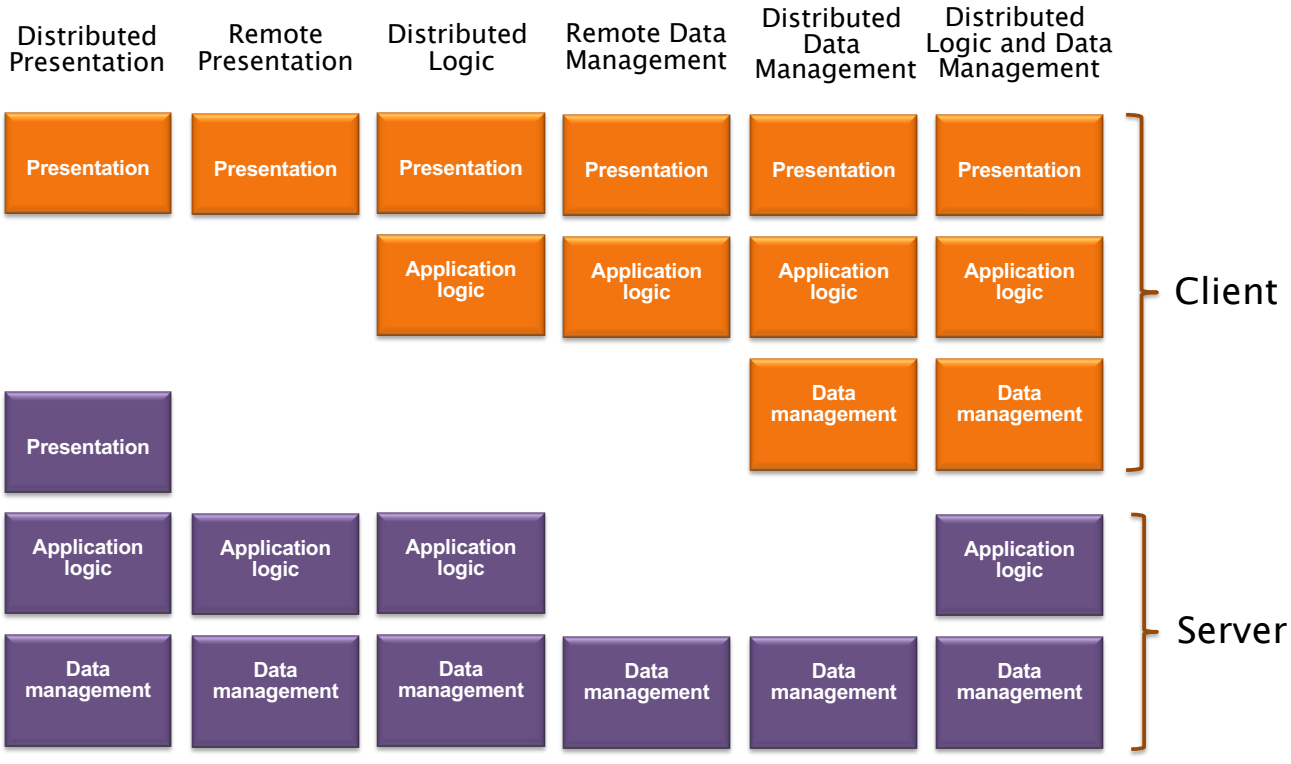
- Extremely powerful computer (mainframe) where all three layers reside
- Terminal performs only I/O

# Client-server(C/S)

Architecture where client processes request services offered by server processes

- Client system: typically running on wide range of devices (e.g. work station, smartphone, tablet) where a portion of the presentation layer reside
- Server system: hosting the rule processing (application server) and data management (data server)

# Fat / Thin Client



# Quality requirements

- A processing architecture must satisfy a few basic requirements:
  - Reponse time: the interval between the request and the display of the response; depending on the application the system shall be more or less reactive (e.g. ATM vs. electricity meter)
  - Scalability: the work load a system is able to sustain, typicaly expressed in number of concurrent users
  - Availability: percentage of time the system is working (typical SI should be around 99.95%)
  - Etc.

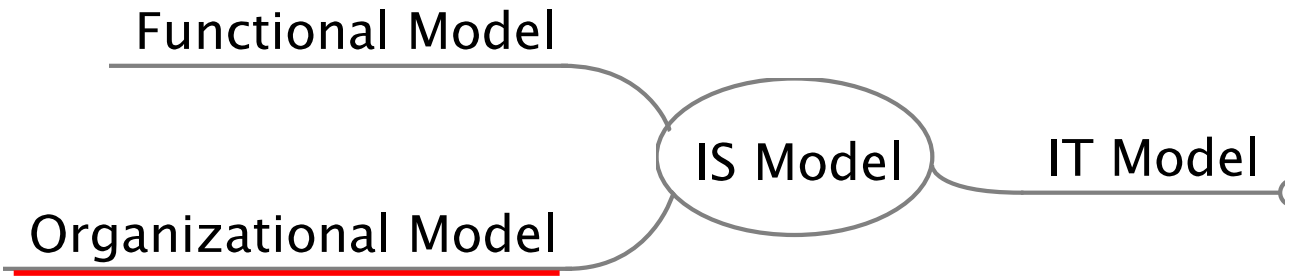
# IT selection

- The selection of the IT model takes into consideration costs, performance, sizing etc.
- Looking at the technology evolution allows considering long-term costs
- Other analysis dimensions include the growth perspectives of the organization

# Enterprise architectures

- Zachman Framework, www.zachmaninternational.com
- TOGAF, www.opengroup.org/togaf
- DoDAF, www.architectureframework.com/dodaf
- Capgemini's Integrated Architecture Framework, www.capgemini.com/services-and-solutions/technology/soa/overview
- US Federal Enterprise Architecture, www.whitehouse.gov/omb/e-gov/fea

# Organizational model



# Organizational models

- IS as a service offered to a business unit or group
- Organizational chart
  - Macro level
  - Micro level
- Linear Responsibility Chart (LRC)
- Swimlane (in activity diagrams UML)

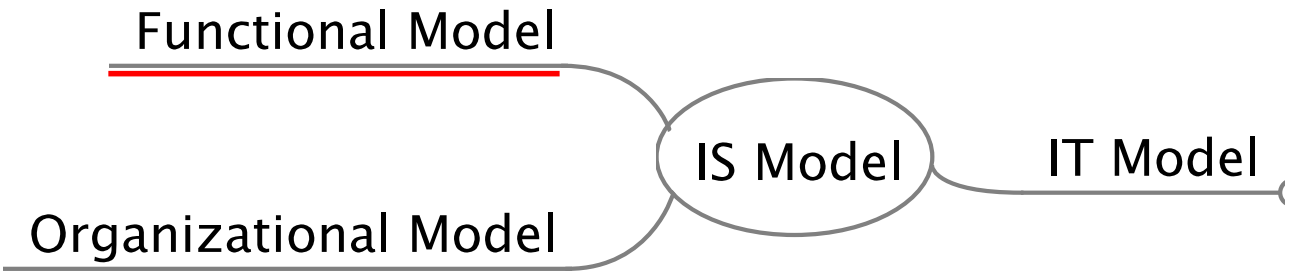
# Organizational chart

# LRC – linear responsibility chart

| Processes (samples) | Organization's Structures | | | | | | | External Actors | |
|---|---|---|---|---|---|---|---|---|---|
| | Purchase | Design | Production | Sales | Admin. | Human Reources | Information Systems | Supplier | Customer |
| Management Report Production | C | C | C | C | P | C | C | | |
| Customer Order Processing | | | P | P | | | | | C |
| Procurement | P | | P | | | | | P | |

P=Participant C=Client

# Functional model



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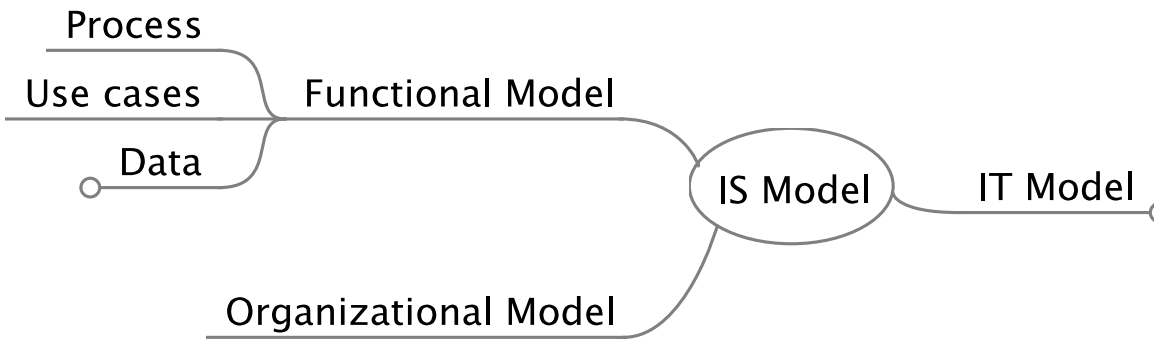



# Functional Model

What should the IS do, abstracting from how it can be done (IT model)

Processes

- Activities, functions
- BPMN, UML activity diagram

Data

- UML class diagram, Entity Relationship diagram

Interaction

- Use cases. UI mockups

# Process

- Business Process
  - Set of activities characterized by:
    - Input / output
      - material, information, knowledge
    - Role
  - With objective of producing valuable product or service



# Processes

- It is possibe to automate processes and increase efficiency, but not necessarily the efficacy

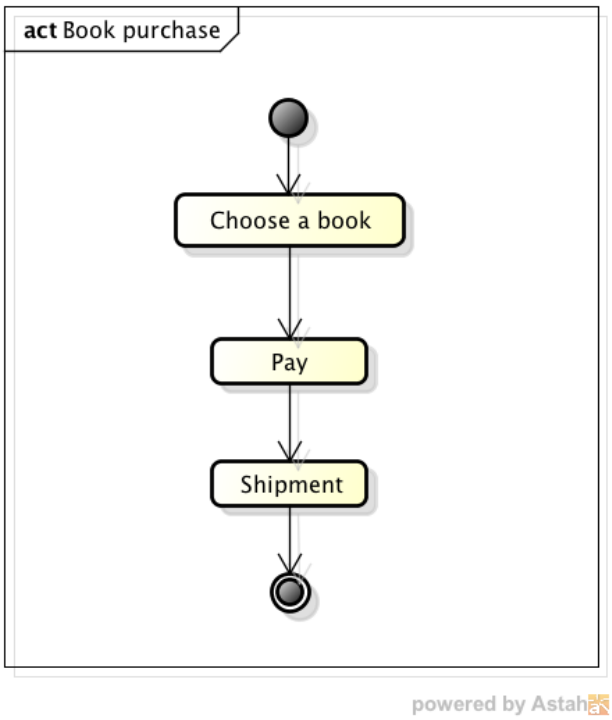
- Focus:
  - Better understand which processes need to be improved
  - Not to automate processes just for the sake of automating

# IS for process support

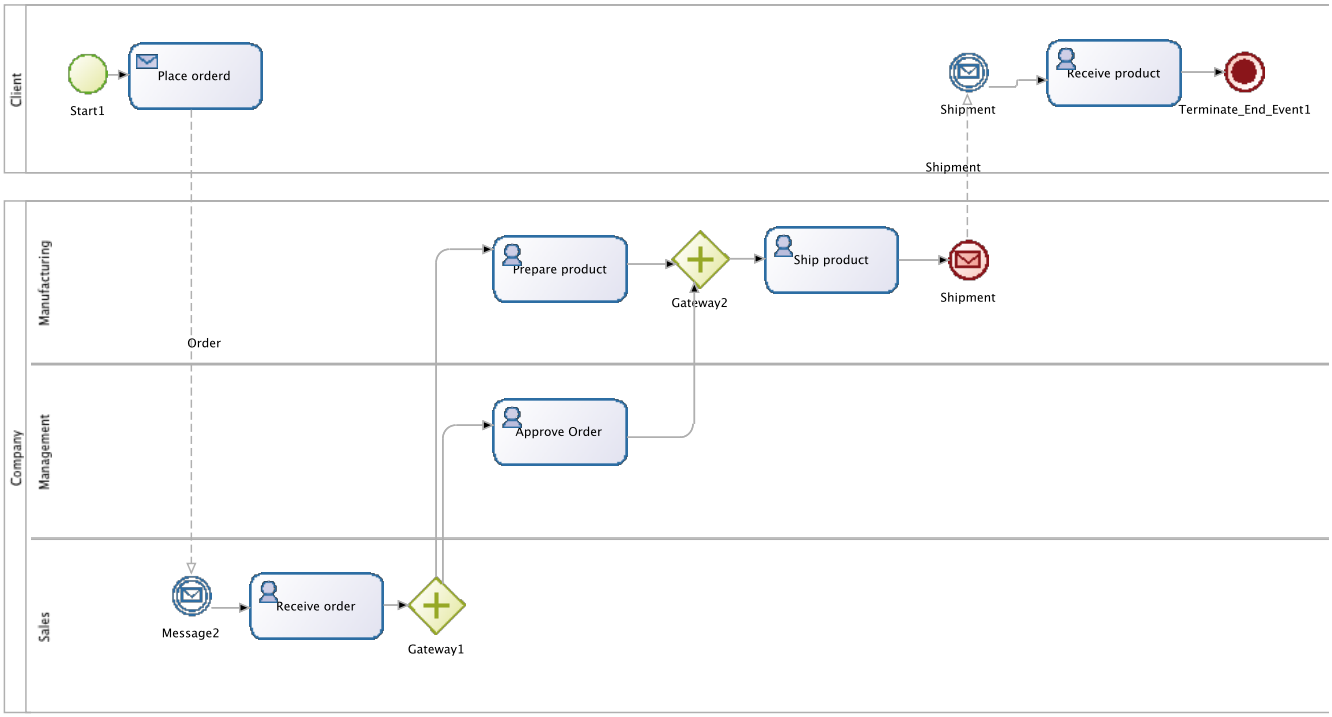
- CRM
  - Customer relationship management
- SCM
  - Supply chain management
- Enterprise systems



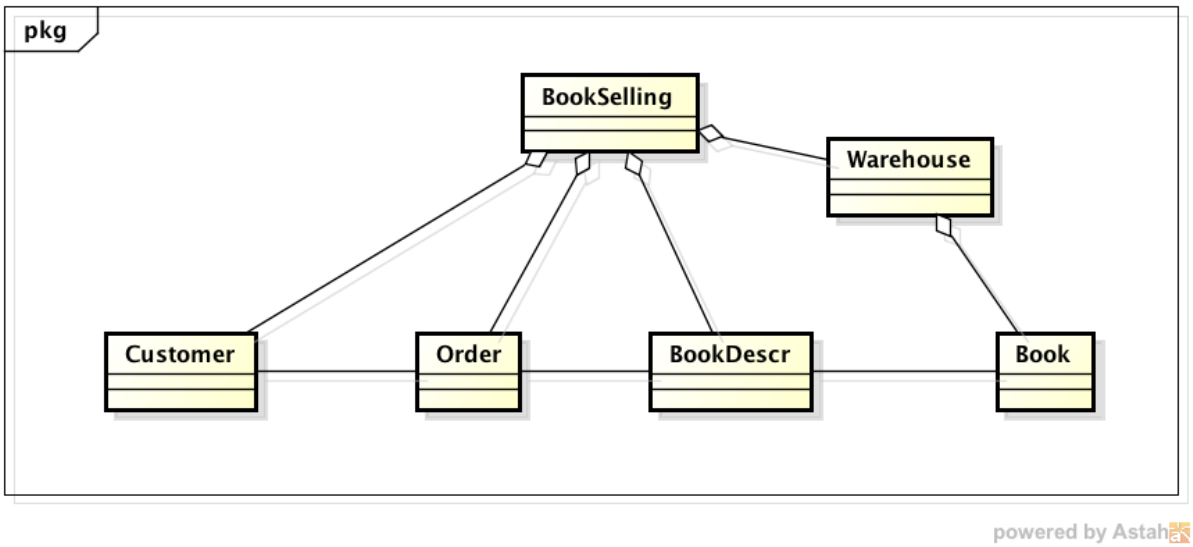
# Book purchase: process model



# Process view




# Book purchase: conceptual model



# Master and transactional data

- Applications of the IS work on
  - Master data (static list, class diagram in UML or ER model)
    - E.g. customers, suppliers, products ..
    - Change but seldom
  - Transactions (events, use case diagram or activity diagram in UML)
    - New order, order completed, received material, sent material

# Master data vs. Transactions

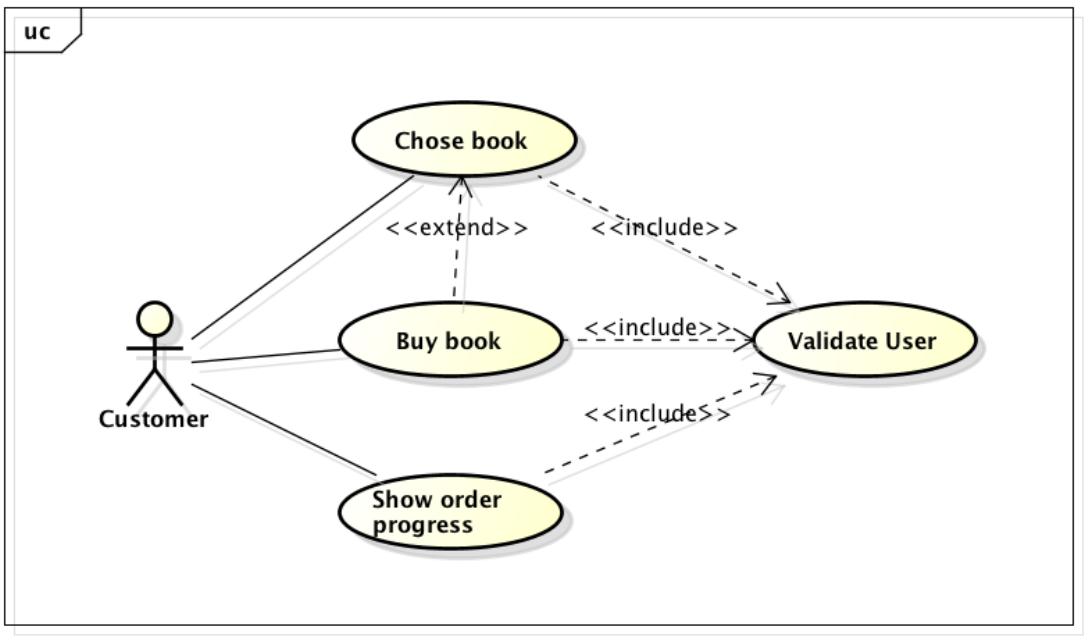
| Macro-process | Transactions a Master data |
|---|---|
| Design and engineering | Update of product and production process master data |
| Incoming Logistics and raw materials supply | Order for materials to supplier |
| Production | Work order |
| Outgoing logistics and sales | Customer order (different channels) |
| Personnel | Presence and absence |
| Administration and infrastructure | Scrap book |

# Conceptual model

| IS type | Master data | Dynamic data | Indexes |
|---|---|---|---|
| Warehouse management | Materials<br>Locations | Storage<br>Turnover | Turnover<br>Storage |
| Bank account | Customers<br>Accounts | Account balance<br>Account turnover | Turnover<br>Customer balance |
| Gas accounting | Customers<br>Price table | Consume<br>Payment balance | Consume stats<br>Customers |
| Customer order processing | Products<br>Customers<br>Price table | Orders<br>Product store | Customer prefs<br>Customers |
| Public services | Citizens<br>Certificates<br>Price tables | Certificate requests | Services<br>Citizens |



# Use cases



# Mock-up


A Web Page
http://
Gestione domande e risposte
Sel.
Data
Titolo
28/01/2015
Primo appello di Sistem Informativi
15/02/2015
Secondo appello Sistemi Informativi
18/02/2015
Appello unico di Tecniche di Programmazione
Seleziona