Chapter 8 User needs assessment & multi-user spatial solutions

1. Introduction

successful implementation of spatial DB tech demands careful user need assessment

2. Concept & method of user needs assessment

2.1 Nature & definition of user needs assessment

a user need : what a user requires of a DB + applications

several common inherent difficulties w/ understanding user needs :

comprehension - users do not know exactly what they want ex. too general / too narrow ideas

communication - users describe & understand differently ex. concept, description, level

arbitrary sys structure & continuous changes - arbitrary & invisible nature of DB, changes of needs

interdependency of needs - different users have interrelated but conflicting needs & priorities

systematic & analytical approach method is required :

document analysis, job observations, questionnaires, interviews, focus group discussions

immediate outcome of a user needs analysis - description of data, business processes, guidelines, constraints & rules for DB applications

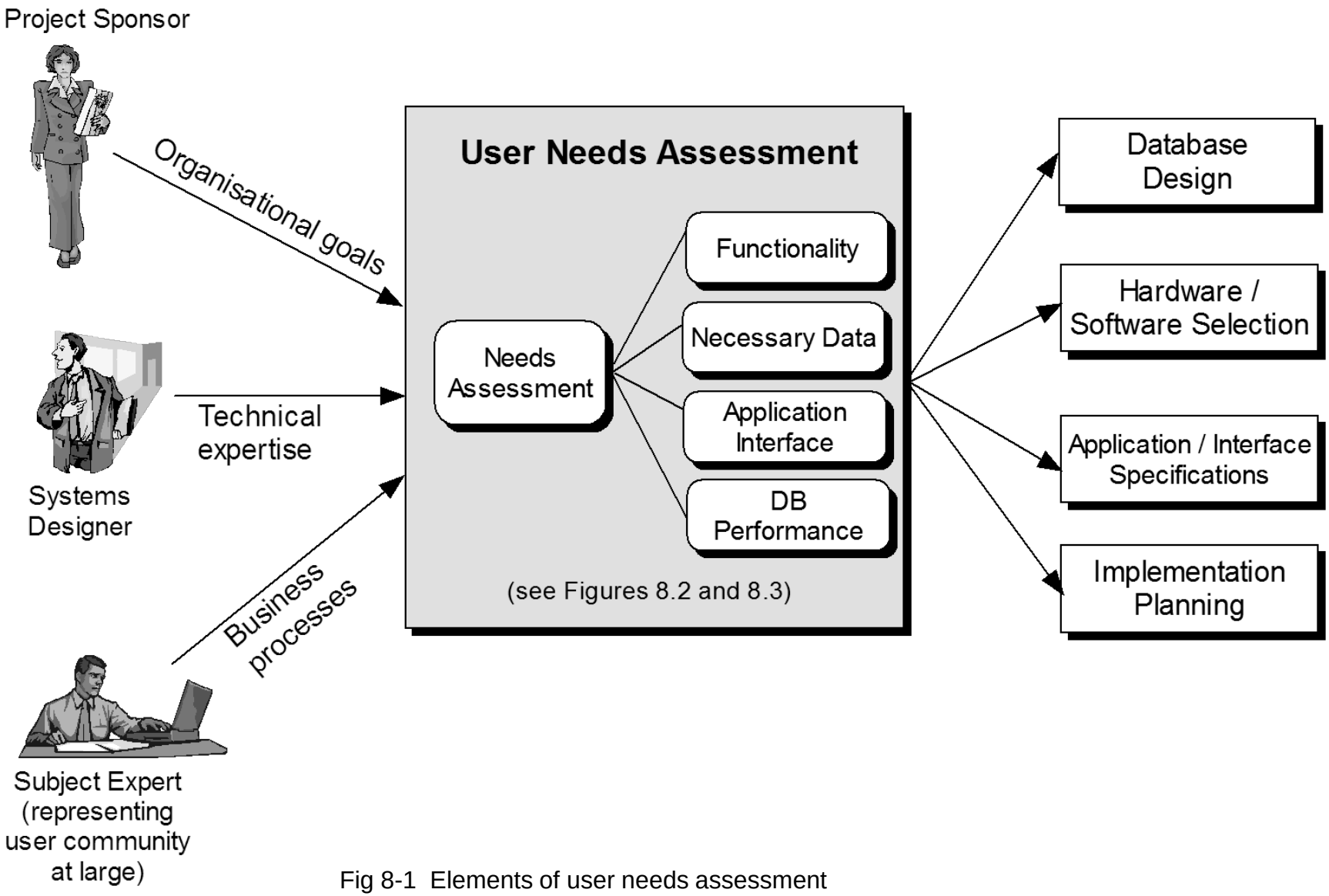


Fig 8-1 Elements of user needs assessment

2.2 Objectives of user needs assessment

objective of user needs assessment - broader concept

1) to provide a holistic, info science perspective of the DB project
2) to provide a structured & systematic approach to identify desired sys functions
3) to provide a coherent framework that relates business object & activities, associations among them
4) to enable the solution of complex business problems by breaking them down into pieces & prioritize
5) to provide a solid foundation & framework for DB & application development
6) to facilitate knowledge transfer & integration between DB users & sys designers
7) to provide a conceptual framework for sharable info services & interoperability
8) to create an atmosphere of trust & respect between the sys development staffs & user community
9) to produce a blueprint for initiating organizational change & transformation

poor user needs assessment - causes enormous cost as SDLC stage goes (Fig 8-2)

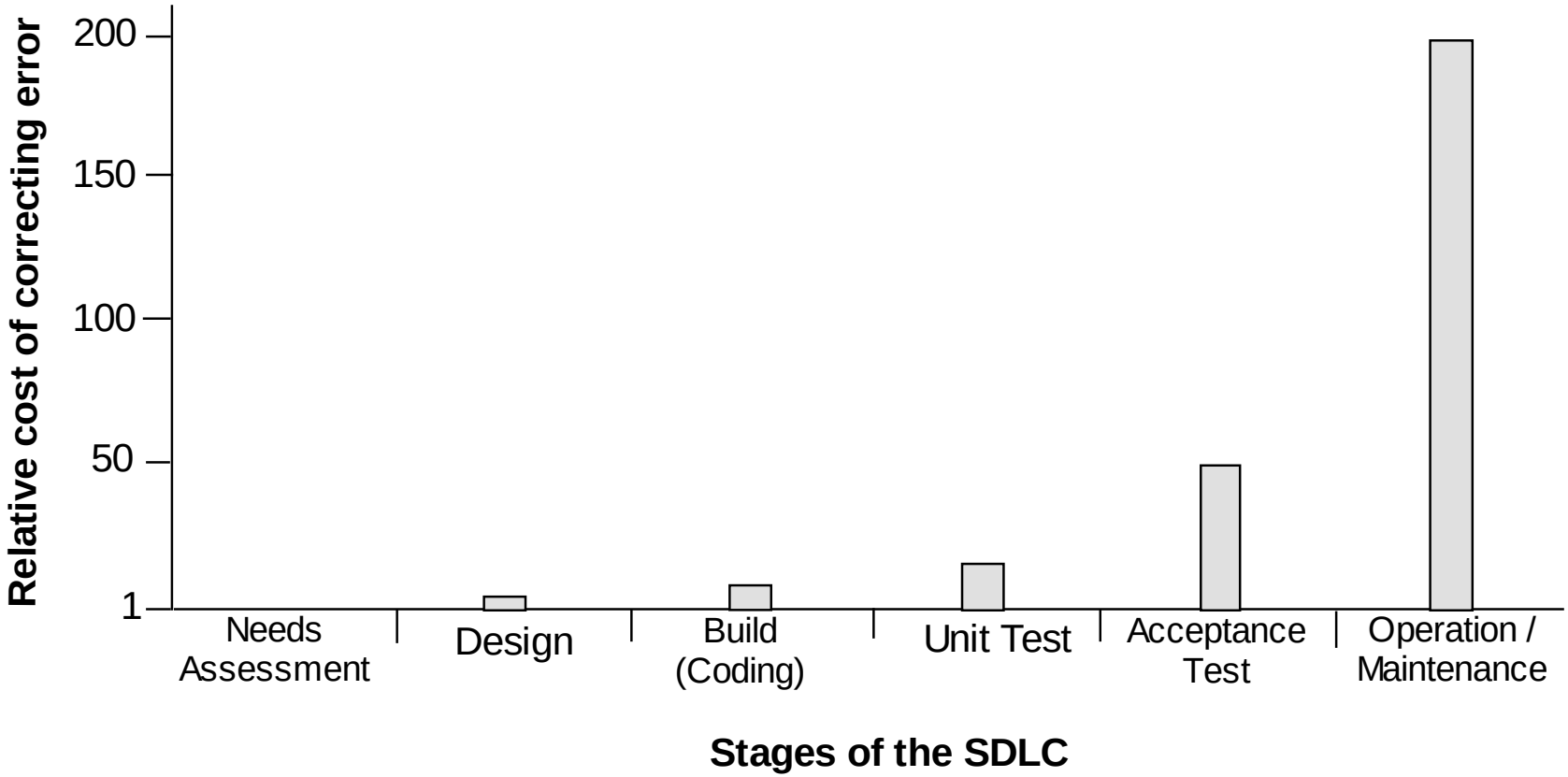


Fig 8-2 Relative cost for correcting systems errors in progressively advanced stages of the SDLC

2.3 An integrated approach to user needs assessment

user needs assessment - an essential aspect of sys development - SDLC

four components :

1) needs development

elicitation - scoping the potential needs of users & filing the identified needs

analysis - decomposing high level needs into detailed functional requirements

prioritizing according to business goals, resources, tech feasibility, cost-benefit, legislations

specification - documenting in an accepted & structured format

verification - evaluating the correctness & completeness, involves feedback

2) needs management

various tools designed to support the needs development

3) rapid prototyping

partial implementation of a sys for a better communication

ex. mock-ups of GUIs to simulate the appearance

4) documentation

measures of good quality documentations - completeness, freedom of ambiguity, consistency, correctness, verifiability, ease of reference

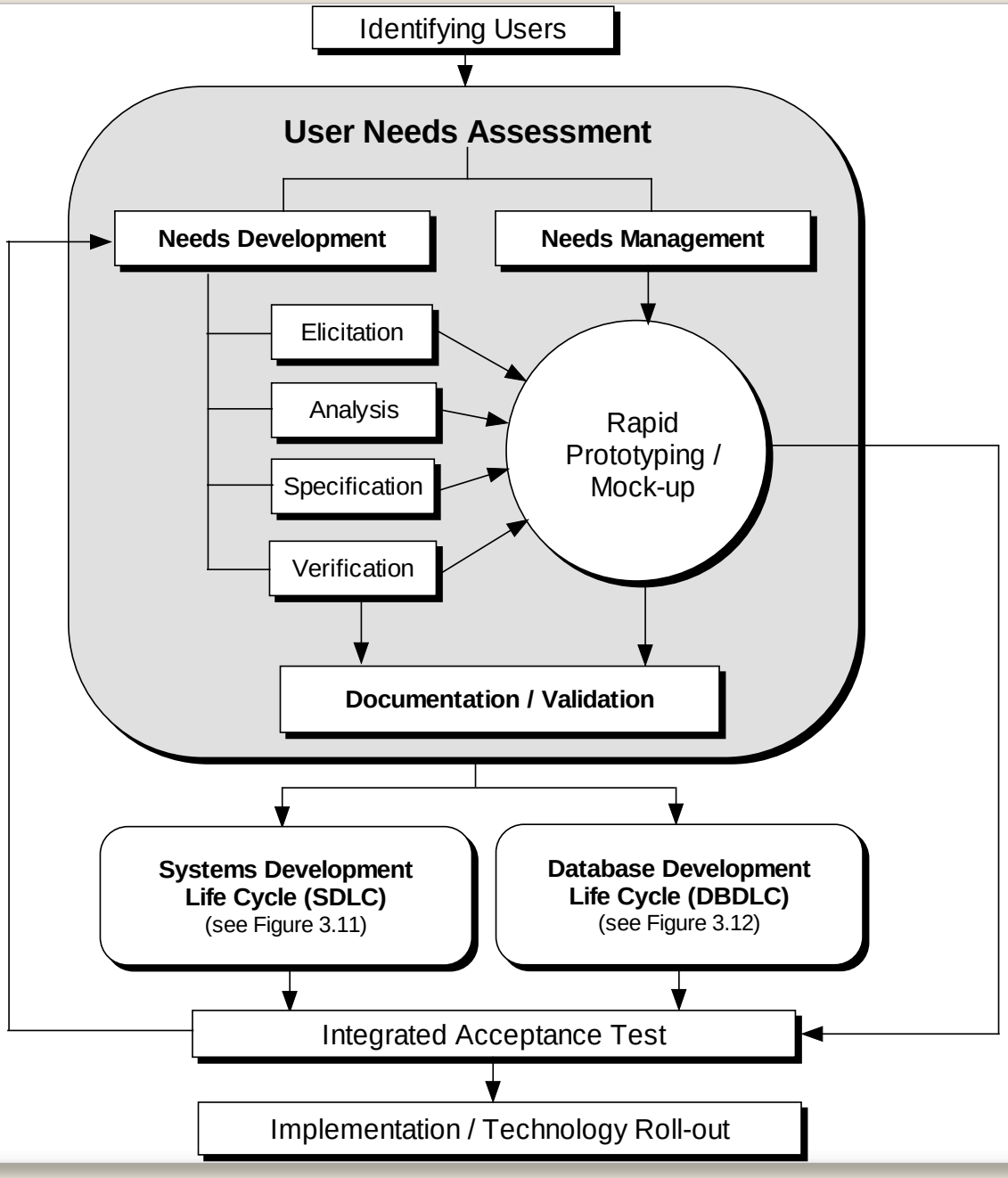


Fig 8-3 Steps & workflow of a typical user needs assessment as it related to the sys & DB development life cycles

3. Collecting user needs information by joint application development

3.1 Definition of joint application development

definition) formalized as a sequence of workshops to elicit, verify, decompose, prioritize user needs

* initially developed by IBM in late 1970s

popularly used for it has numerous advantages over other approaches :

robust methodological foundation - follow the principles of best practice in sys development

simplicity & structure - provides a relatively simple but structured approach

user participation & commitment - identify who have the knowledge, get users involved

communication & group dynamics - improves communication, chances to educate users & sys staffs, generate group dynamics to work together

consensus building & conflict resolution - helps identify important issues & resolve them

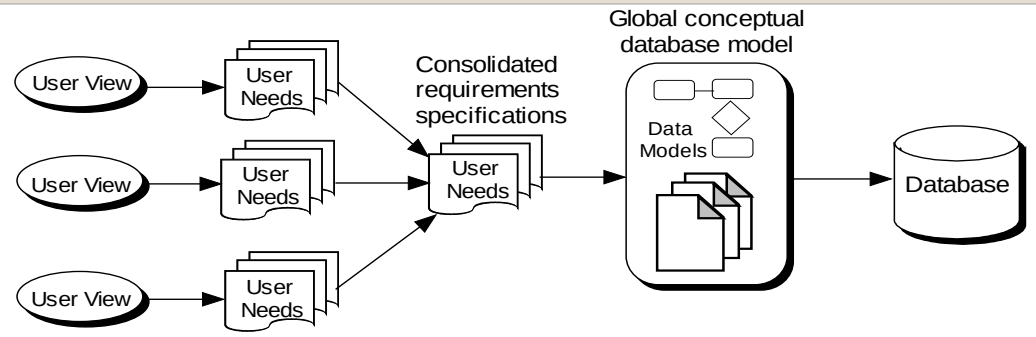
flexibility & transition management - support the evolutionary process of defining business processes, helps facilitate the transition between project phases

3.2 Joint application development in a multi-user DB environment

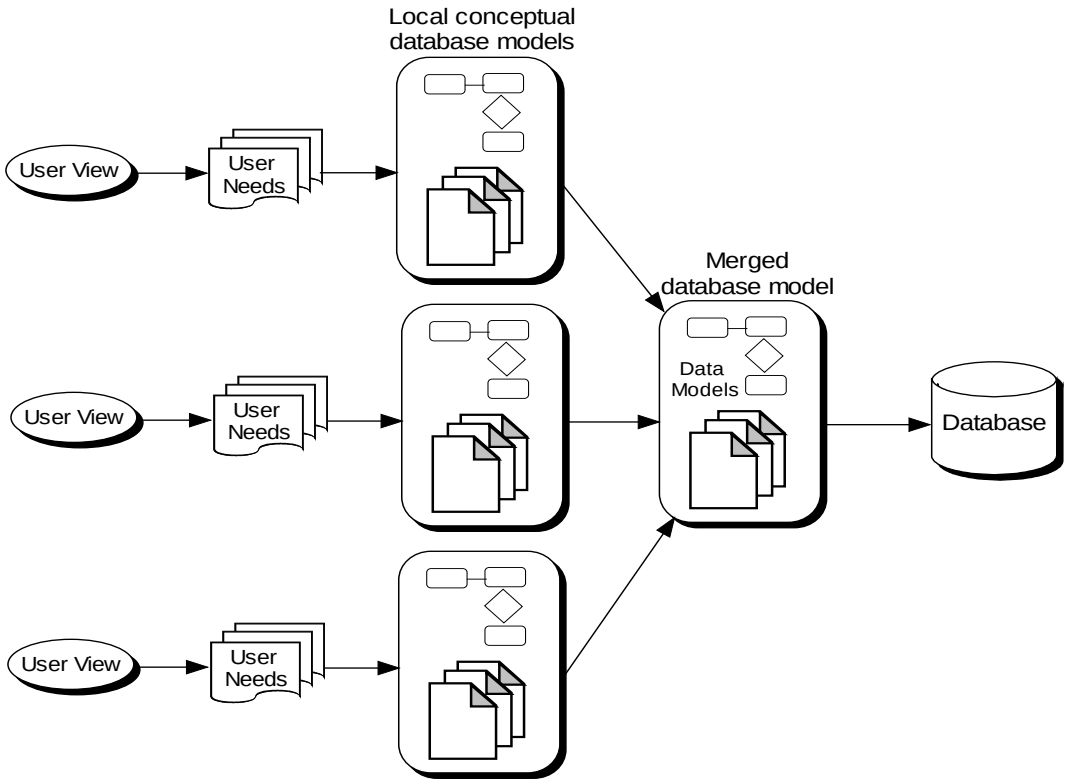
two approaches to deal w/ multi-user views in JAD :

centralized approach - collates the views & needs of different users into a single set of requirements specifications

view integration approach - each view & need makes a local DB model, then merged later



(a) The centralised approach to multi-user needs assessment



(b) The view-integration approach to multi-user needs assessment

Fig 8-4 Approaches to user needs assessment in a multi-user DB environment

3.3 Key participants in joint application development

key participants - DB users + sys professionals (3:1 ratio)

especially important is a **facilitator** (specially trained & experienced in workshops)

users are commonly called subject matter / domain experts

project manager - as a logistical supporter of the facilitator / observer

3.4 The process of joint application development

3.4.1 Pre-workshop activities

3.4.2 Workshop activities

1) introduction - ground rules & agenda of the workshop are announced

2) review/ follow up - careful review of the results of the previous meetings

3) business function identification & analysis

* business function : logical grouping of business processes

examine the org business function as a whole (not from department / business unit view)

explore business processes, break down individual activities into detailed work steps

starts from a high level, moves into smaller & more detailed work steps → business function decomposition (BFD)

outcomes of the BFD can be graphical → function decomposition diagram (FDD)
can be textual → business function hierarchy (BFH)

4) prototyping

5) scribe

6) review

7) wrap up

3.4.3 Post-workshop activities

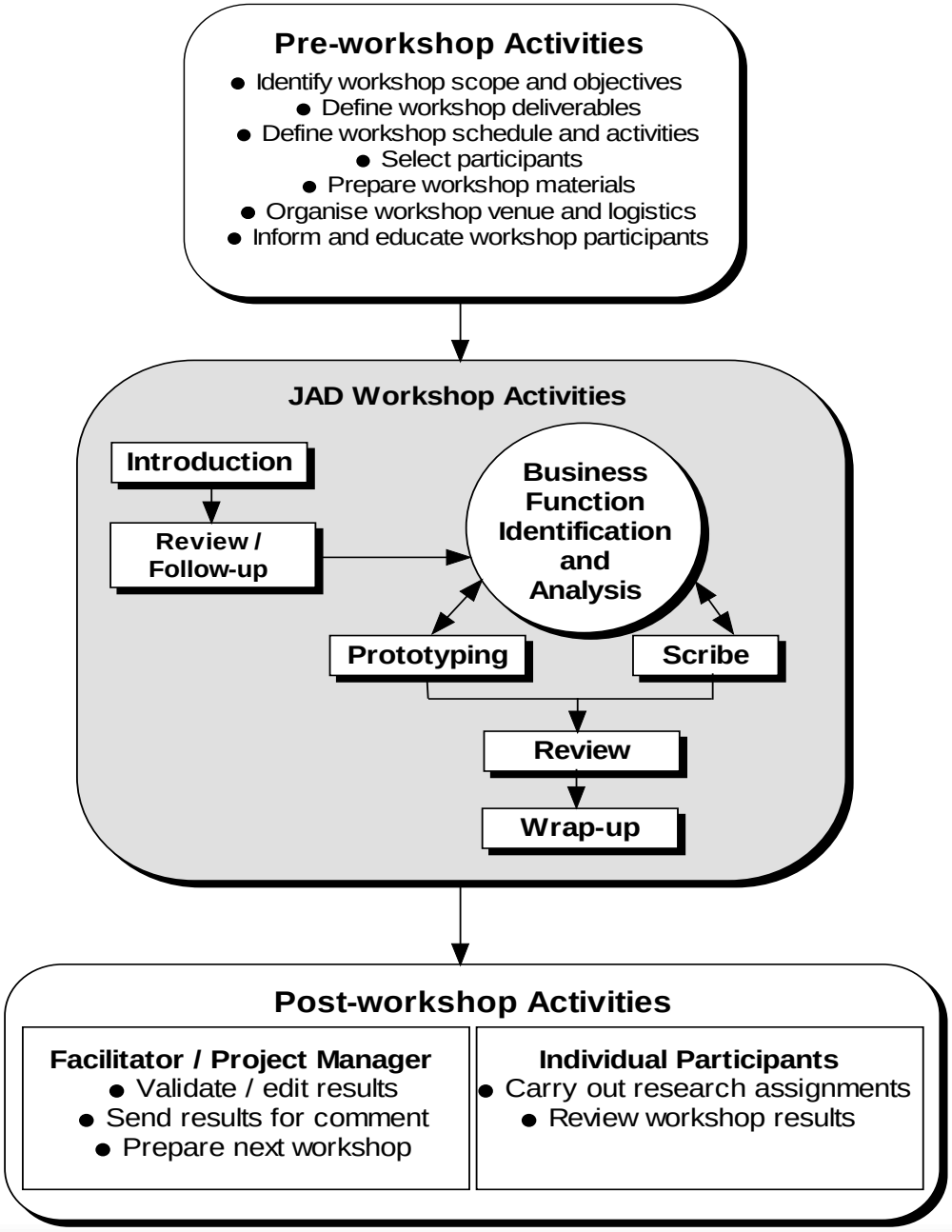


Fig 8-5 The three phases of JAD activities

4. Translating business functions into user needs specifications

4.1 Business function decomposition

FDD is a very effective way of visually presenting the relationships between functions & processes

but some limitations - ex. grows too quickly to be in a single sheet of paper (Fig 8-6)

BFH - more flexible (Fig 8-7)

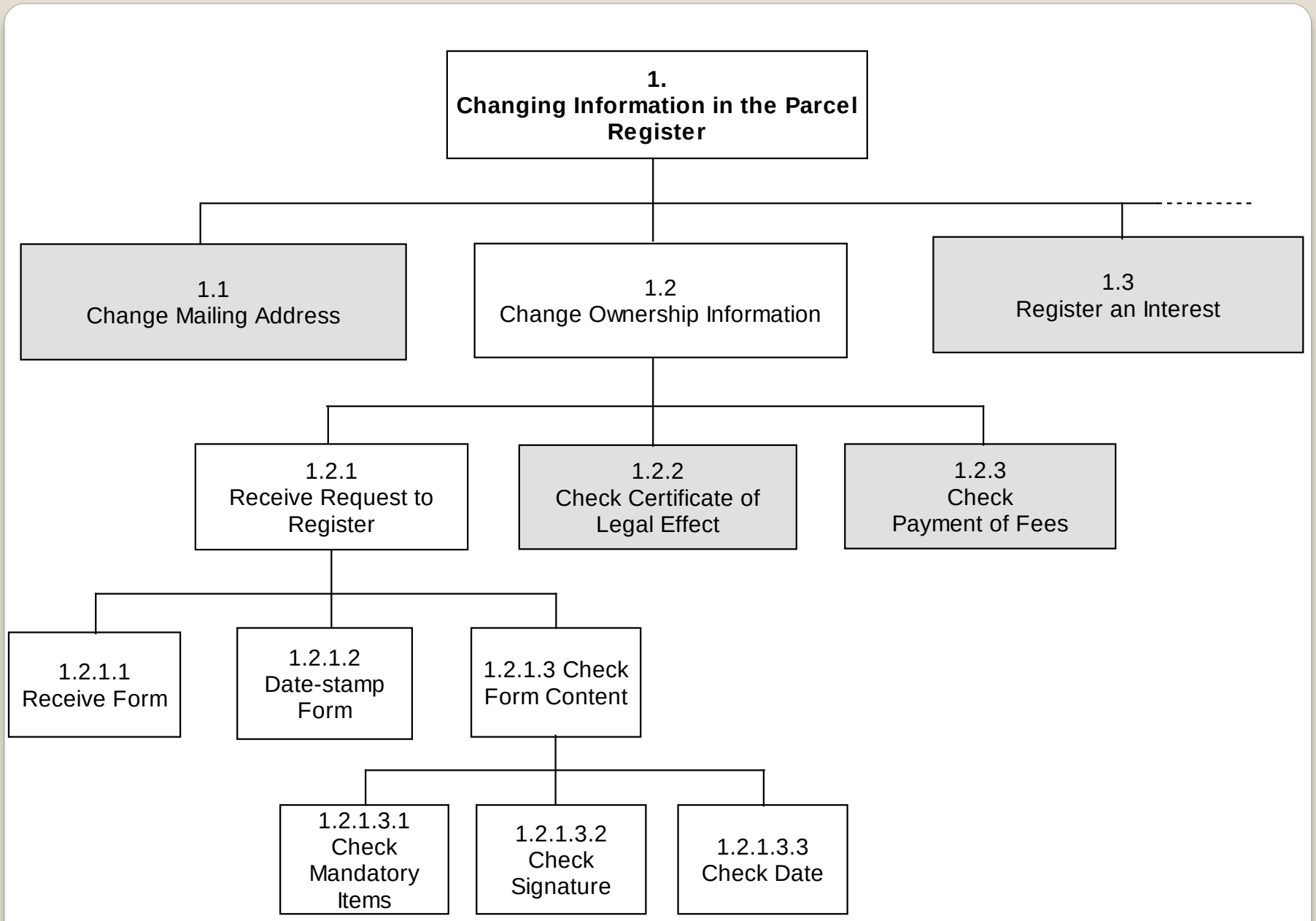


Fig 8-6 The concept of business function decomposition (BFD) as illustrated by a function decomposition diagram (FDD)

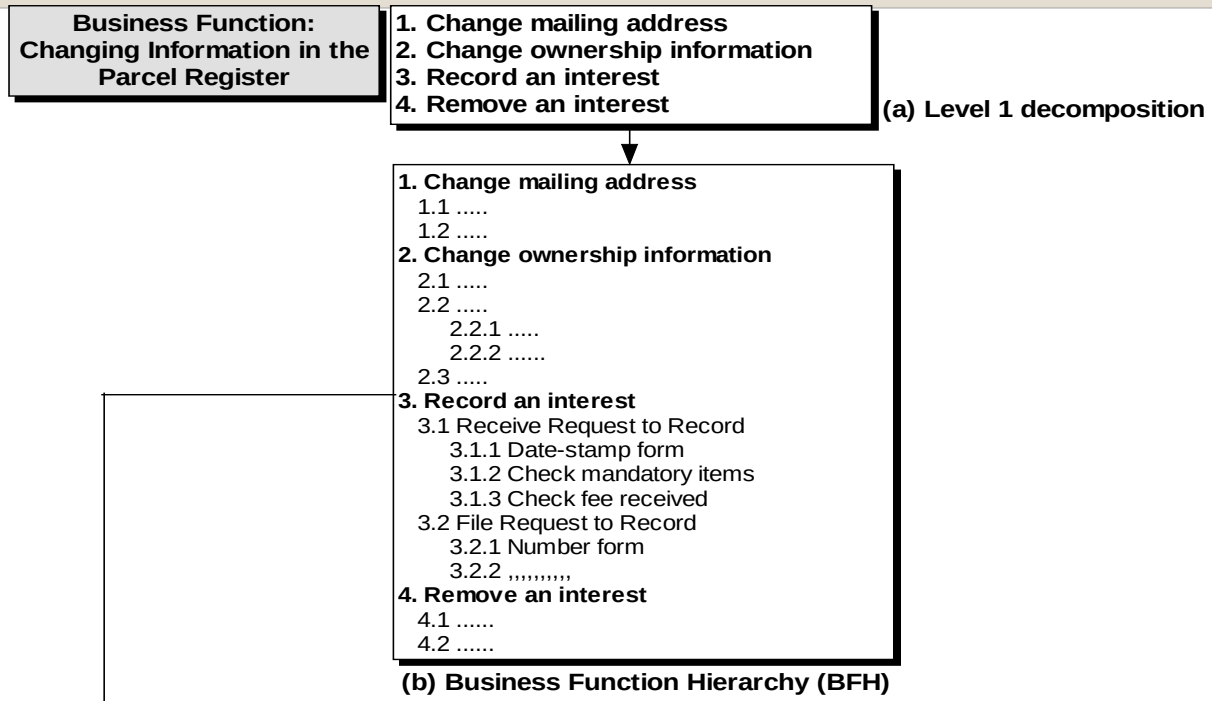


Fig 8-7 Example of a business function hierarchy (BFH) & its associated business function definitions (BFD)

4.2 Business data modeling

process to identify the business processes that consume / produce data by analyzing BFH

business data modeling steps :

a. go thru the BFH functions & processes them to those that use / generate an info product

* product - textual data forms, statistical tables, reports, maps, images, existing DBs, DW

→ create function-info product table (FIPT)

b. identify the data required by / associated w/ each info product

→ create info product data table (IPDT)

c. grouping related data item in a data specific table (DST)

d. define characteristics of the attributes of each data set in the DST

business data modeling reflects user view of the DB (not designer view)

ex. no relationship between data sets, no cardinality info

thus, viewed as a prerequisite

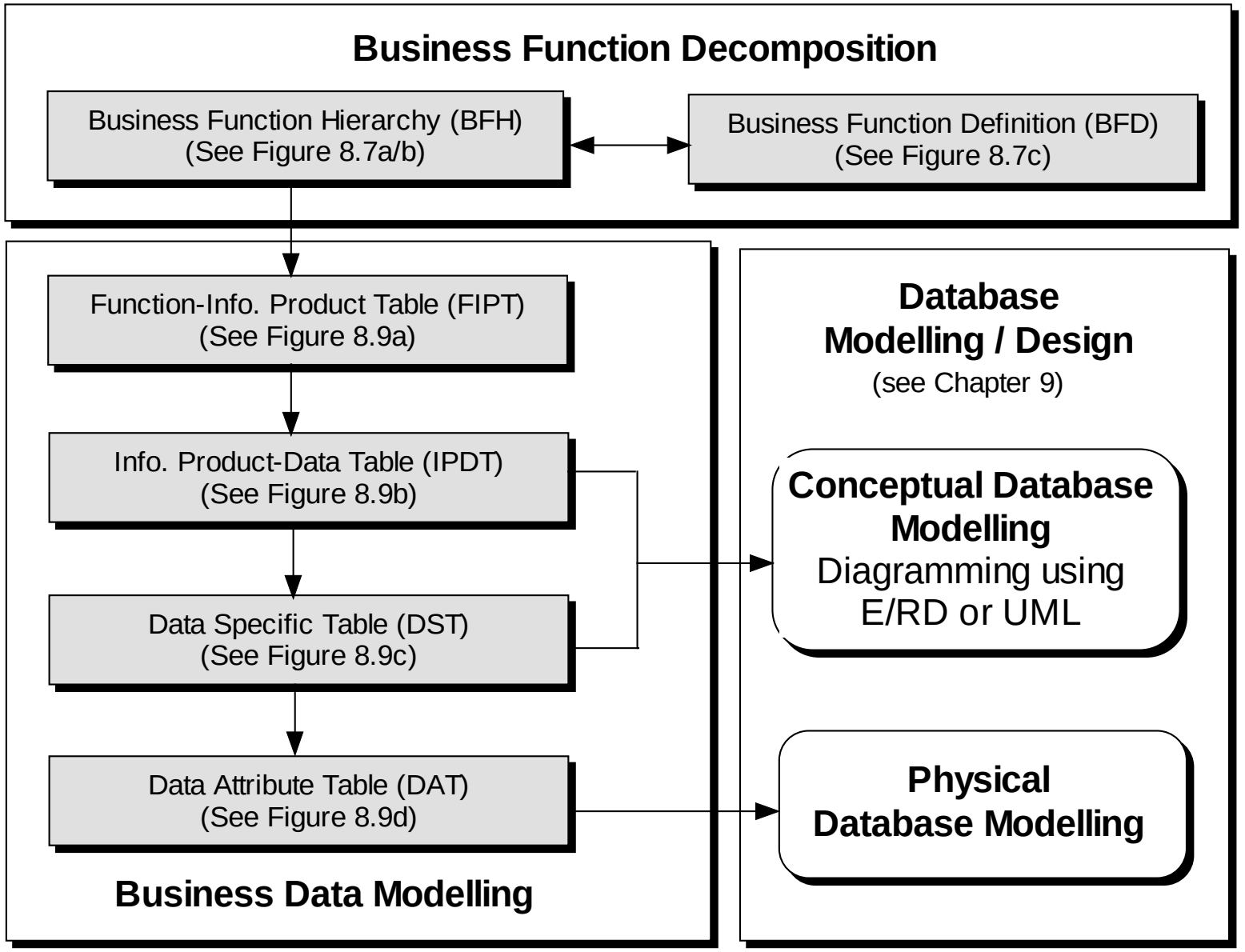


Fig 8-8 Using BFH in business data modeling to generate info products & related data tables

Function	Information Product
1.1 Receive notice of change	Notice from owner
2.1 Check Change Ownership form	Change of Ownership form MBS-0012-CHG
3.1.1 Obtain Req to Rec form	Request to Record an Interest form MBS-0009-REC
.....	

(a) Partial listing of a **Function-Information Product Table** (FIPT) derived from Figure 8.8c

Information Product	Data Required	Process
Change of Ownership Form MBS-0012-CHG	Parcel ID	2.1 Verify parcel ID Land Records DB
	Vendor name	2.2 Check Land Record DB
	Vendor mailing address	
	Parcel location address	
	Date of transaction	2.2.1 Check date stamp
	Buyer name	
	Buyer mailing address	
	Reference to deed	
	Reference to survey	5.1 Load parcel map DB

(b) Partial listing of an **Information Product Data Table** (IPDT)showing data in an information product called "Change of Ownership Form"

Data Set	Source	Type	Attribute
Parcel info	Land Records Office	Text	Parcel ID
			Parcel location address
			Reference to deed
			Reference to survey
Owner info	Land Records Office	Text	Parcel ID
			Vendor name
			Vendor mailing address
			Buyer name
			Buyer mailing address
			Date of transaction

(c) Partial listing of a **Data Specific Table** (DST) showing data sets and associated attributes derived from (b)

Attribute	Type	Domain	Description
parcel_id	C, 20	PIN	Parcel Identification Number
vendor_name	C, 35		Name of vendor
vendor_address_1	C, 100		Mailing address of vendor line 1
vendor_address_2	C, 100		Mailing address of vendor line 2
buyer_name	C, 50		Name of buyer
buyer_address_1	C, 100		Mailing address of buyer line 1
buyer_address_2	C, 100		Mailing address of buyer line 2
date_transaction	Date		Transaction date yyyy/mm/dd

(d) Partial listing of a **Data Attribute Table** (DAT) showing characteristics of attributes associated with the "Owner info" data set in (c)

Fig 8-9 Illustration of data-related tables resulting from business data modeling

4.3 Business process modeling (BPM)

entails how data are used - identify how individual business functions & processes are related to the DB & to one another

ex. which process requires data from the DB, what info will be produced, how data from one process are used as input to another process

three general approaches :

a. data flow-oriented approach - use DFD (data flow diagram) to depict the movement of data between processes, data stores, **interfaces** (source & destination of data)

b. data structure-oriented approach - use STC (structure chart), focuses on the identification of info entities & the actions applied to them

c. object-oriented approach - results in a design that interconnects data & processes (operations) in a way that modularize info & processing

BFD + BFH + related tables are used as input to BPM

BPM using an object-oriented approach is fast becoming the industry standard - explained below

4.3.1 Identification of objects, operations, messages

done by go thru the BFH carefully, then identify objects, operations, messages

4.3.2 Diagramming of business practices

depict graphically the objects, operations, messages

two diagrams are useful :

UML activity diagram - shows activity involved in the business process
shows how objects interact w/ one another

UML sequence diagram - shows objects, operations, messages involved in the business process

other diagrams are also created if needed - use case diagram, collaboration d., state chart d.

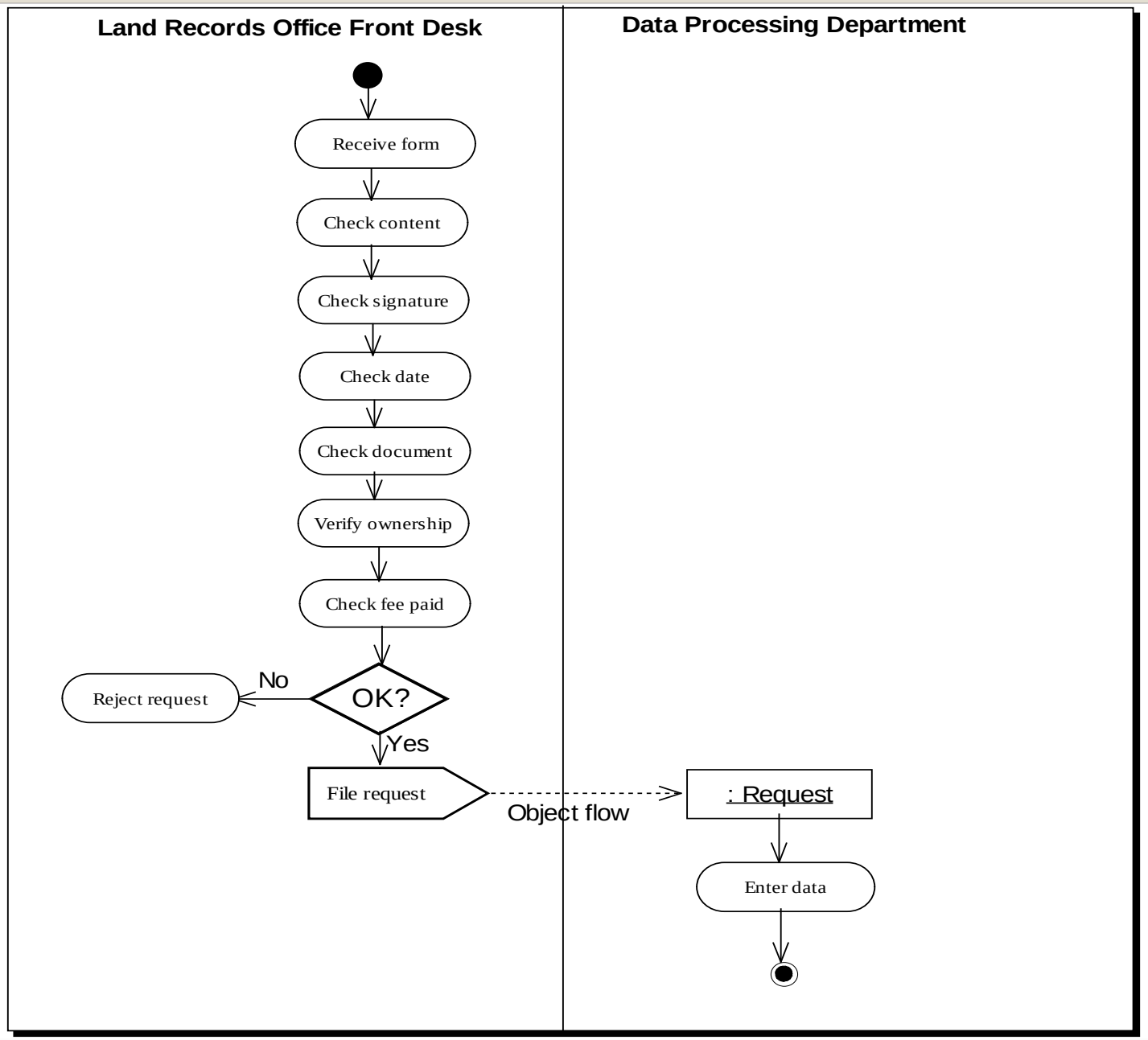


Fig 8-10 Example of a UML activity diagram showing the workflow of the business process of handling a Record an Interest application

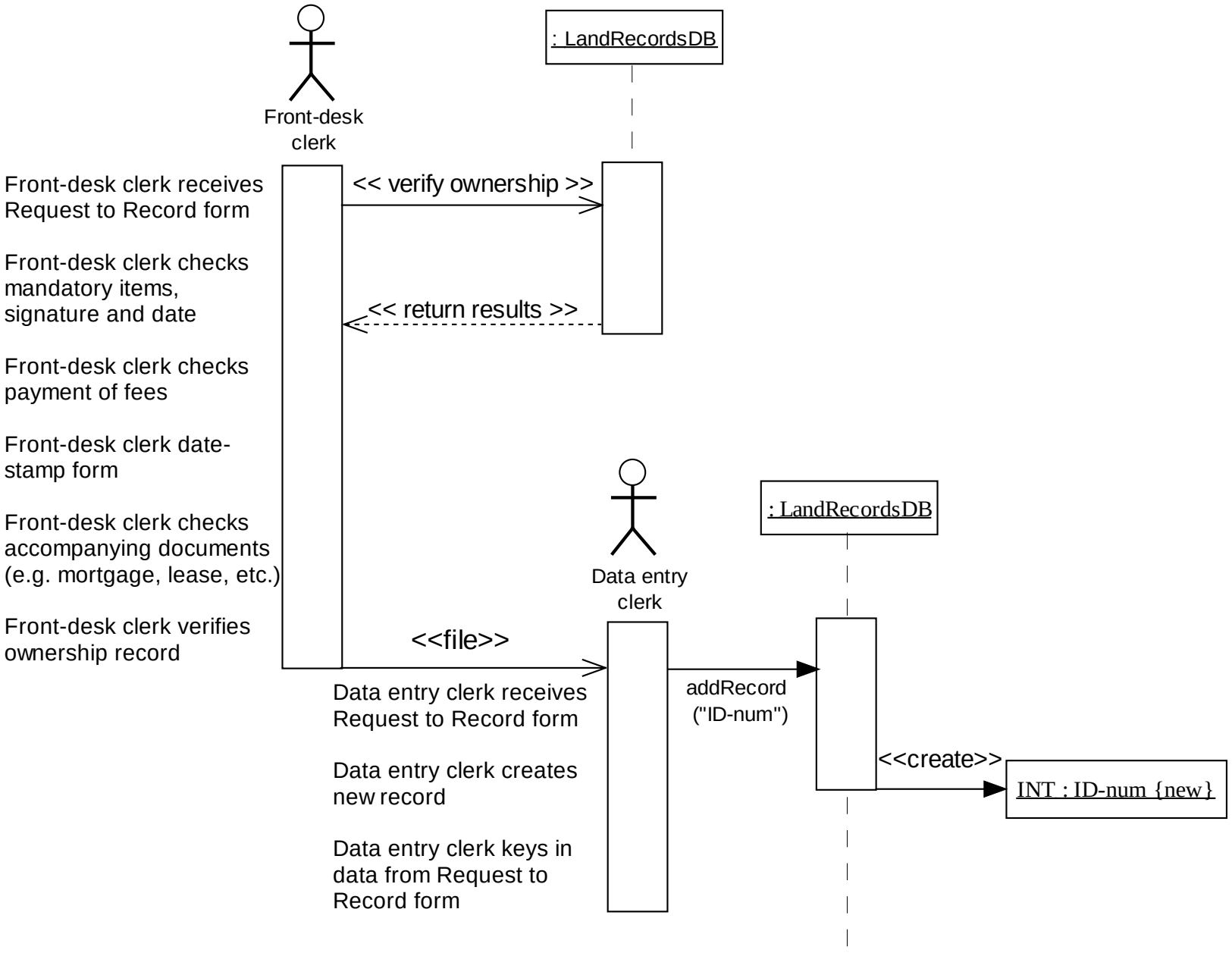


Fig 8-11 Example of a UML sequence diagram showing objects, operations & messages involved in the business process of handling a Request to Record an Interest application

5. Multi-user DB models & spatial solutions

5.1 Characteristics of multi-user DB environment

multi-user DB sys - support multiple users concurrently

- workgroup DB - DB supports a small number of users (ex. 50) / a specific department
- enterprise DB - supports entire organization / more than 50 users

several salient characteristics :

- multi-representation of data - w/ respect to storage format, content, quality
- common user interface - provide the same look & feel for applications in different domains
- concurrent access & security - support access by different users of different applications simultaneously
  - to maintain DB integrity & consistency, sophisticated algorithms, strict business rules, transaction control mechanism are required
- standards - data standard + technical standard
- metadata support
- systems architecture - data warehouse / federated DB architectures is possible

5.2 The concept of multiple representation of spatial data

two aspects of multi-representation of spatial data :

i. coexistence of data in a DB pertaining to the same real world features represented by diff DB models, geometries, descriptions, other characteristics

ii. ability of DB sys to abstract & manage such data consistently & w/o human intervention

multi-representation is a fundamental to the multi-user DB environments

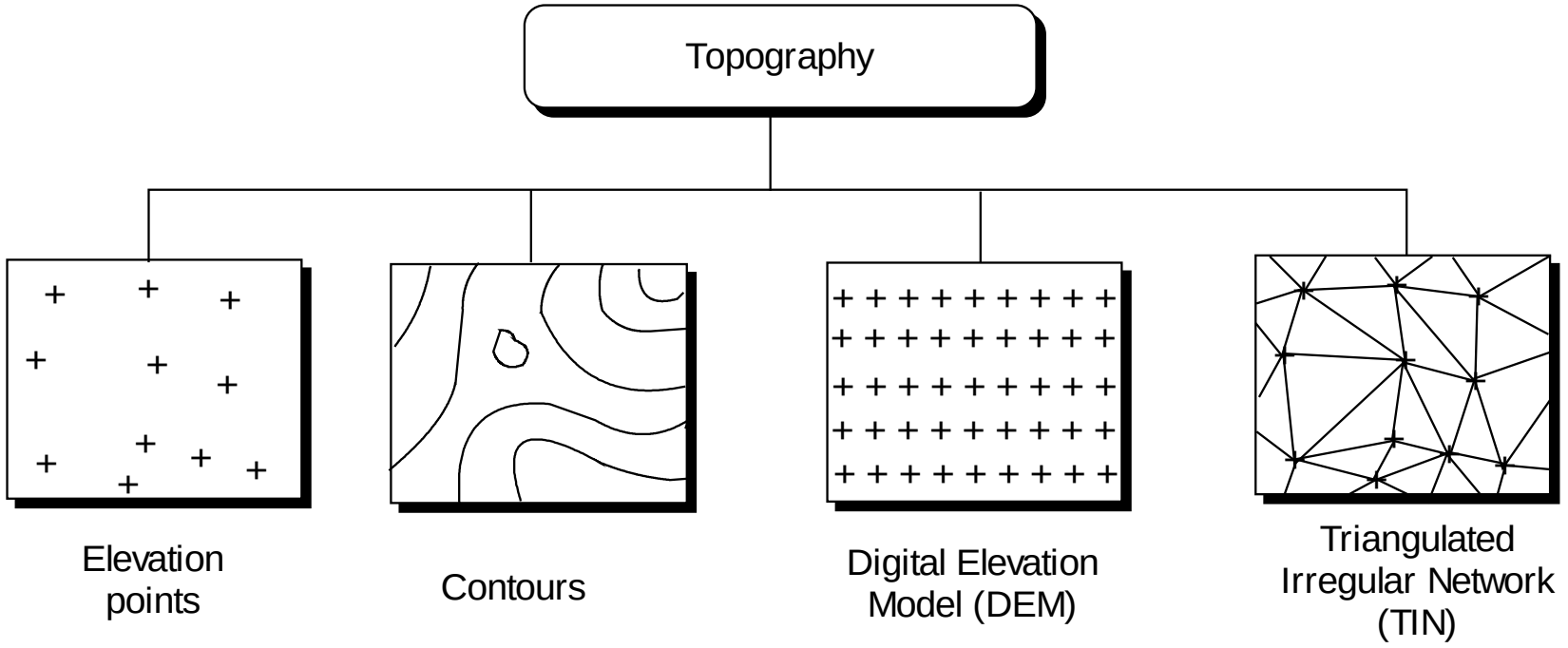


Fig 8-12 Depicting the same real world feature using different representations

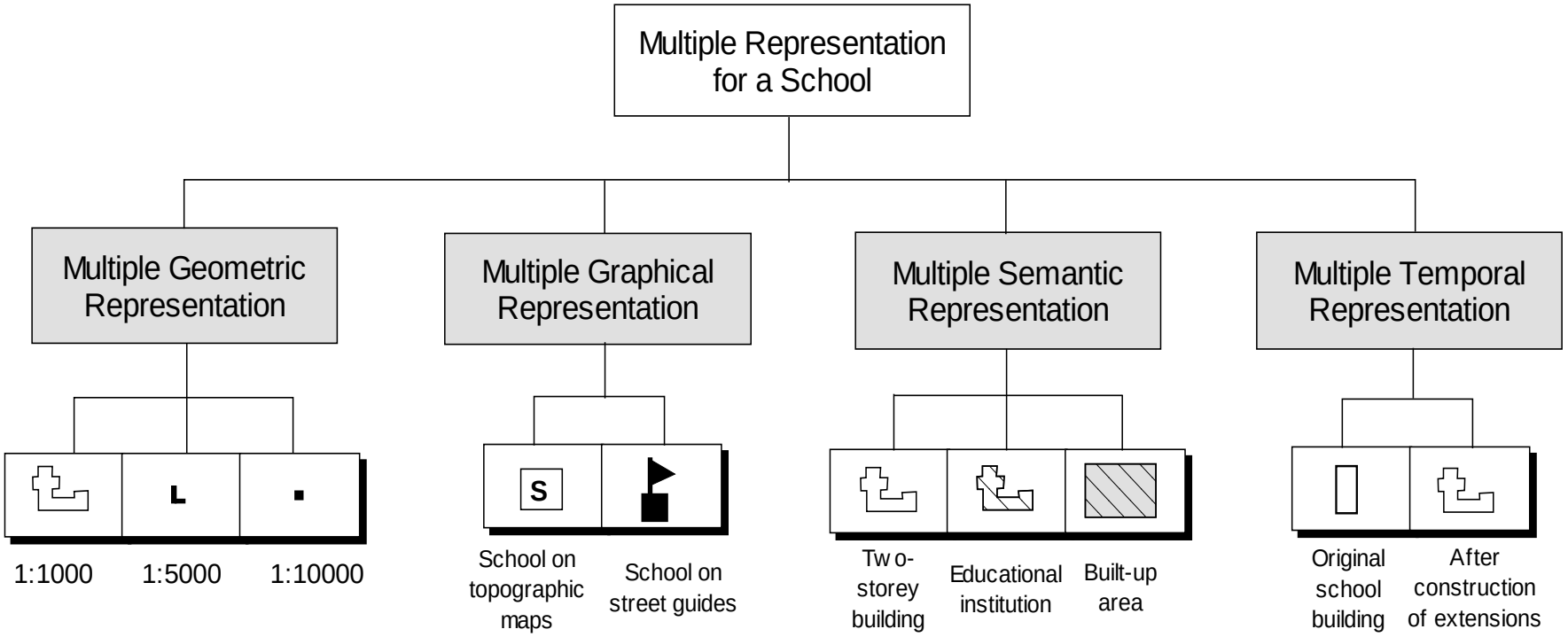


Fig 8-13 Different representations of the same real world features using different geometries, cartographic symbols & textual descriptions

5.3 Multiple representation & multi-user DB models

earlier research focused on geometries of spatial objects - changes geometries at different scales

current emerging methodologies - 1)multi representation data warehousing modeling 2)MAD modeling

5.3.1 Multiple representation by cartographic generalization

reduce the detail of a map as a result of reducing its scale - multi scale representation

focused on the algorithms for line & polygon simplification - very complicated as it is concerned w/ geometries + attribute data

5.3.2 Modeling of multiple representation in spatial data warehouse

the same objects be represented at different scales by different geometries in a data warehouse

two-tier / three-tier infrastructure is possible (in three-tier, data marts can be constructed for themes)

using a CASE tool is a good approach to modeling - UML derived object oriented formalism

* Perceptory - a visual modeling tool based on UML, PVL (plug-in visual language) is used

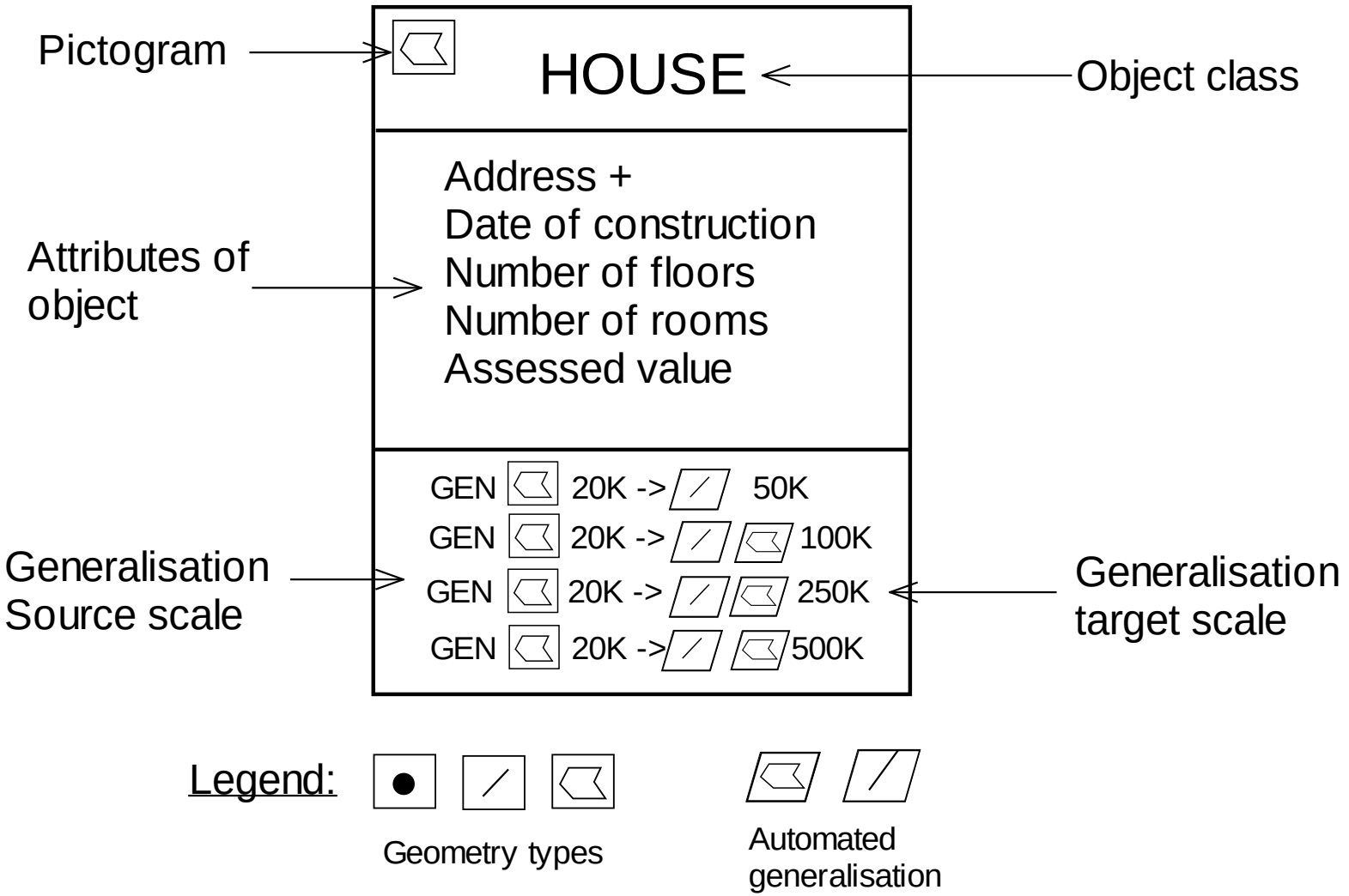


Fig 8-14 Modeling of the object class “HOUSE” using PVL graphic notation

5.3.3 MADS modeling (MADS : Modelisation d'Applications a Donnees Spatiales)

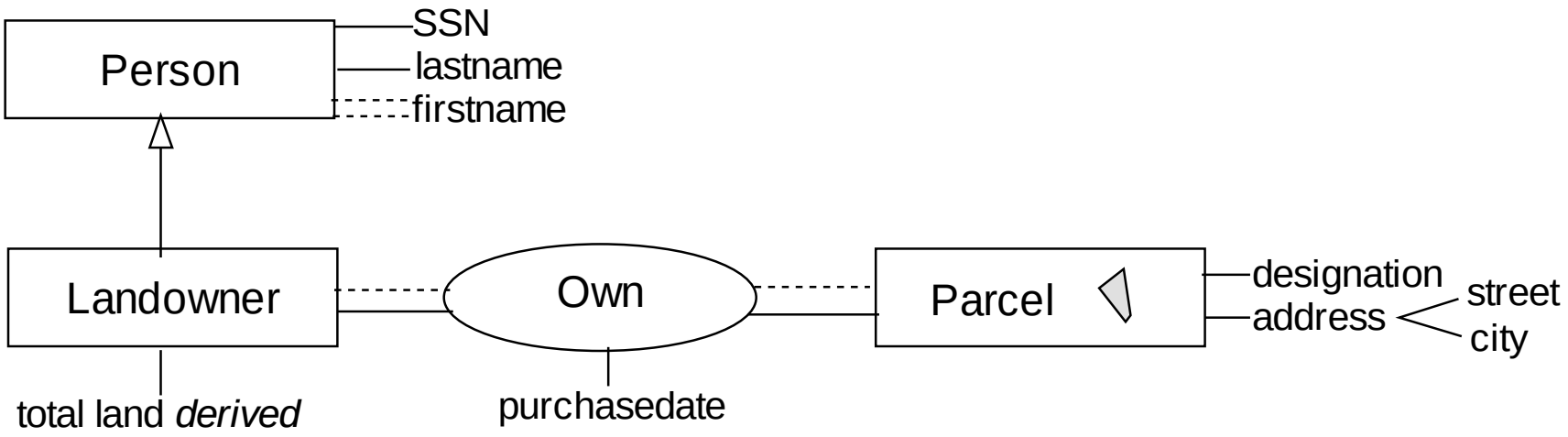
developed in the late 1990s for conceptual modeling of spatio-temporal DBs

an entity-relationship modeling technique extended to support the main concept of object orientation :

object types, relationship type, simple &complex attributes, spatial data type equivalent to those specified by the OGC, temporary data type, specific data type, binary spatial / temporal relationships

used as a conceptual modeling methodology for a multi-user DB

takes into account the thematic, spatial, temporal user needs



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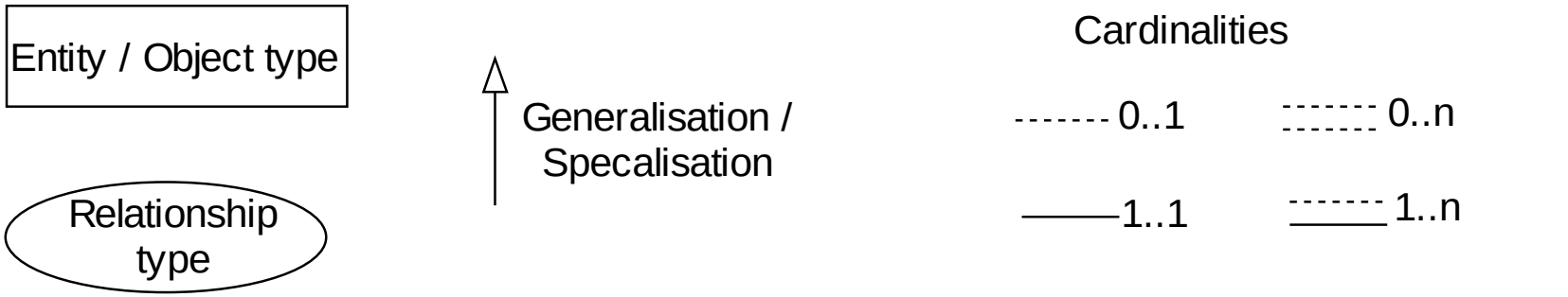

Fig 8-15 An example of conceptual modeling using MADS

5.4 Multi-user application development

central to multi-user application development is the use of standards - many advantages :

- divide the tasks into components - code teamwise & communicate between component teams
- individual teams are freed from the need to develop coding style & specifications
- programs are easier to maintain
- reuse of components for other applications w/ min modification

MDA (model driven architecture) - emerging sys development paradigm

- entire application development is driven by the activities of modeling the SW sys
- PIM (platform independent model) & PSM (platform specific model) play a key role
  - PIM - describes business functions, processes, behaviors, rules in UML
    (HW & DB sys are not considered)
  - PSM - use **UML profiles** (extension to UML) to specify the sys in terms of implementation constructs
  - automatic transformation from PIM to PSM to codes is possible though not yet complete

Table 8-1. Categories of software application development standards (Source: Lo and Yeung, 2006)

Category of standards	*Contents*
Coding or scripting	o Templates for new programs o Program header o Syntax including comments o Parameters and options o Exit status o User and global variable names o Error handling
Data naming	o Entity names o Attribute names o Data name suffices o Table names o File names
Application and GUI	o Window and menu-naming conventions o Window and menu design and resources o Display management o Function keys o Tool bars and icons o Screen and hard copy input / output forms o Design documentation o User documentation o On-line help
Development and Version management	o Directory and file structure o Revision control of codes o Revision control of applications o Access control for collaborative application development o Component test and acceptance procedure

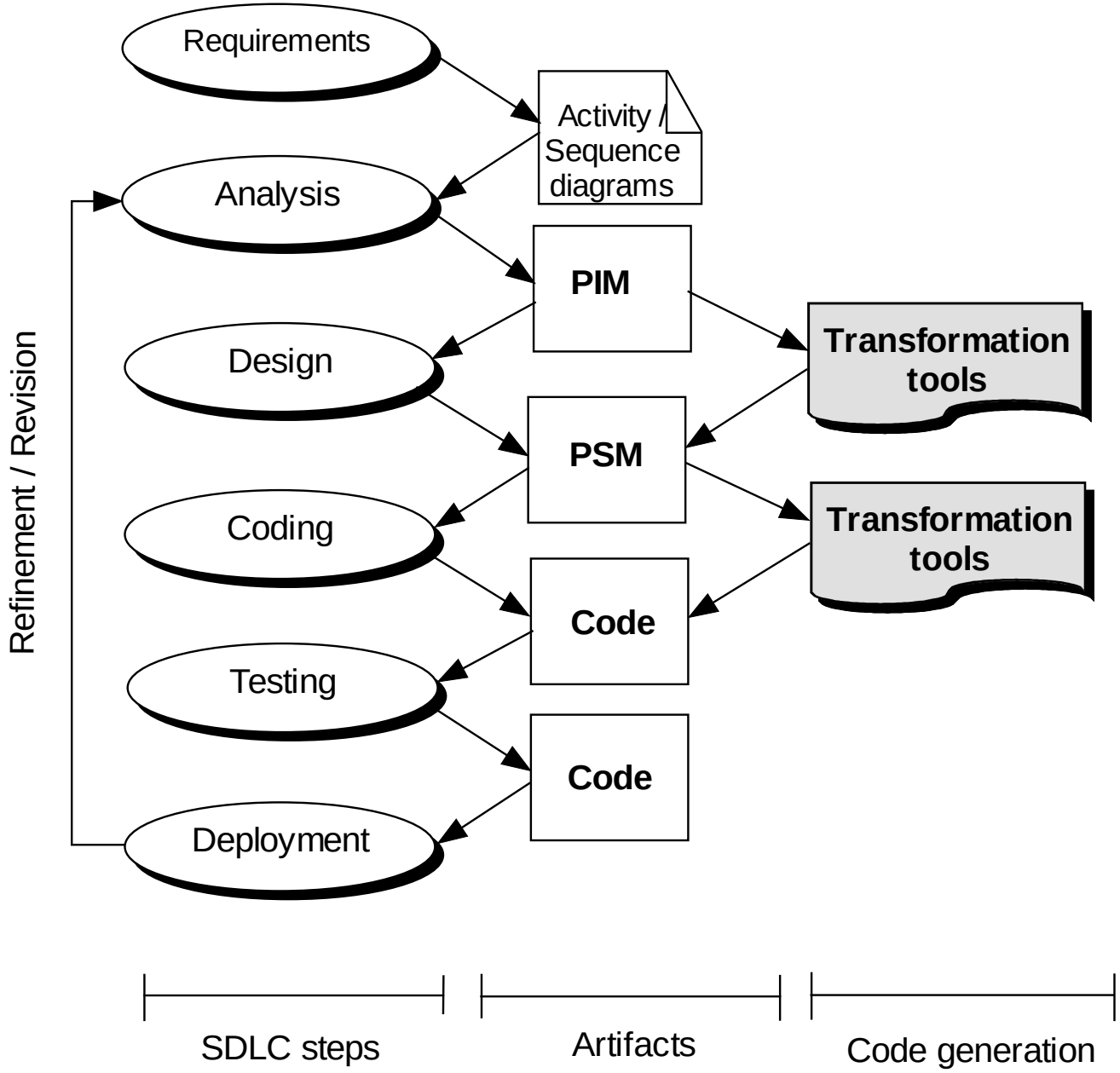

Fig 8-16 The MDA development life cycle