Business Analysis and Services Design
Models for User Information Requirements

ISAC
(Information Systems Analysis / Change Analysis)
Revision 2001/2009 /2011/2013

ISAC (Information Systems Analysis / Change Analysis) Extended

INTRODUCTION
A-GRAPHS
C-GRAPHS
I-GRAPHS
INTEGRITY CHECK
COMPLETION OF DESIGN
ACL CASE STUDY

INTRODUCTION

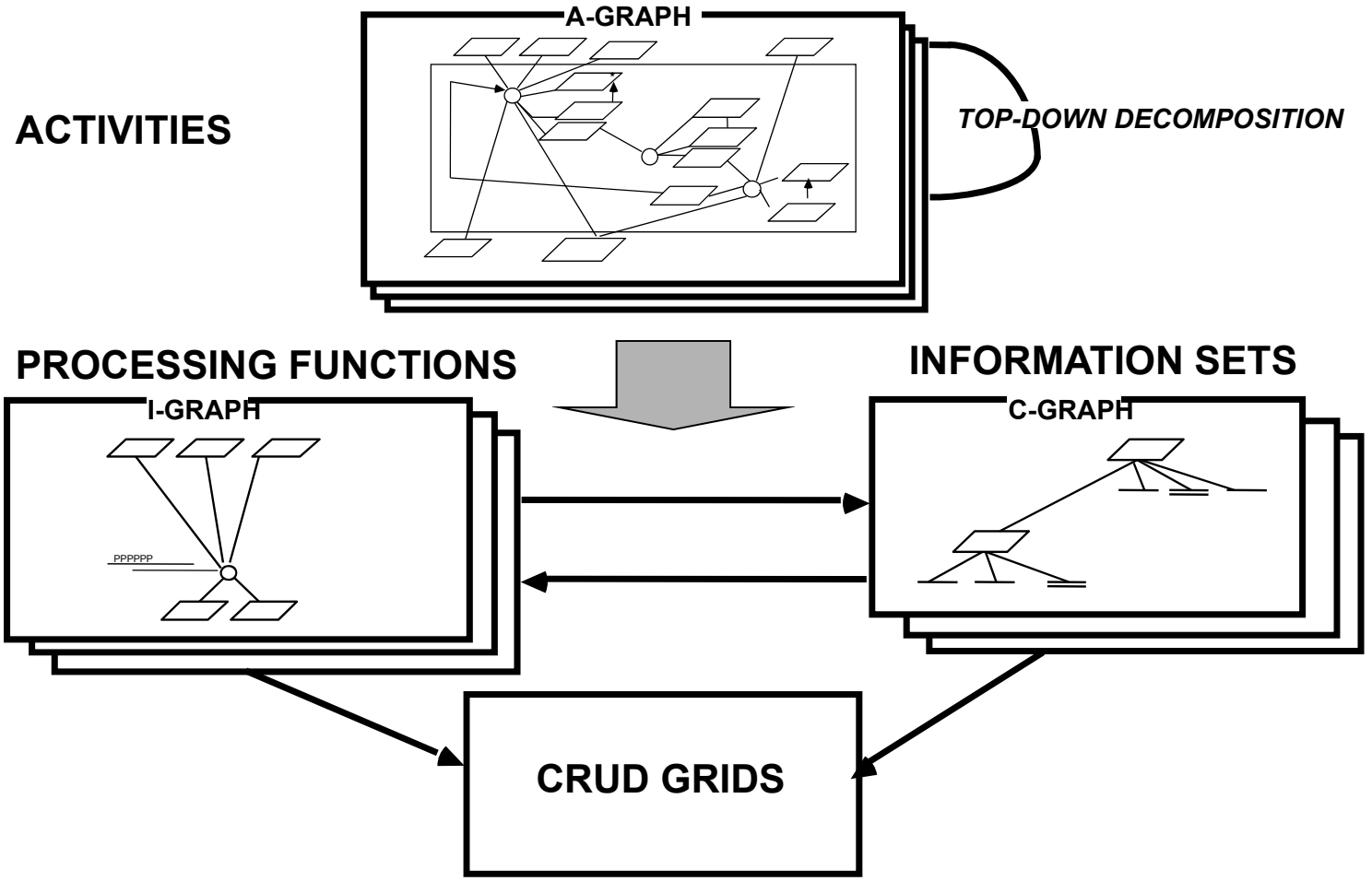
LOGIC

METHOD STEPS

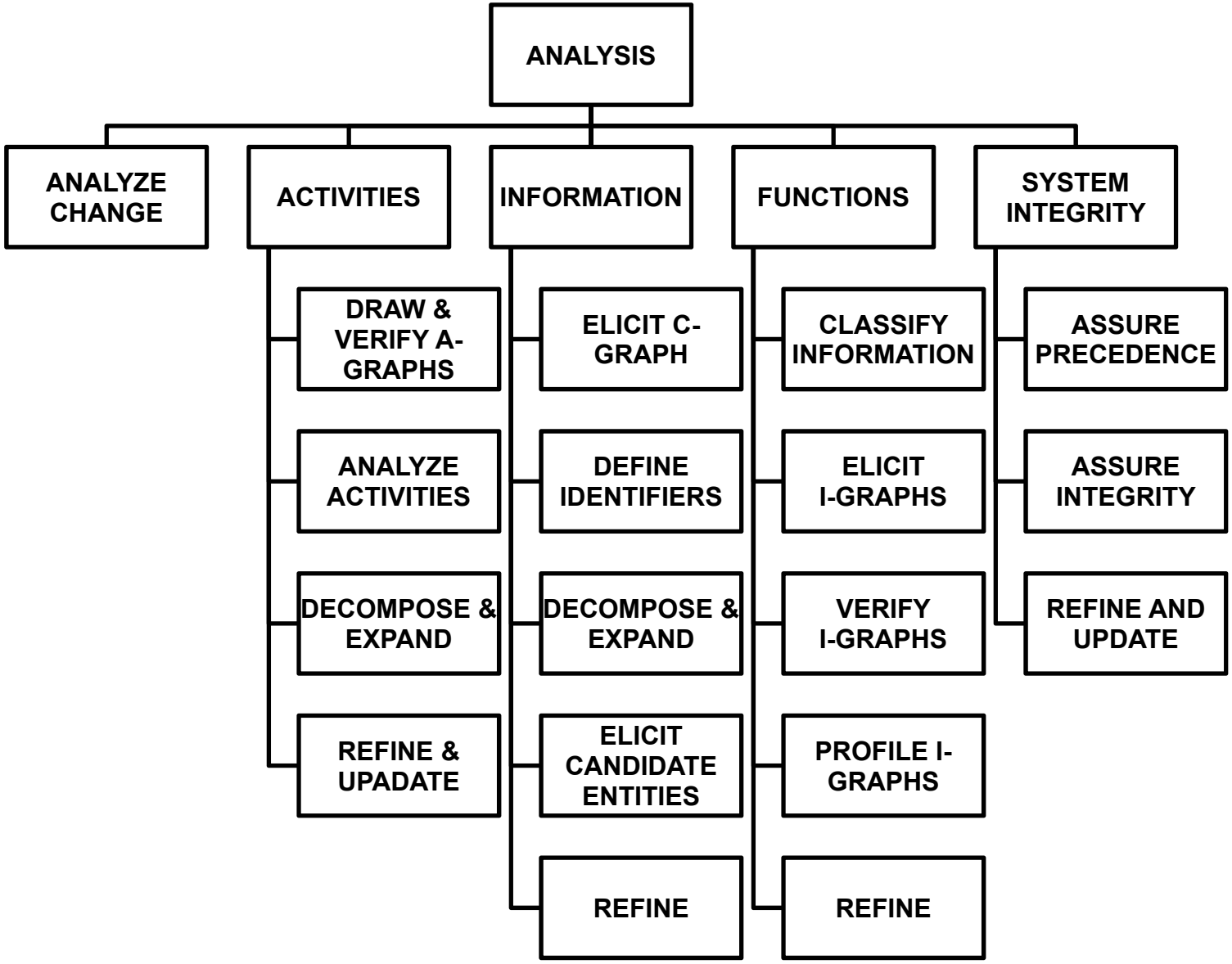
What is ISAC

- ISAC is
  - An end to end method for systems analysis
  - Unsurpassed for combined processes (physical + information flow)
  - Born in the Eighties to elicit information requirements from changes in business process transformation
- We here present a version that
  - Targets user requirements
  - Radically simplifies the original notation and completes the method
  - Incorporates and adapts the work of professor Wrycza , to elicit ER from C-Graphs
- References
  - Lundeberg, M., Goldkuhl, G., Nilsson, G. (1979): A systematic approach to information systems development, Information Systems **4**: 1-12 , 93-118.
  - Lundeberg, M. (1982): The ISAC Approach to Specification of Information Systems and its Application to the Organization of an IFIP Working Conference. In: Olle et al. (eds.), Information System Design Methodologies- a comparative review, North-Holland, pp. 173-234.
  - Wrycza S. (1990), "The combined ISAC-ER methodology of information systems"
  - Bracchi G. Motta G. (1993) Progetto di Sistemi informativi (= Design of Information Systems), Etas Libri, Milano

ISAC: OVERVIEW



METHOD STEPS



RM CASE

ANALYSIS OF CHANGE

RM CASE STUDY: TEXT DESCRIPTION

RECEIVING

Suppliers ship pallets according to the deadlines specified on monthly supply plan. Shipments are described by bills of lading (XAB). The formal correctness of supplier's information is checked against information stored in PART, supplier orders (ORFOR) and Supplier master data (ORFOR) . An entrance bill (BEN) is issued, in which are recorded the details of the arrival. For each received pallet, a loading unit record is created (UCR). It specifies details of delivery. A paper copy of UCR follows the material.
Quantity and quality differences are recorded on ORFOR and PART files. Refusal are recorded on a discard bill (BSC) and related material is put in an ad hoc area.
Hot requests (RPRE) are flashing in the arrival area and are filled immediately by dispatching the required material to the factory, with a paper copy RPRE.

STORAGE

The non-hot material is moved to the warehouse entrance. Free warehouse cells are identified and reserved on the warehouse map (MAP). The material is stocked in the warehouse and its actual position is recorded on UCR and MAP.

PICKING

The factory requires picking by a specific form called RPRE. The location of the requested material is identified on PART and MAP. If the material is found, the corresponding UCRs are booked. If the material is not found, RPRE is forwarded to the receiving staff. When picking is over, spent UCR are "erased", and also MAP (locations freed) and PART are updated.

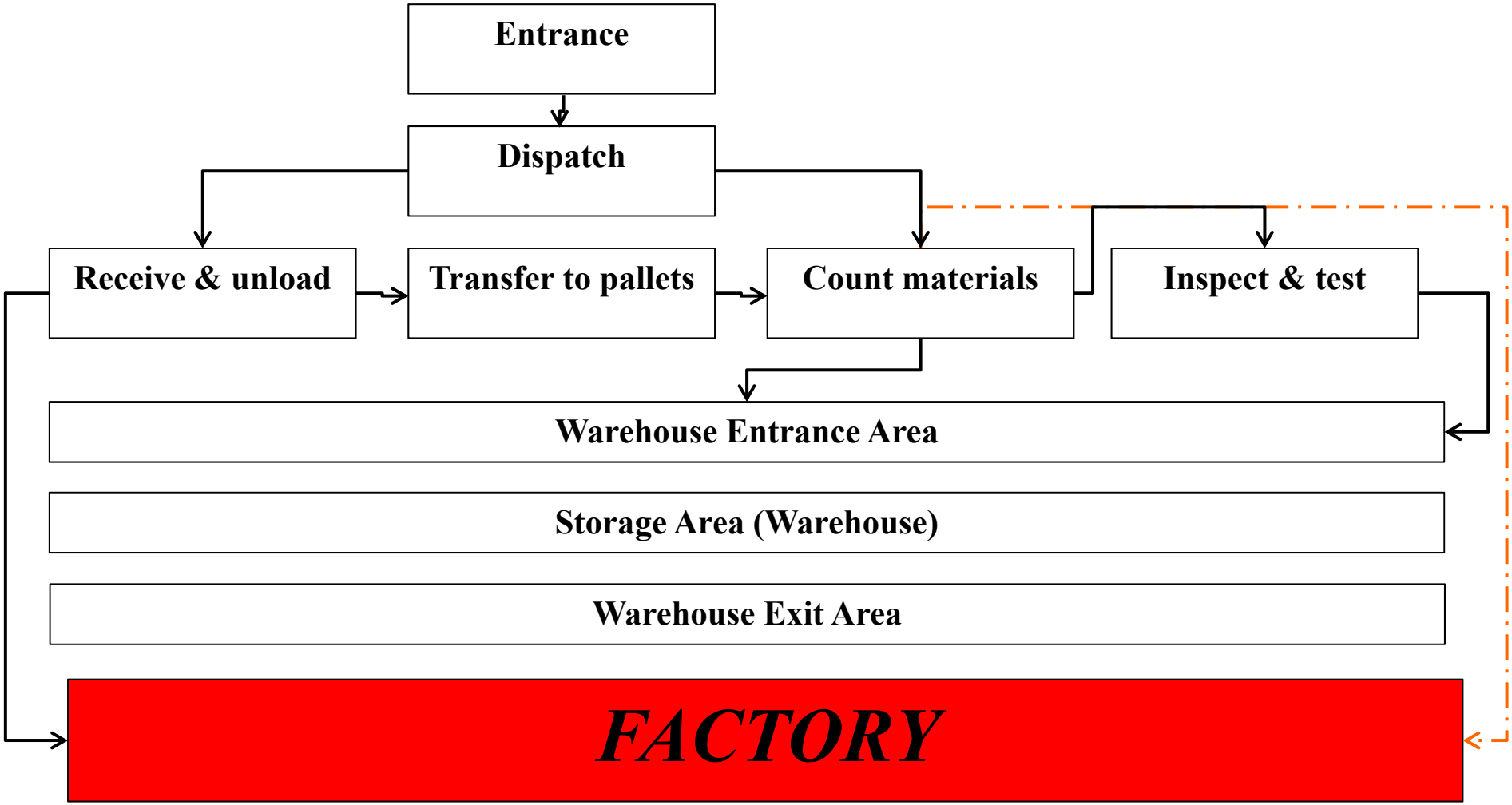
RM CASE STUDY: OBJECTIVES

#	Objectives	Comments
01	Efficient use of space	Spare space
02	High service level to the Factory	Avoid out of stock and slack overstock
03	Real time control of materials	Record location and status of all materials arrived and/or arriving; have all information on line.
04	Minimize paperwork	Spend the shortest time for documents / artifacts that accompany the materials and recording tasks
05	Minimize pick and store operations	Minimize cart trips whitin the warehouse
06	Control materials by pallet	Pick materials in the same sequence it has been stored ; know the inventory by pallet
07	Minimize scrap	Do not forget materials

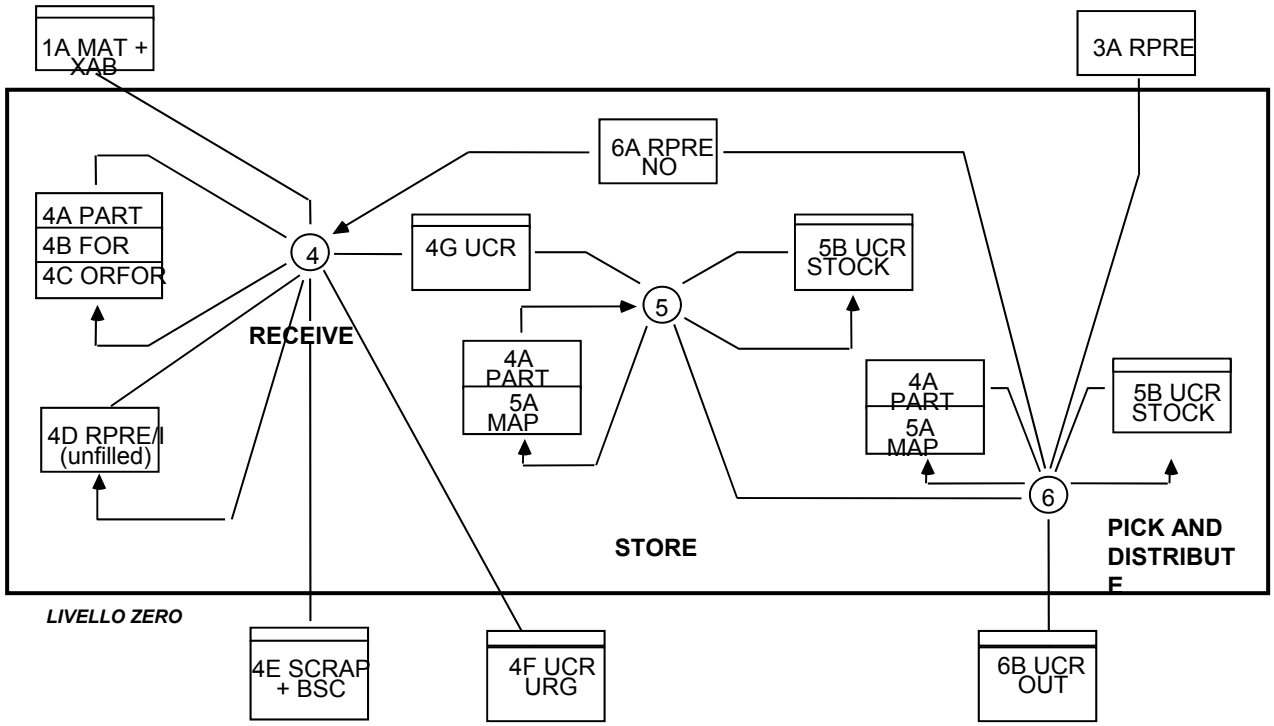
RM CASE

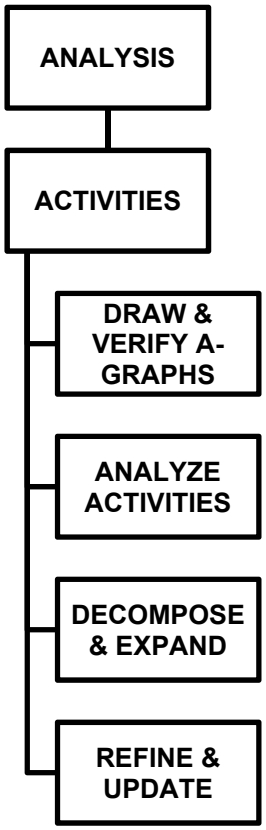
A-GRAPHS

RM CASE STUDY : PROPOSED PHYSICAL FLOW

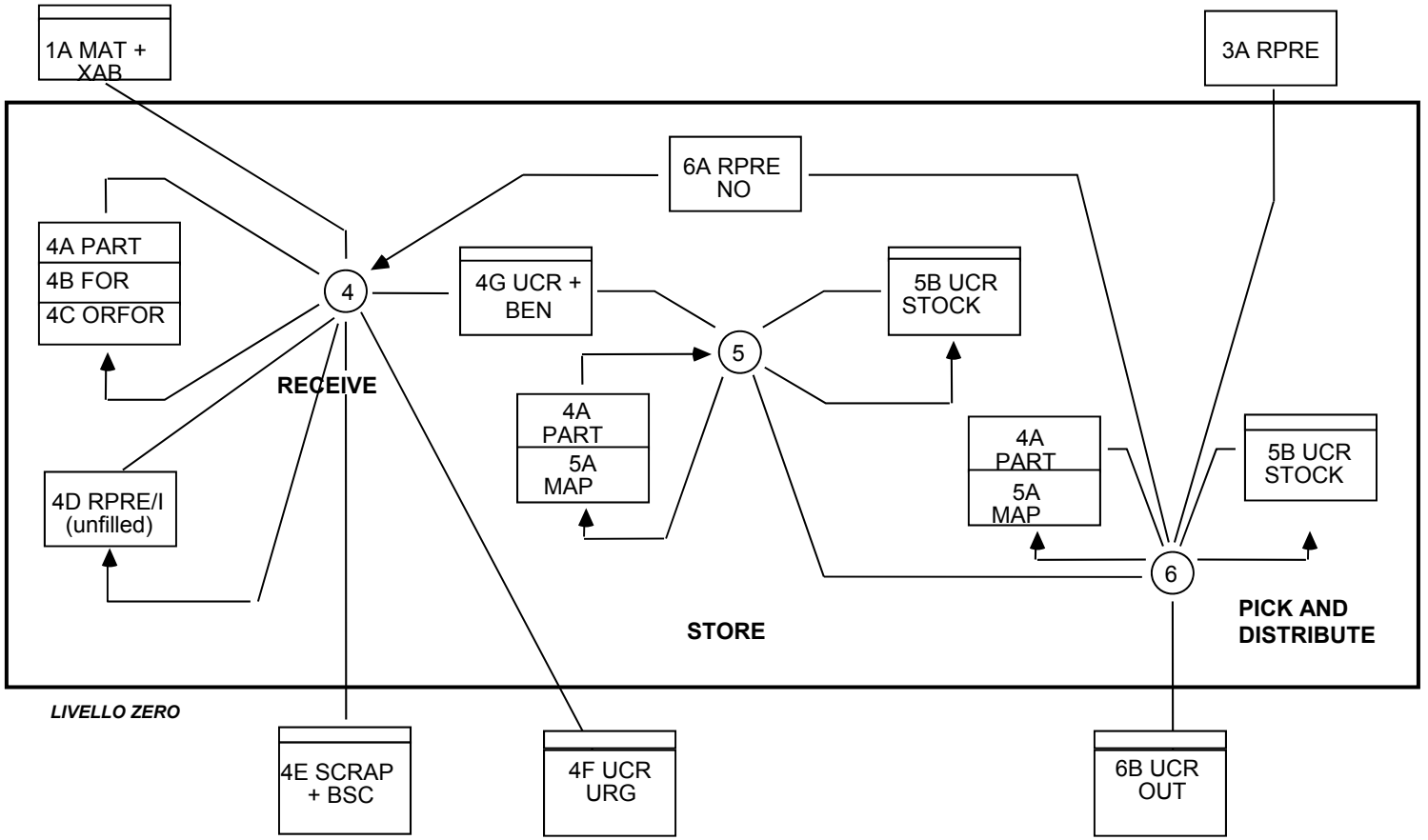


A-GRAPHS: MODEL AND METHOD

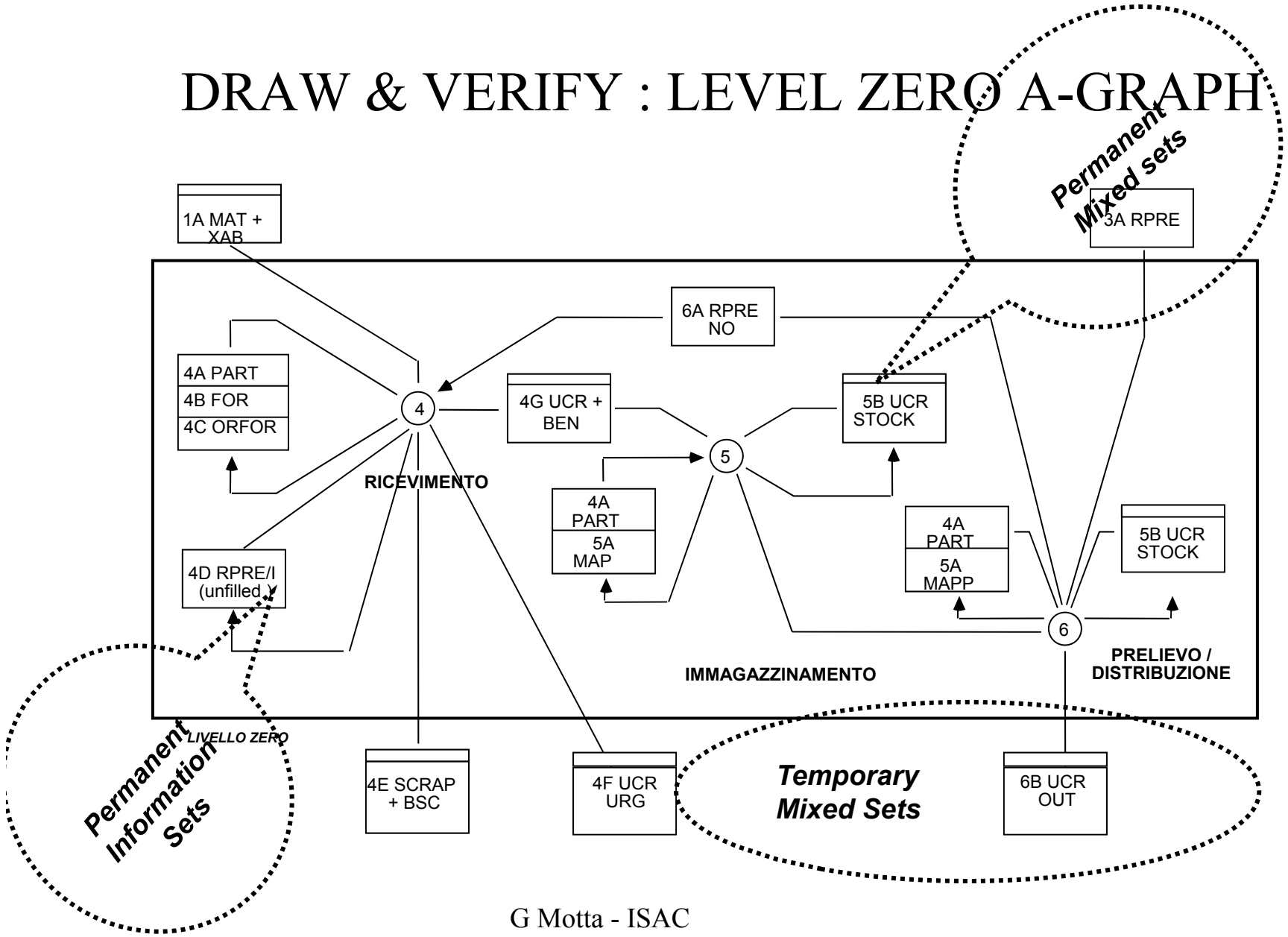




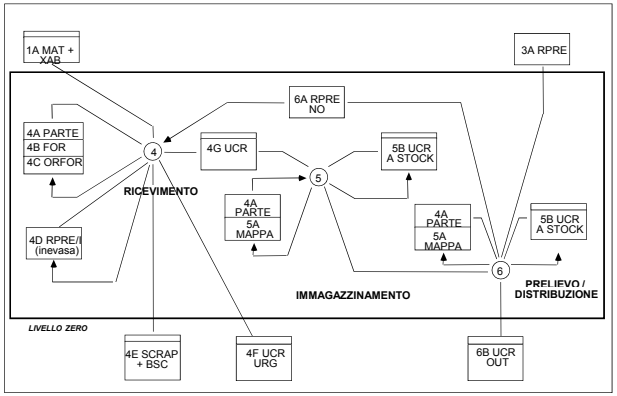
DRAW & VERIFY : LEVEL ZERO A-GRAPH



DRAW & VERIFY : LEVEL ZERO A-GRAPH



DRAW & VERIFY : A-GRAPH NOTATION



ACTIVITIES

- *Are identified by nodes*
- *Model operations on sets of objects (physical, mixed, information)*
- *Their representation is independent from their implementation - machine, man, combined*

ORIENTED ARCHES

- *Transport of Objects (function)*
- *Time precedence*

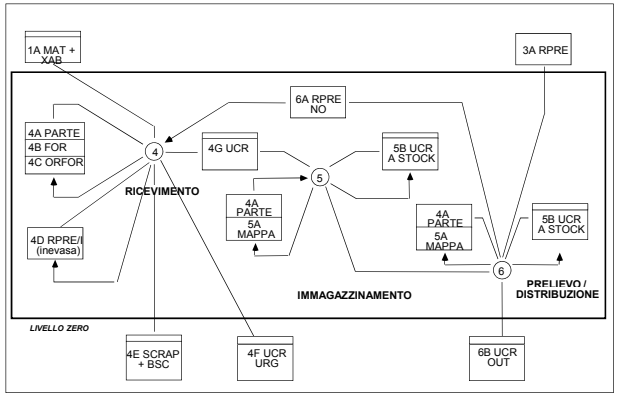
SETS

- *Onthology*
  - **Physical**: a bunch of iron
  - **Information**: messages, files, artifacts, documents
  - **Mixed**: sets made of physical material and infornation e.g. a truck with a bill of lading, a physical set that can identified e.g. a biscuit box with a bar code
- *Volatility*
  - **Temporary** e.g. a message
  - **Permanent** e.g. a data base

DRAW & VERIFY A-GRAPH
DESCRIPTION OF PROCESS PROPERTIES

Object	Dayly volumes	Average Level
1A Arrivals	500	-
1B XAB	600	-
3A RPRE	1200	-
4A1 FOR	-	800
4A21 PARTE	-	6000
4A22 ORFOR	-	4000
4B Material + UCR	1200	-
4C Refusal document (BSC) + refused material	20	-
4D Urgent Picking	50	-
5A Map	-	3000
6A Unfilled RPRE	50	-

DRAW & VERIFY

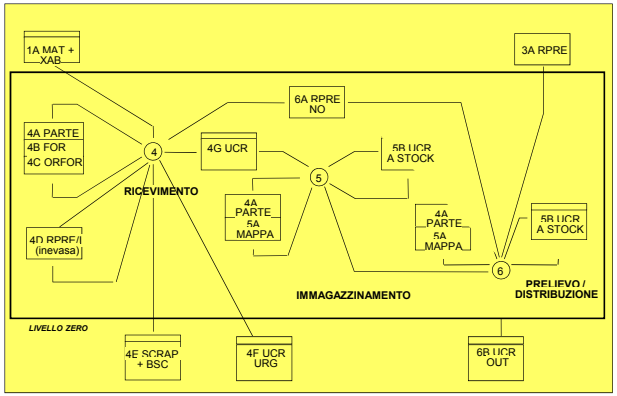


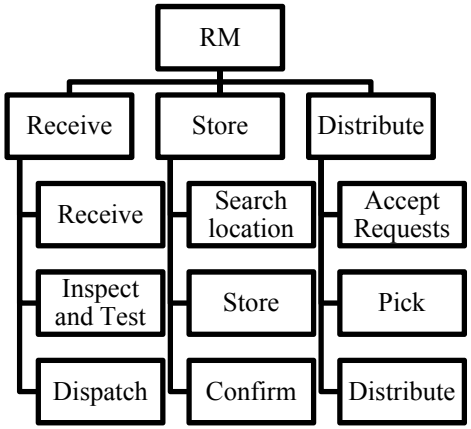
Draw and verify A -Graph

- *Identify external system input and output*
- *Identify activities within the sytem*
- *Draw arches beween outside input and output, and the inside activities*
- *Starting from the first one dress activities*
- *Verify precedences*

- The same information set can be used by multiple activities
- Independence / dependence of information sets:
  - Independent : R
  - Dependent : C, U, D
- Relevant points:
  - ***Fork*** in receiving activity
  - ***Identical sets but different events*** in Store, Distribute
  - ***Empty Arch***: time sequence without trasmitting info or objects
  - Arches may both clokwise or unclockwise (see RPRE)
  - Activity = change of system state = action on permanent sets

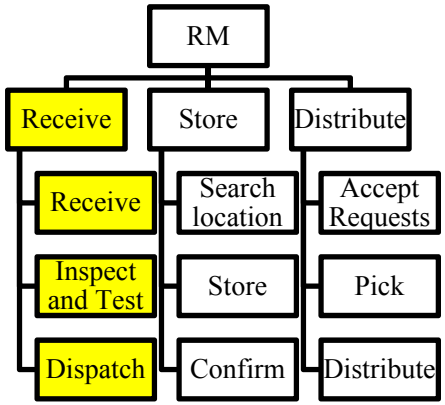
ANALYZE ACTIVITIES

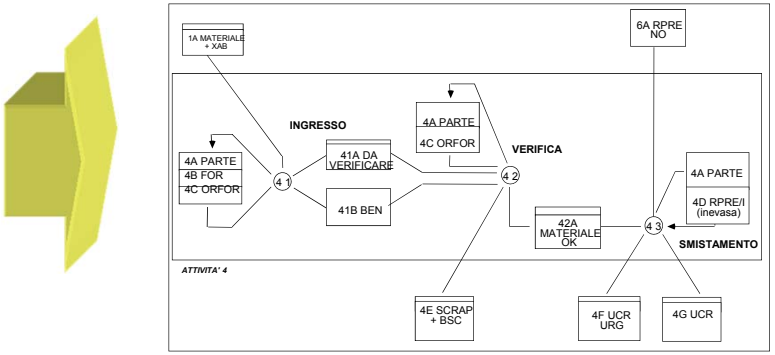




- *Level 1 Activities (on left diagram) are decomposed on sub-activities (on right)*
- *Decomposition continues until elementary activities have been identified*
- *Elementary activities are homogeneous in terms of :*
  1. *Frequency*
  2. *Event*
  3. *Actor*
  4. *Information sets and business rules*
  5. *Technology*

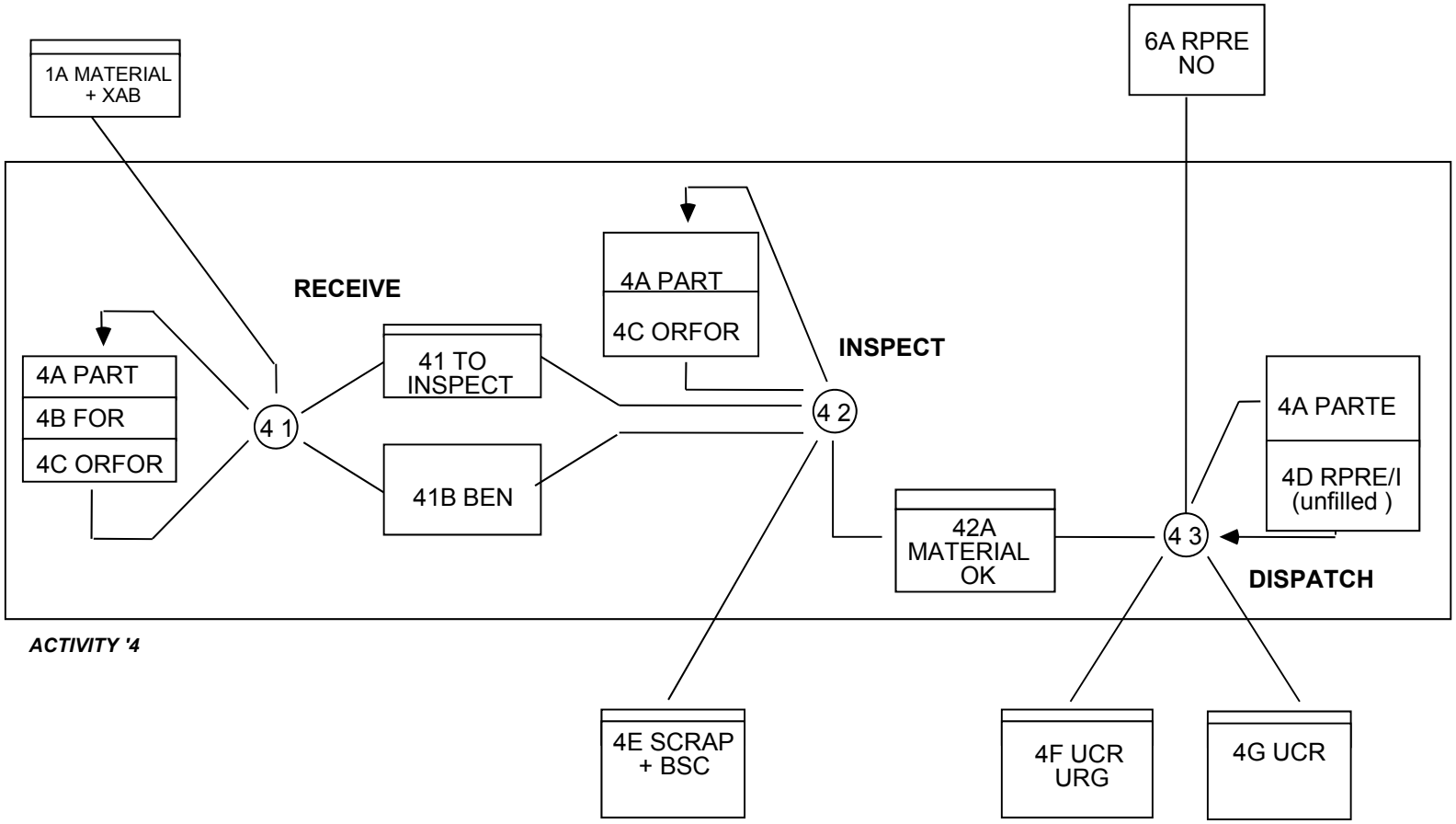
DECOMPOSE & EXPAND



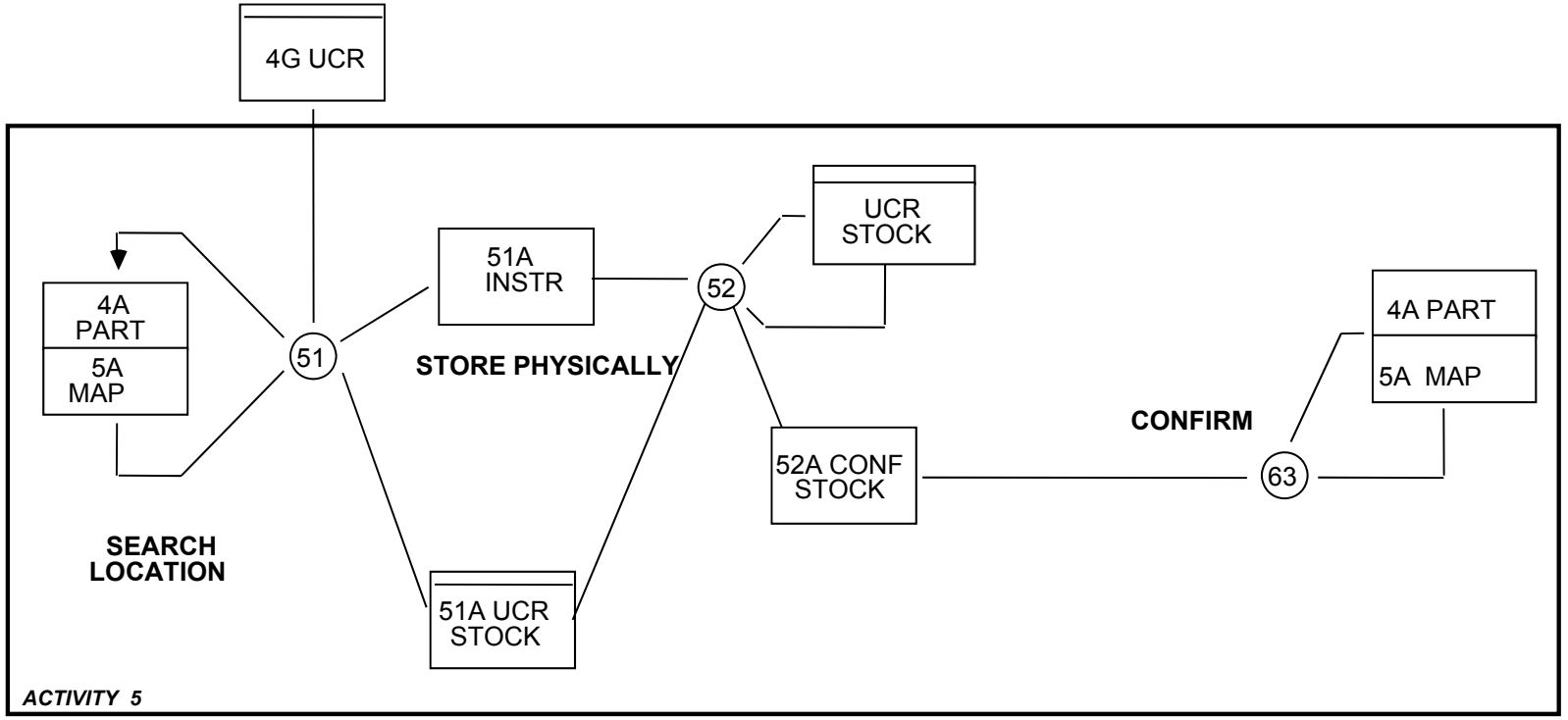


- *Select a level zero activity and position in input to the rectangle all its inputs*
- *Elicit its sub-activities and put them inside the rectangle*
- *Link sub-activities by arches*
- *Take permanent and temporary sets that have been already identified in Level Zero and link them to the appropriate sub-activities*
- *Make sure that all level zero sets are present and detail them as needed*
- *Add appropriate derivable sets e.g.*
  - *Log*
  - *Temporary BEN*
  - *Permanent BEN*

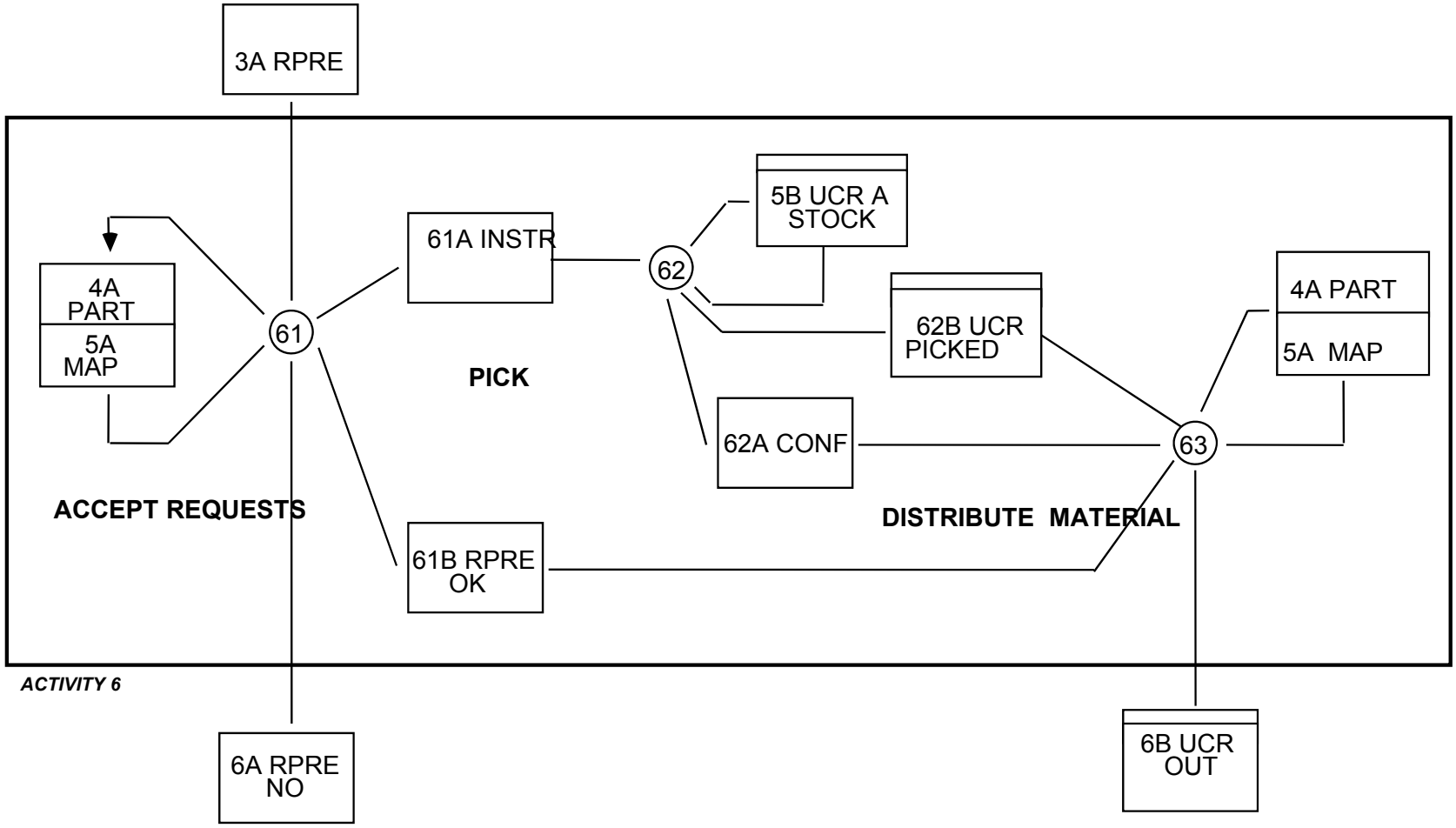
DECOMPOSE & EXPAND : ACTIVITY 4



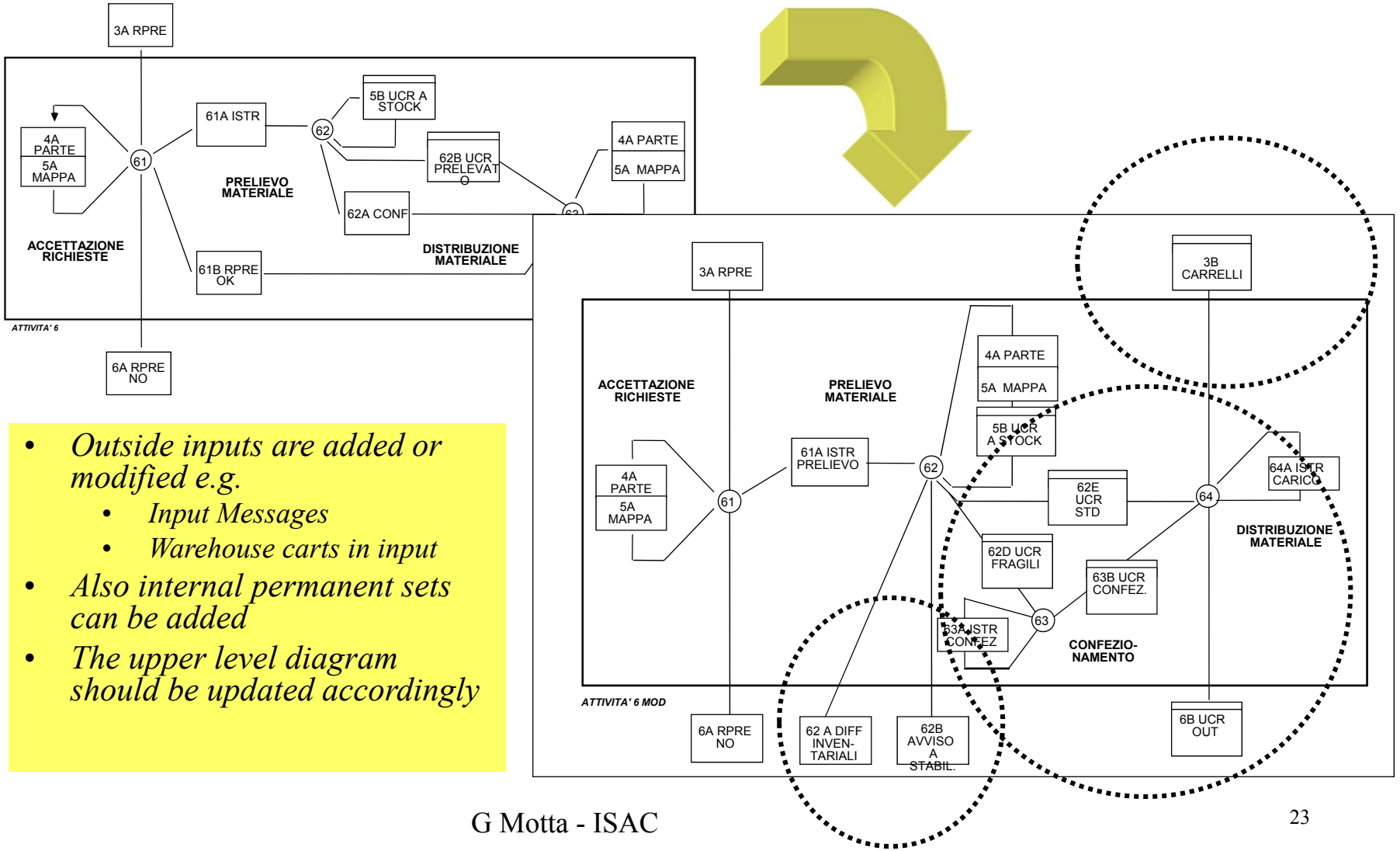
DECOMPOSE & EXPAND : ACTIVITY 5



DECOMPOSE & EXPAND : ACTIVITY 6

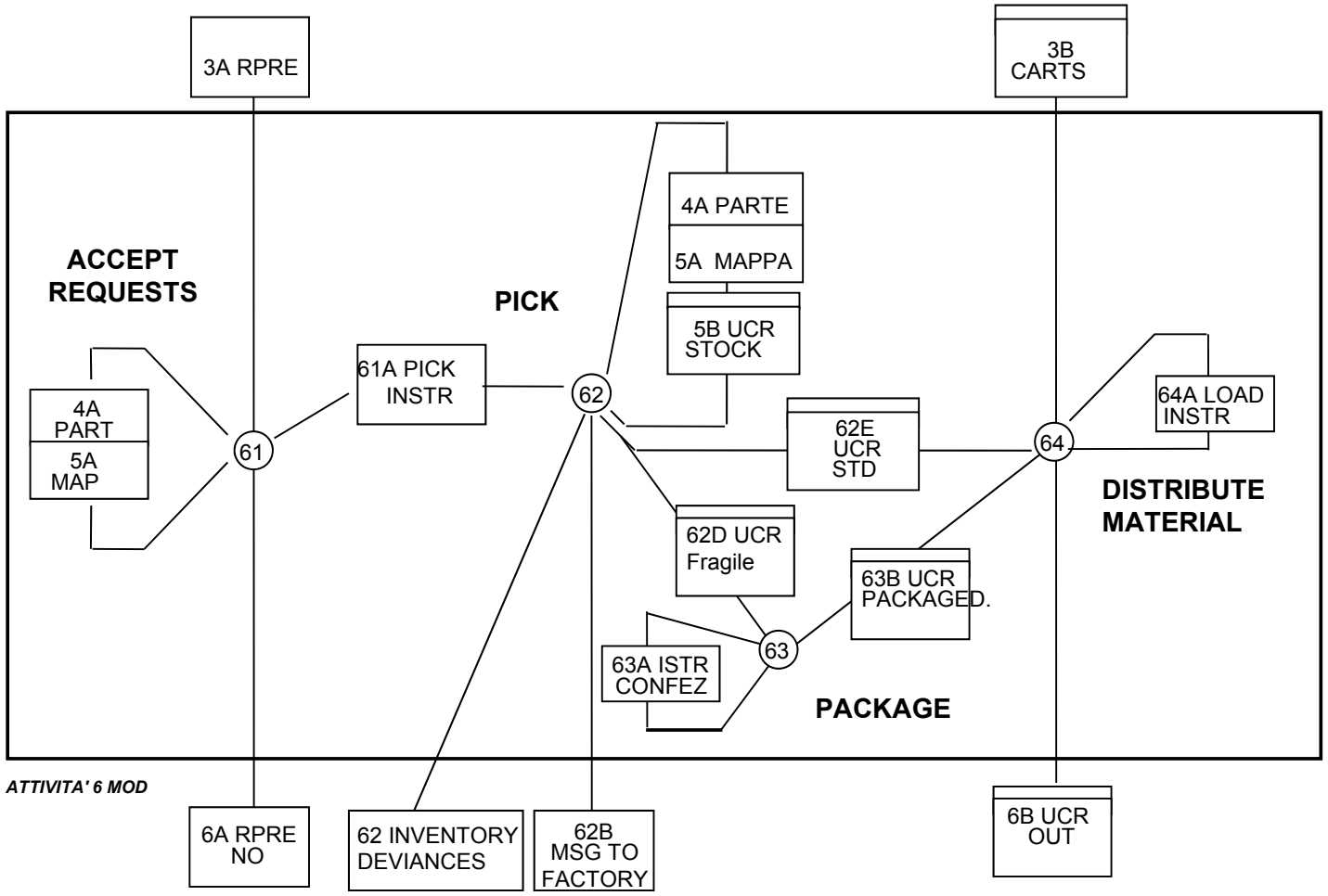


REFINE: ACTIVITY 6

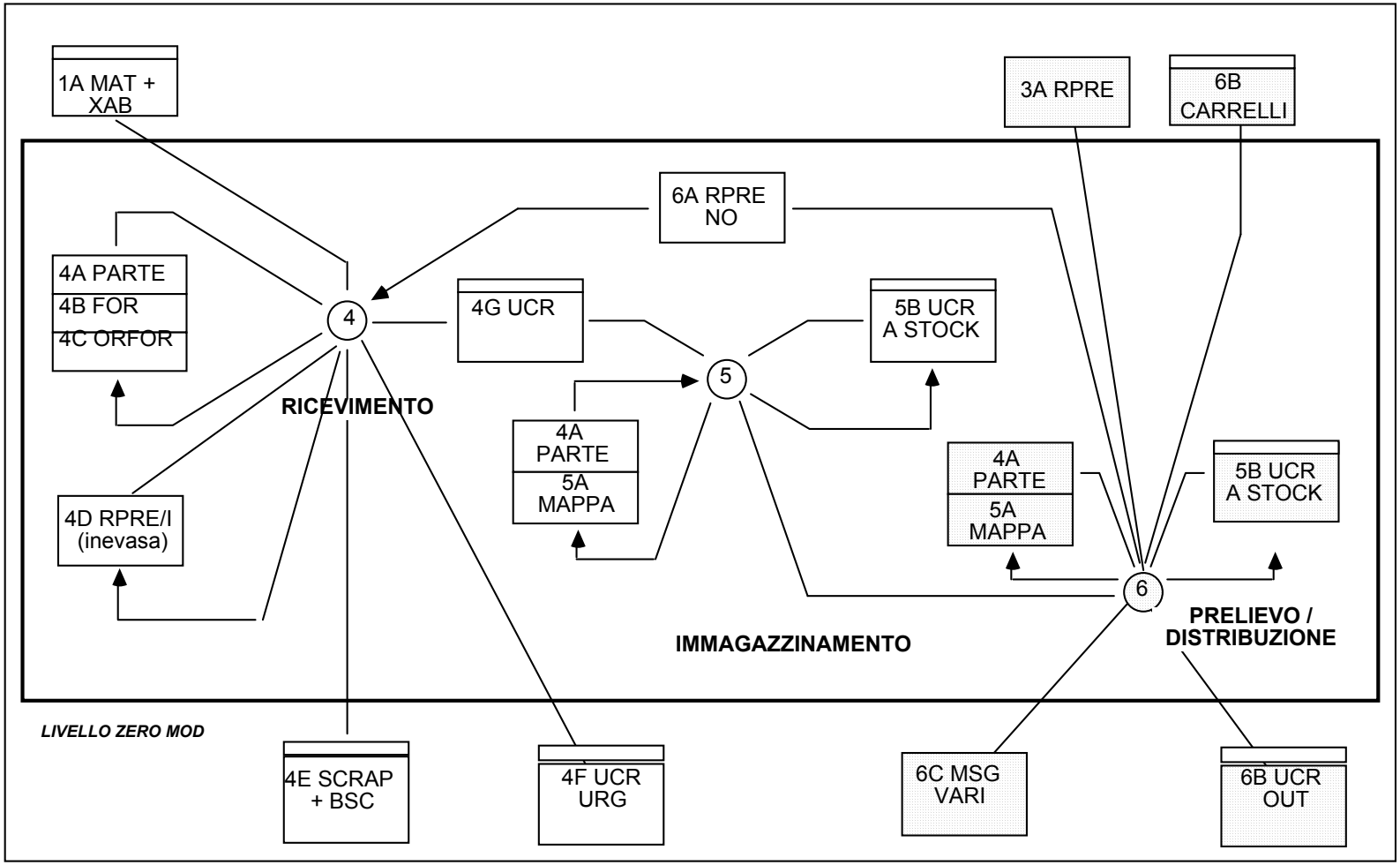


- *Outside inputs are added or modified e.g.*
  - *Input Messages*
  - *Warehouse carts in input*
- *Also internal permanent sets can be added*
- *The upper level diagram should be updated accordingly*

REFINE: ACTIVITY 6



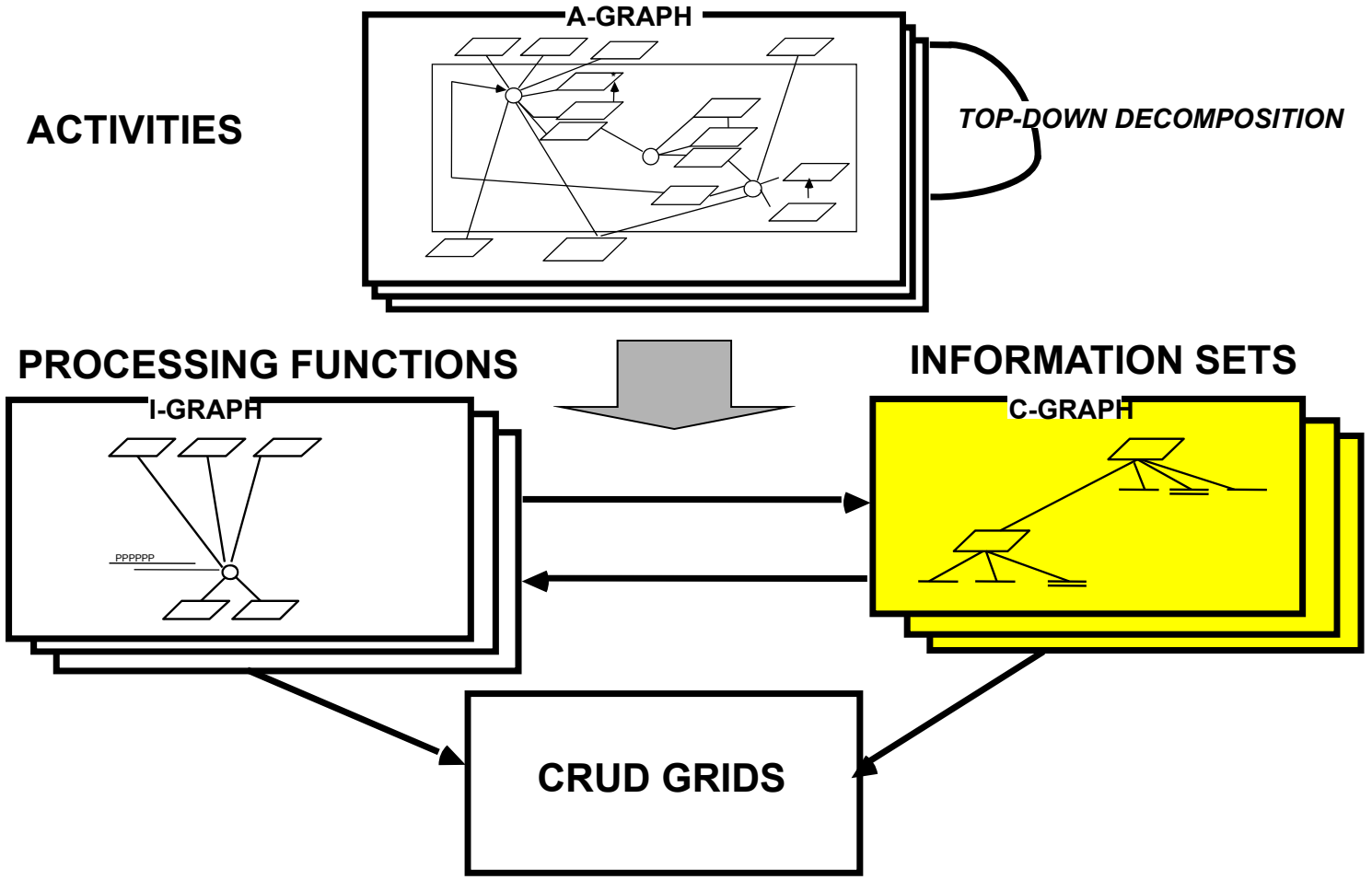
UPDATE : LEVEL ZERO A-GRAPH



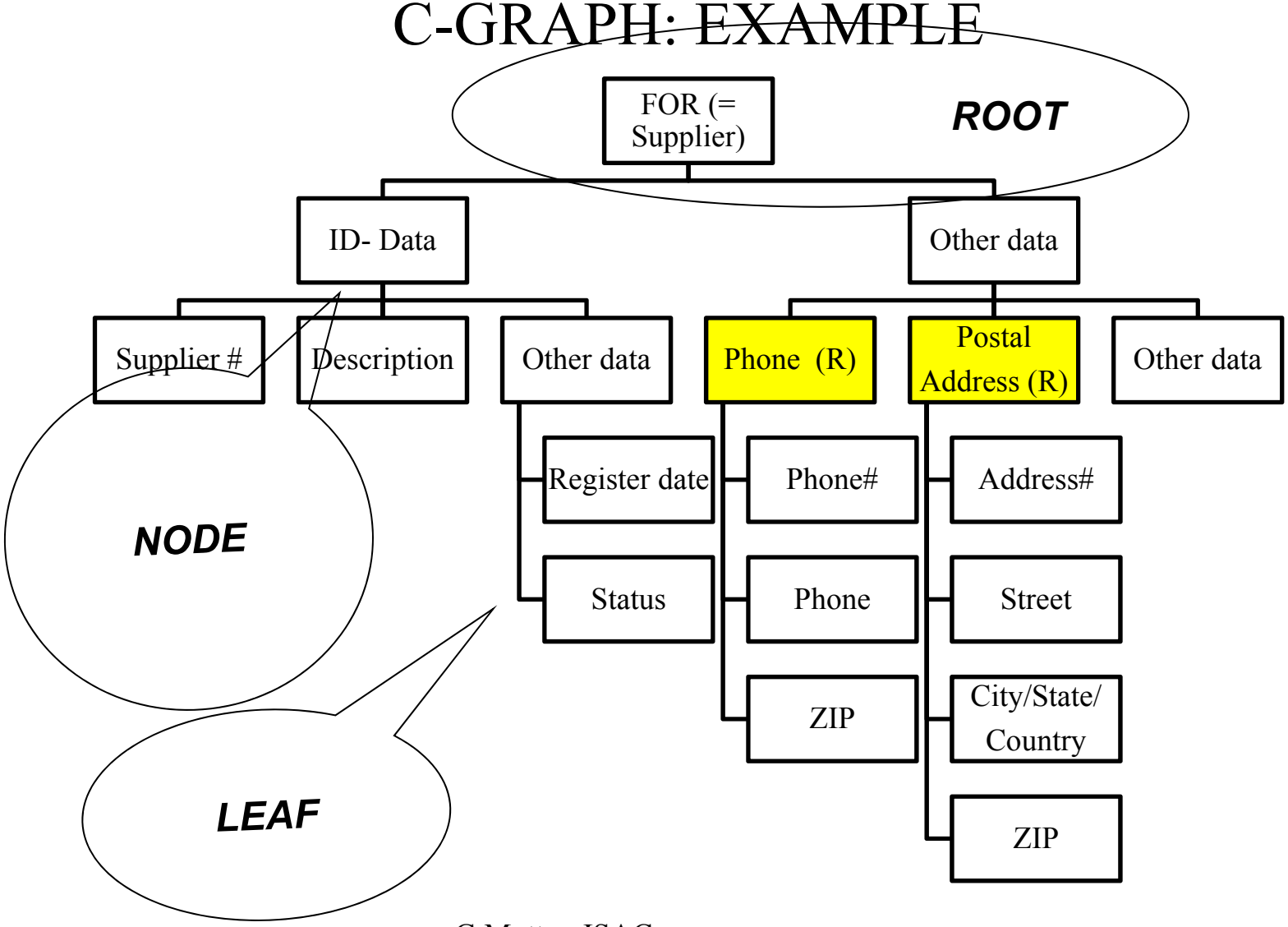
RM CASE STUDY

C-GRAPHS

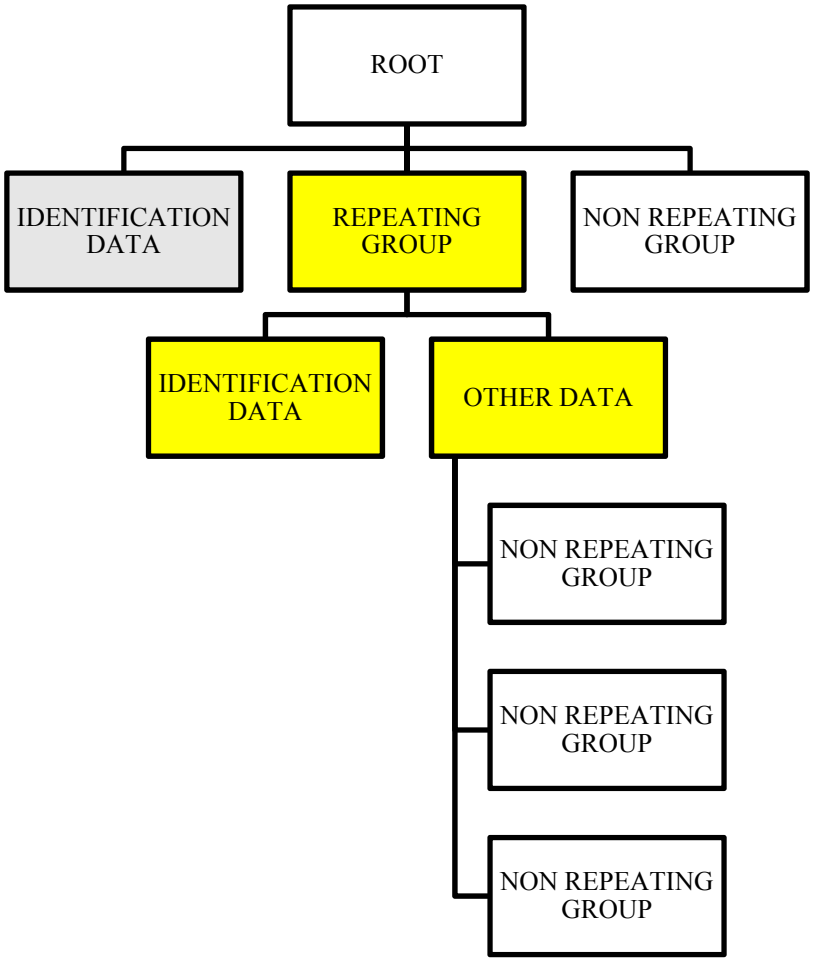
C-GRAPHS: OVERVIEW

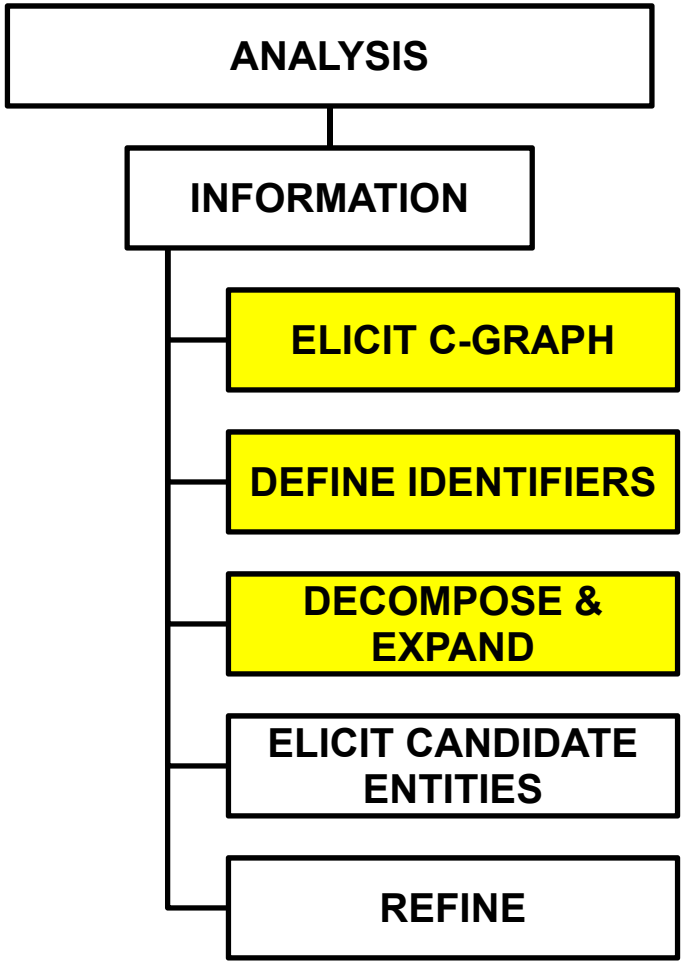


C-GRAPH: EXAMPLE

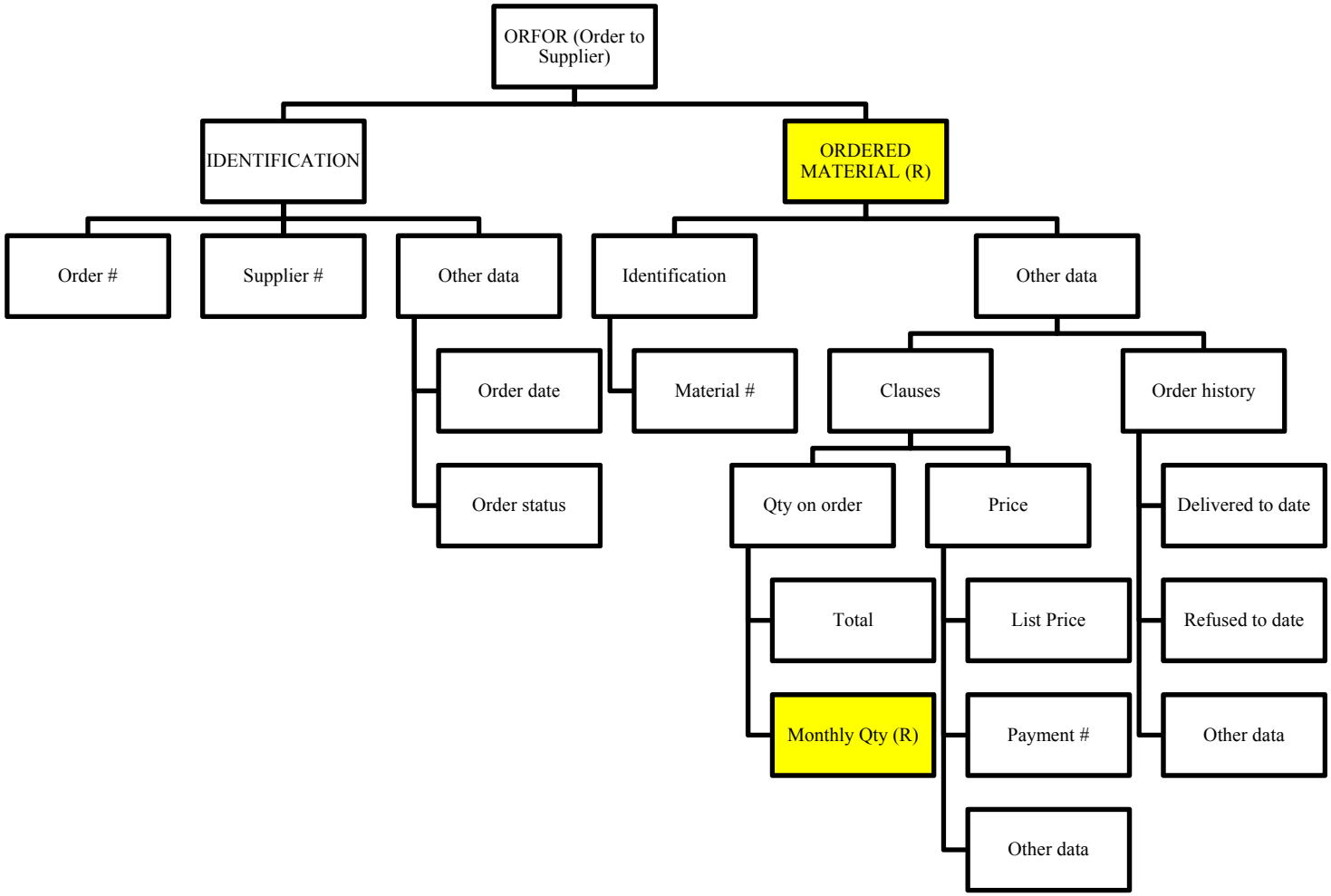


C-GRAPH MODEL AND METHOD

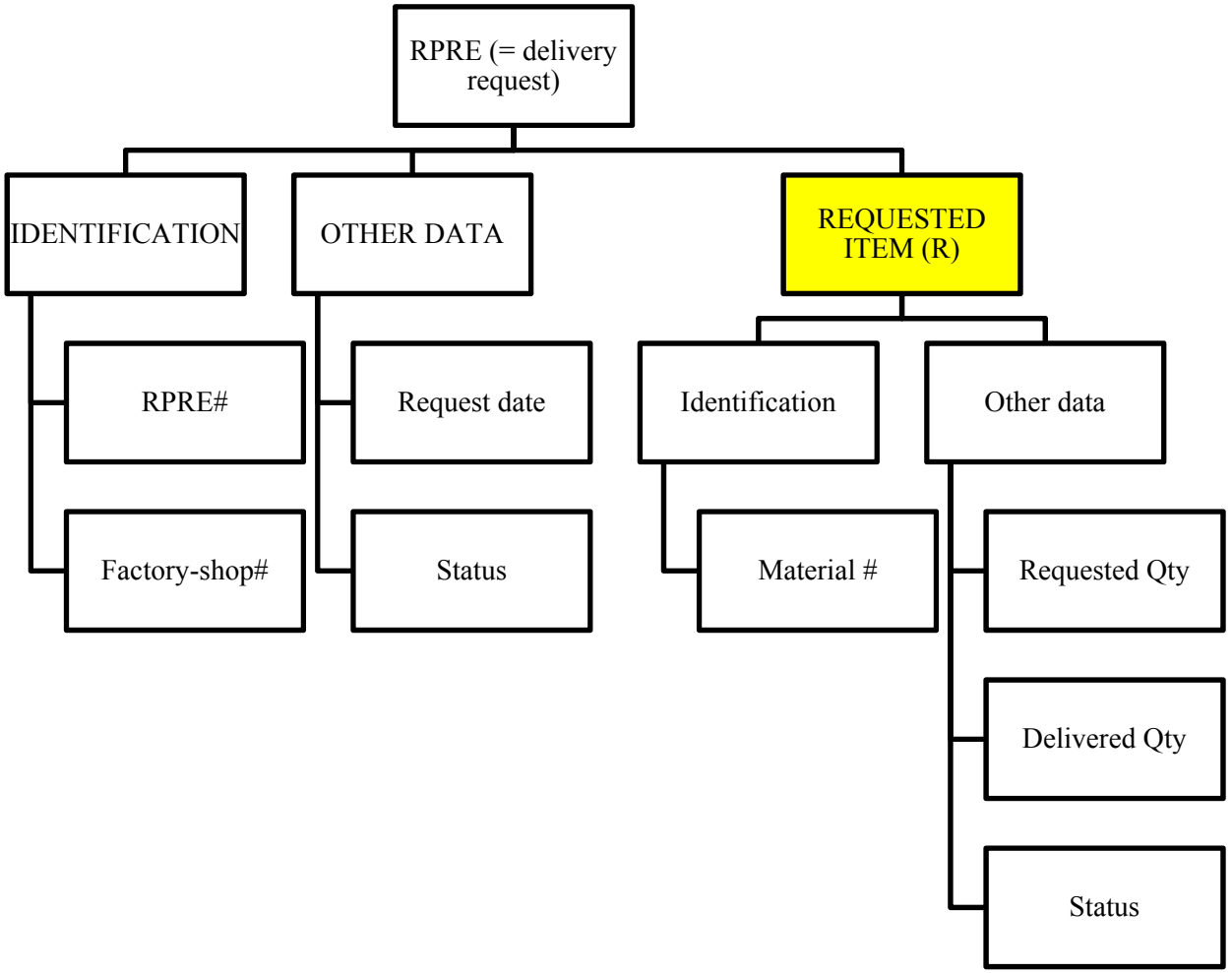




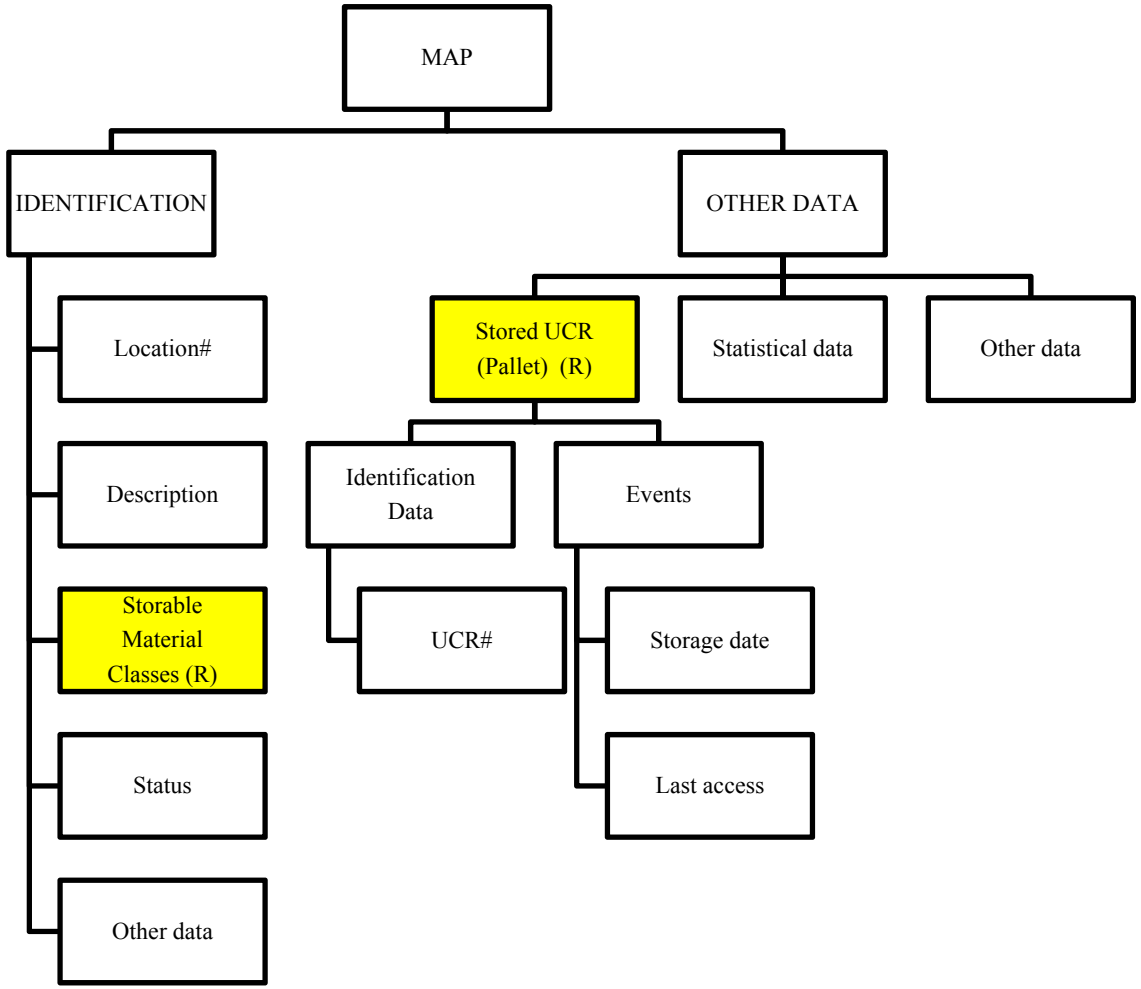
DECOMPOSE AND EXPAND : ORFOR



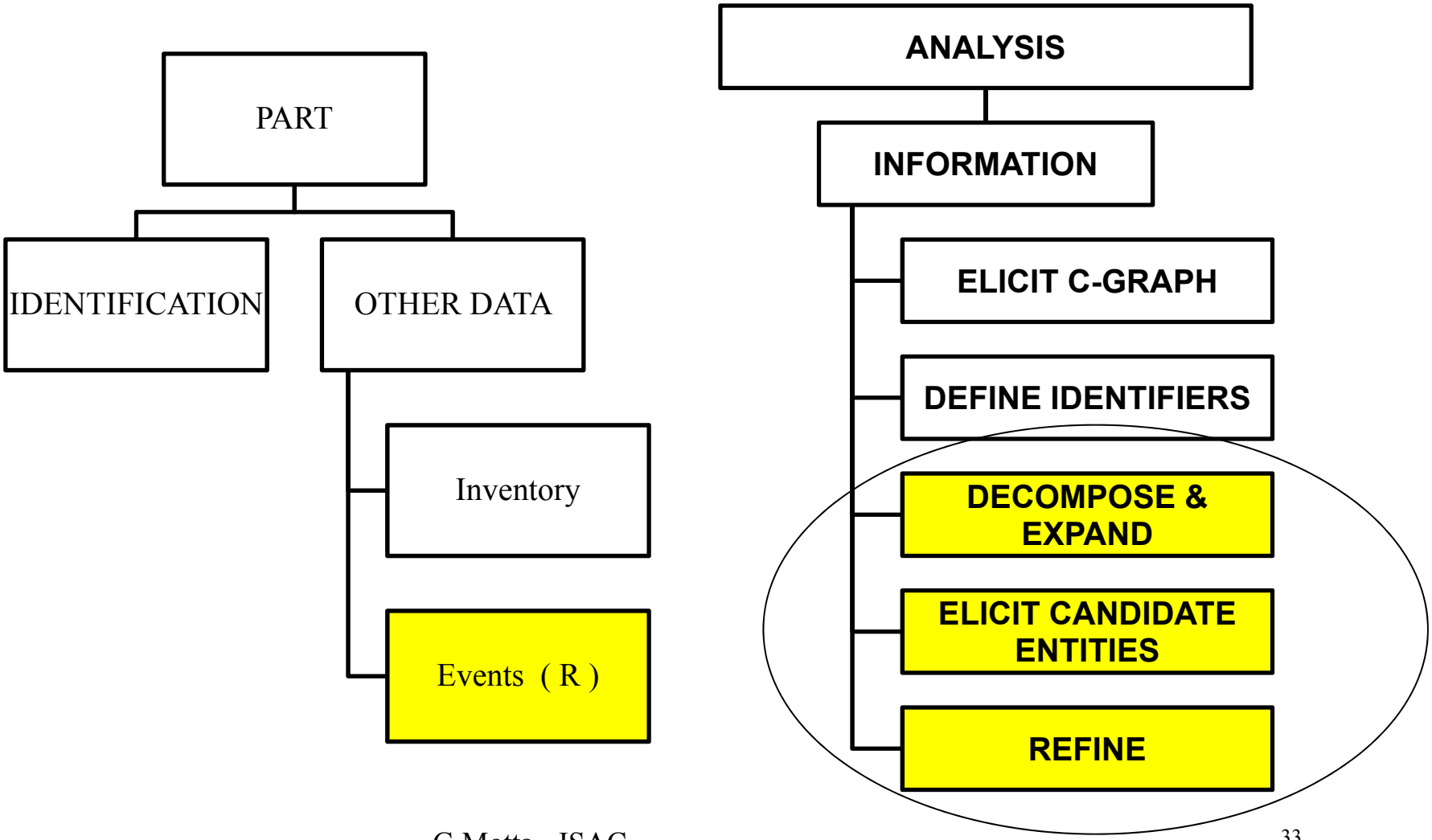
DECOMPOSE AND EXPAND : RPRE

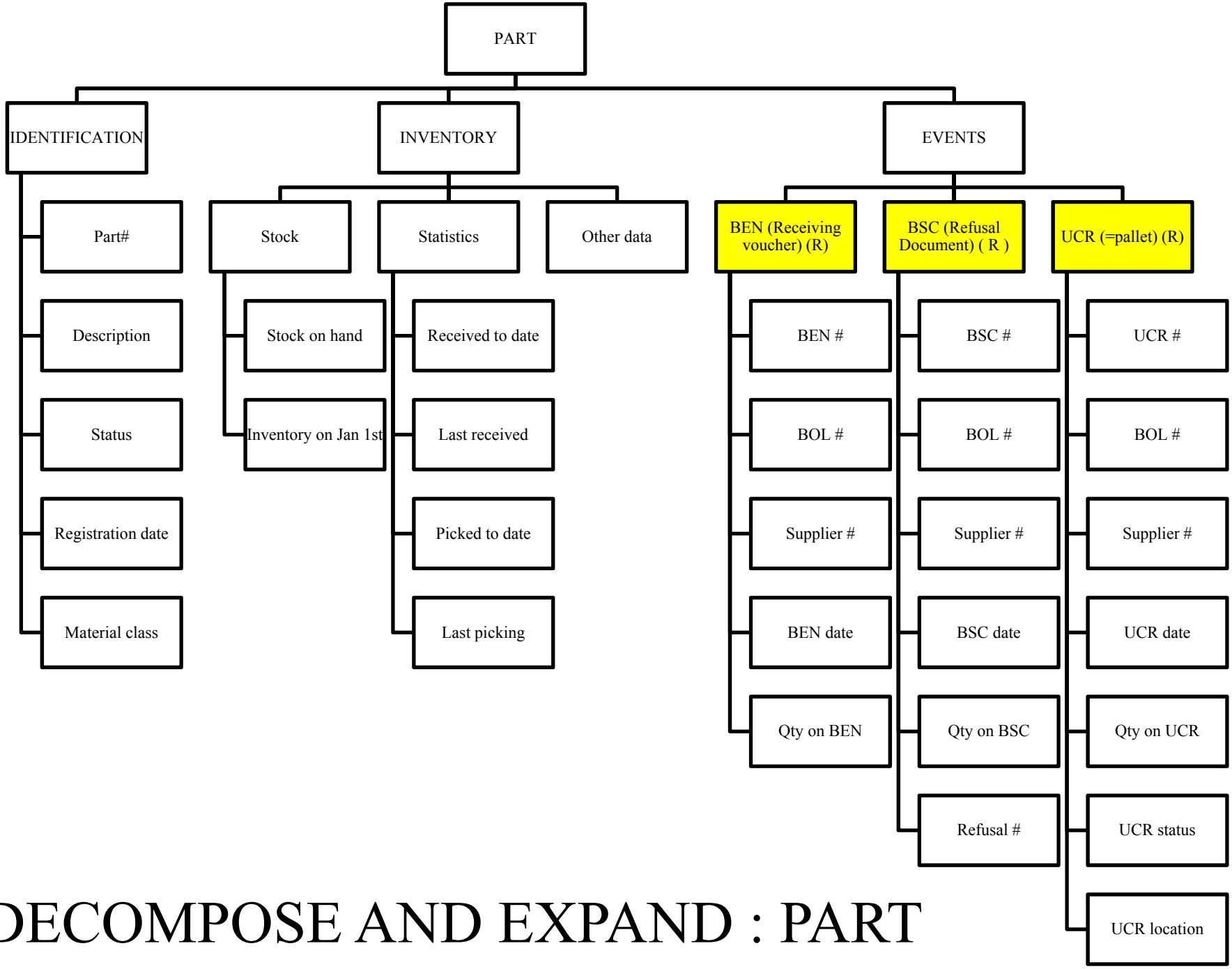


DECOMPOSE AND EXPAND : MAP



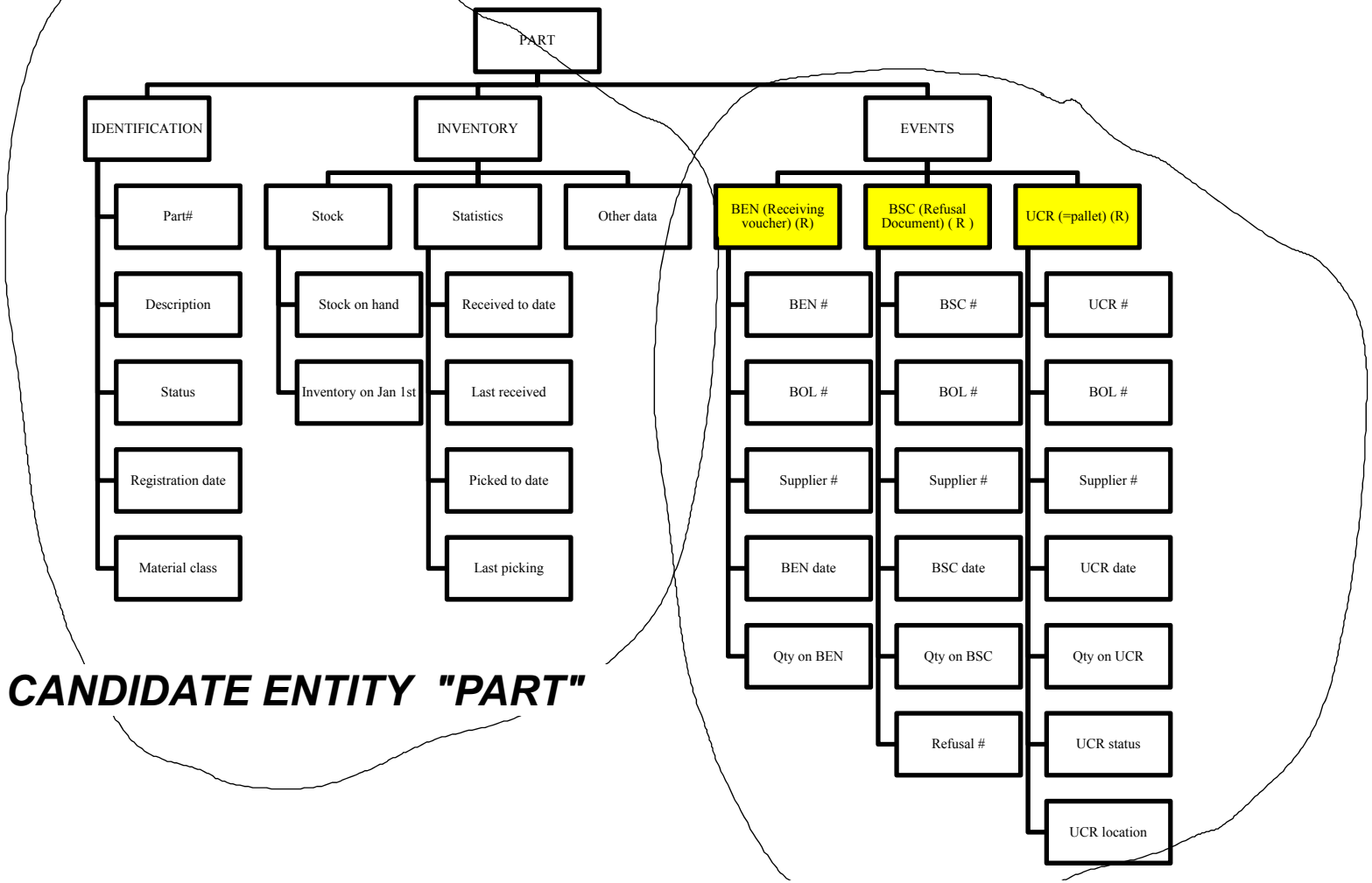
DECOMPOSE AND EXPAND : PART





DECOMPOSE AND EXPAND : PART

IDENTIFY CANDIDATE ENTITIES : PART



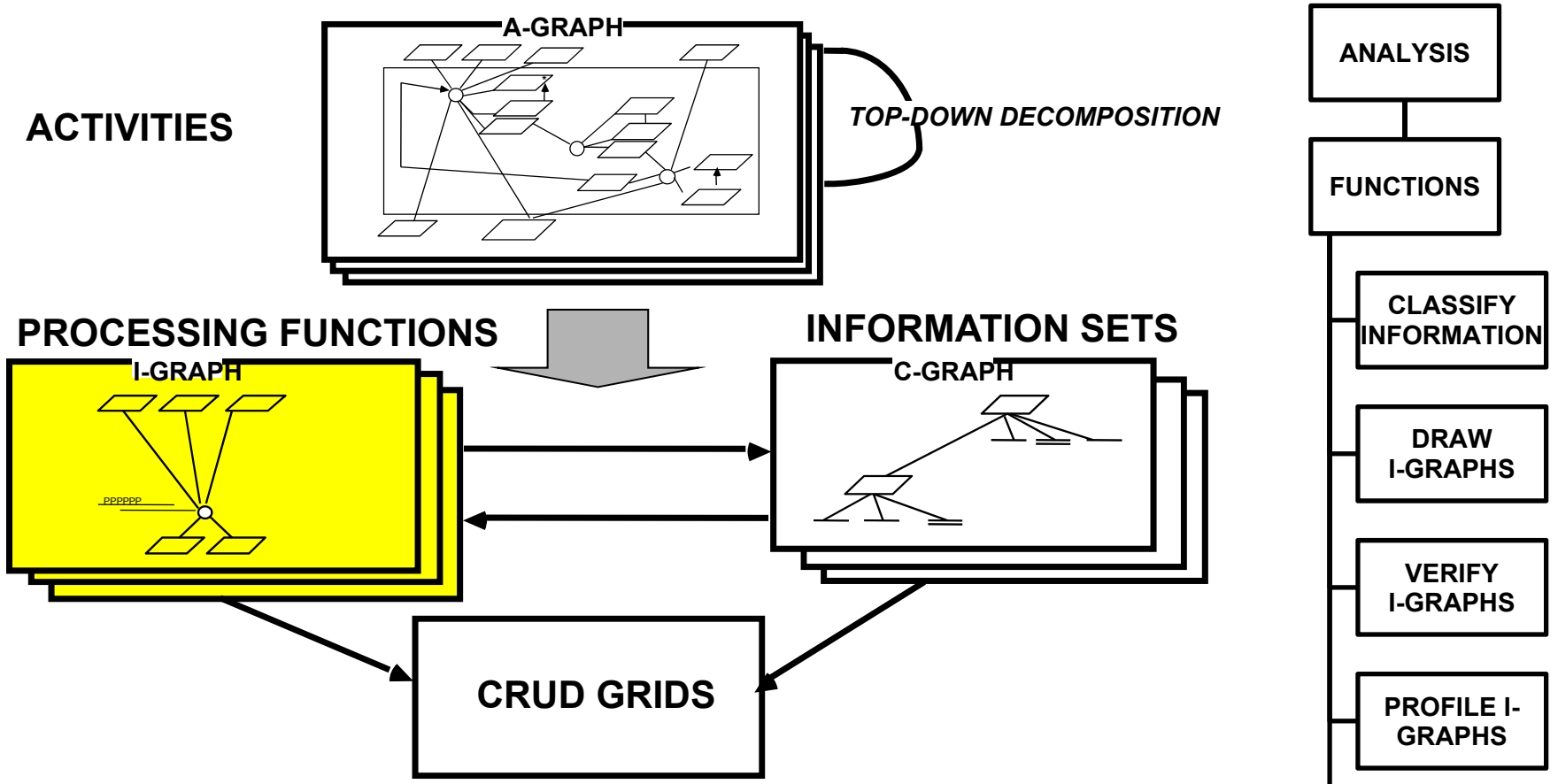
CANDIDATE ENTITY "PART"

EACH REPEATING GROUP IS A CANDIDATE ENTITY

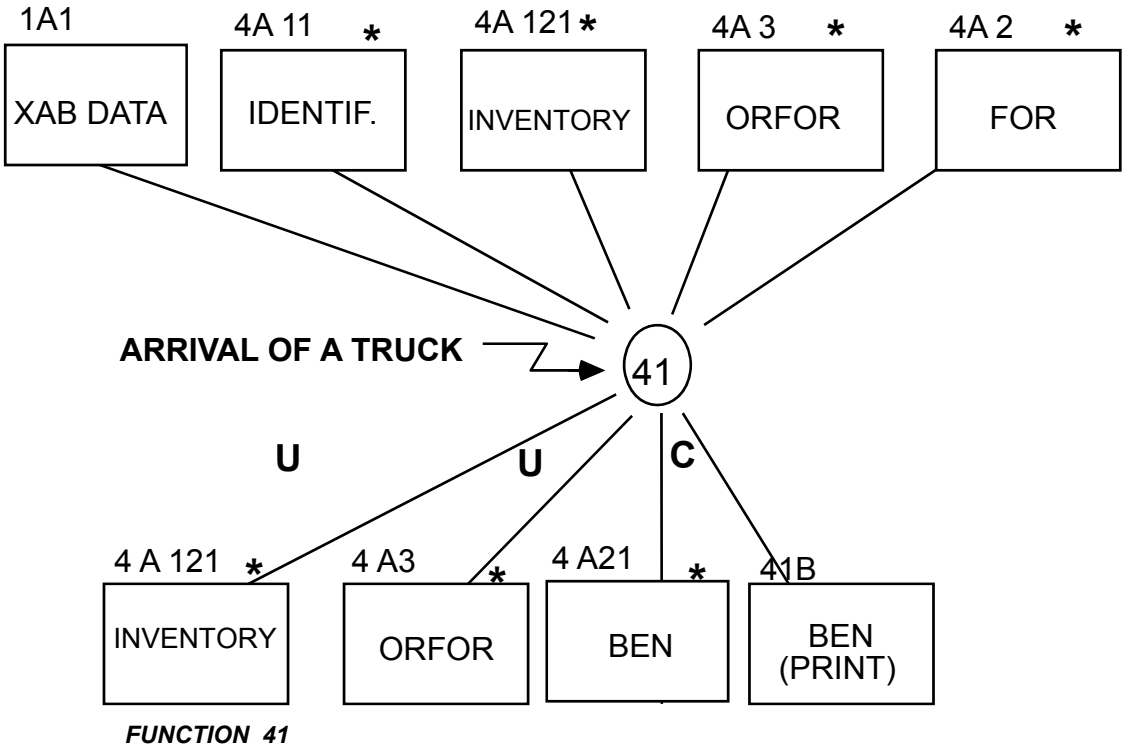
RM CASE STUDY

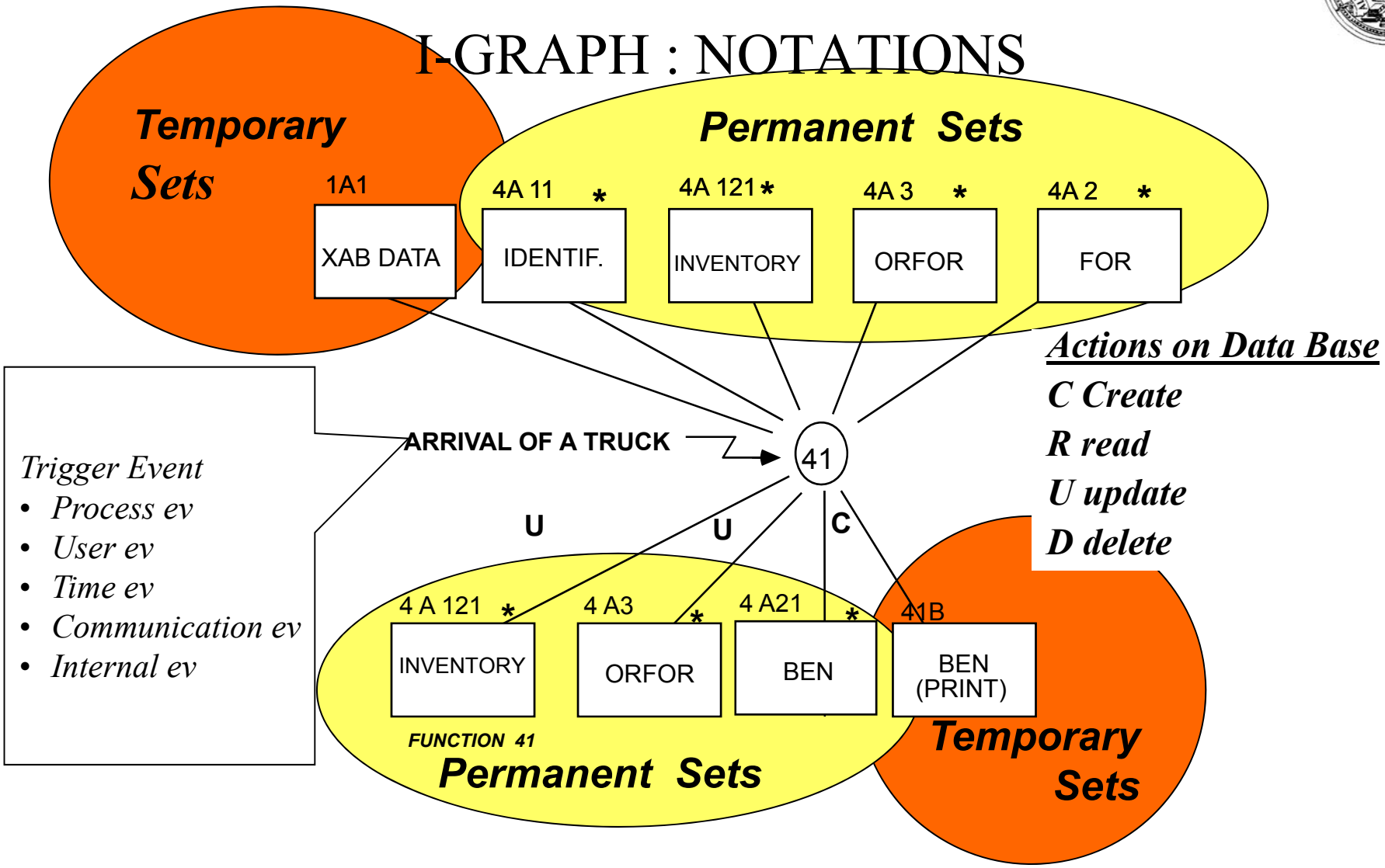
I-GRAPHS

I-GRAPHS: MODEL AND METHOD

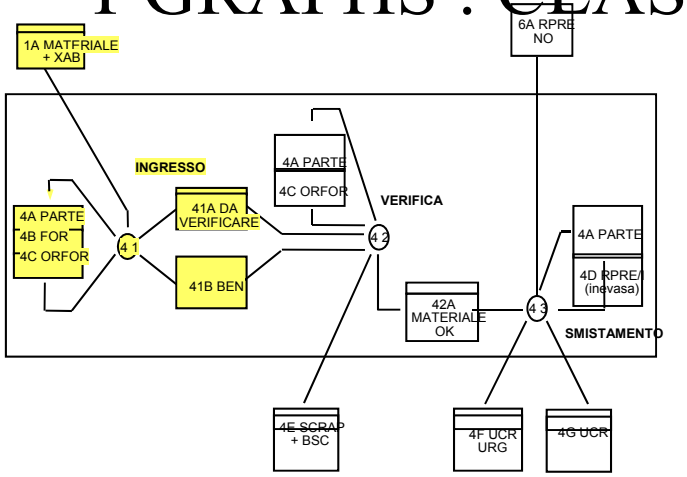


I-GRAPH : AN EXAMPLE




I-GRAPH : NOTATIONS
Temporary Sets
1A1
XAB DATA
Permanent Sets
4A 11 *
IDENTIF.
4A 121 *
INVENTORY
4A 3 *
ORFOR
4A 2 *
FOR
Actions on Data Base
C Create
R read
U update
D delete
Trigger Event
• Process ev
• User ev
• Time ev
• Communication ev
• Internal ev
ARRIVAL OF A TRUCK
41
U
U
C
4 A 121 *
INVENTORY
4 A3 *
ORFOR
4 A21 *
BEN
41B
BEN (PRINT)
FUNCTION 41
Permanent Sets
Temporary Sets

I-GRAPHS : CLASSIFY INFORMATION



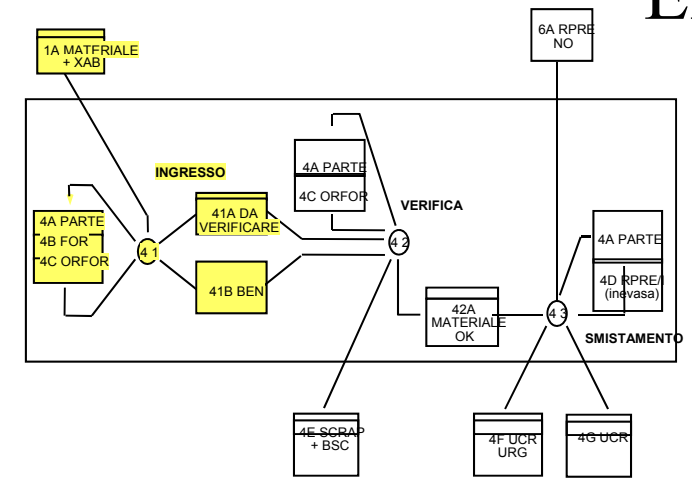
The classification is intended to select the information that the system should process given

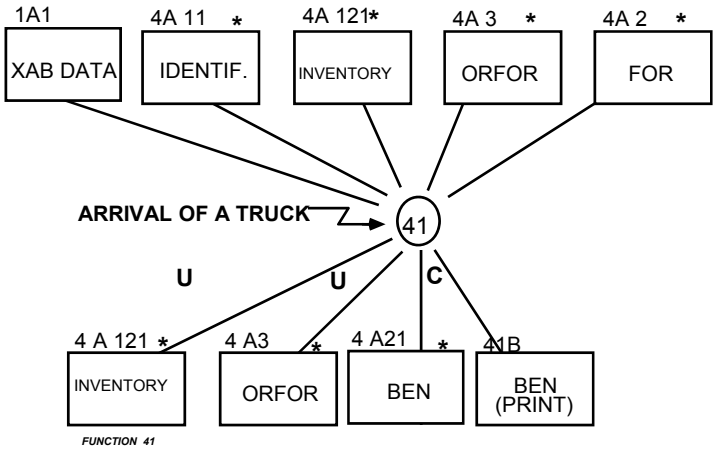
- The profile of the information (see on the right side)
- Objectives of the system (see at the first section)

CLASSIFICATION OF INFORMATION

- *Non formal unstructured info e.g.*
  - *Personal Contacts*
- *Formal unstructured info*
  - *Verbal info (e.g. a phone call)*
  - *Text Info (e.g. a contract)*
  - *Multimedia Info*
- *Formal structured info*
  - *Records*

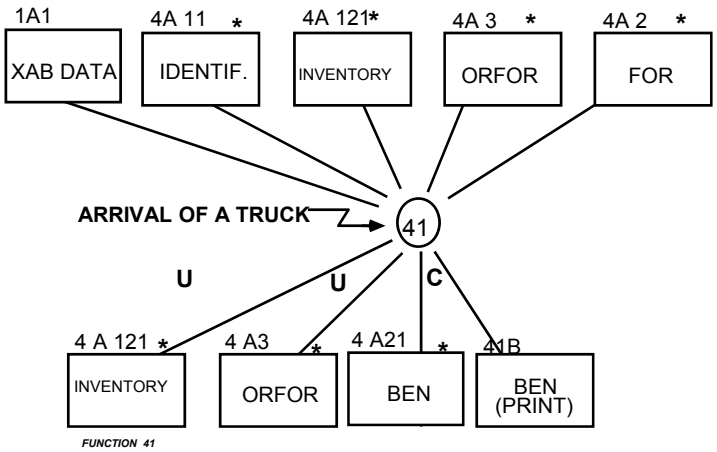
ELICIT





- *Select an elementary activity of an A-Graph :*
  - *Temporary sets are put in Input or Output of the I-Graph*
  - *Permanent sets are put (tentatively) both in I and O*
- *Profile the I-Graph.*
  - *Identify trigger (at least one)*
  - *With multiple triggers, decide if I-Graph should be one or split*
- *CRUD analysis and definition of the permanent sets in I and O*
- *Verify precedence : O sets should derive from I sets*

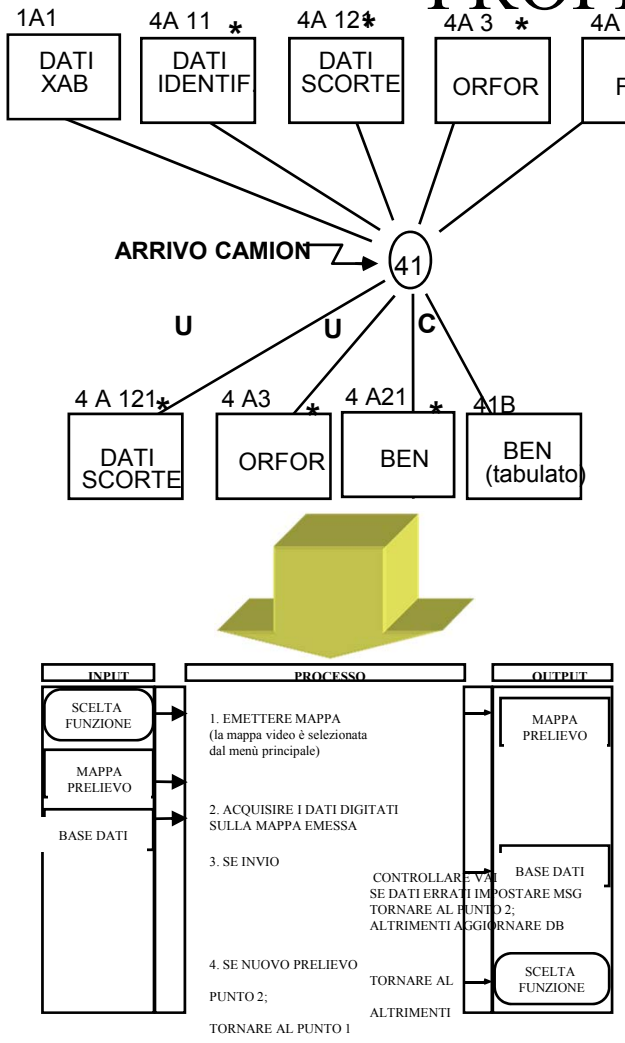
VERIFY I-GRAPHS



The verification intends to check that each output information is obtained from a transformation of some input information by a process – e.g. relational algebra, computation, copy

- ***Precedence*** *is a* ***P*** *operator that if applied to information sets of a system prroduces the corresponding list of precedences*
- *Let us consider the case here below*
  - *P (A) = B,C,D*
  - *P(B) = E*
  - *P(C) = E,F*
  - *P(D) = F*
  - *P (E) = 0*
  - *P(F) = 0*
- *In the above case E and F are imputs to the system; for, if we simplify, we obtain*
  - *P(A) = E,F*

PROFILE I-GRAPHS



Profiling means to specificy

- *Porcesisng mode*
  - *Batch*
  - *Online*
  - *Realtime*
- *Potential pre-requirements*
- *Processing steps*
- *Business rules*
- *Interface (GUI)*

I-Graphs may be profiled as Use-Cases, or as Jacobson descriptions or alike

RM CASE STUDY

INTEGRITY VERIFICATION

INTEGRITY VERIFICATION

- Information Systems are open – the life cycle of data seldom is complete within a single system
- In RM case study
  - No D operation on Data Base (Data are created and updated but never cancelled)
  - The system is partially closed on the Transaction Data itself creates
  - The systems is totally open on its Master Data

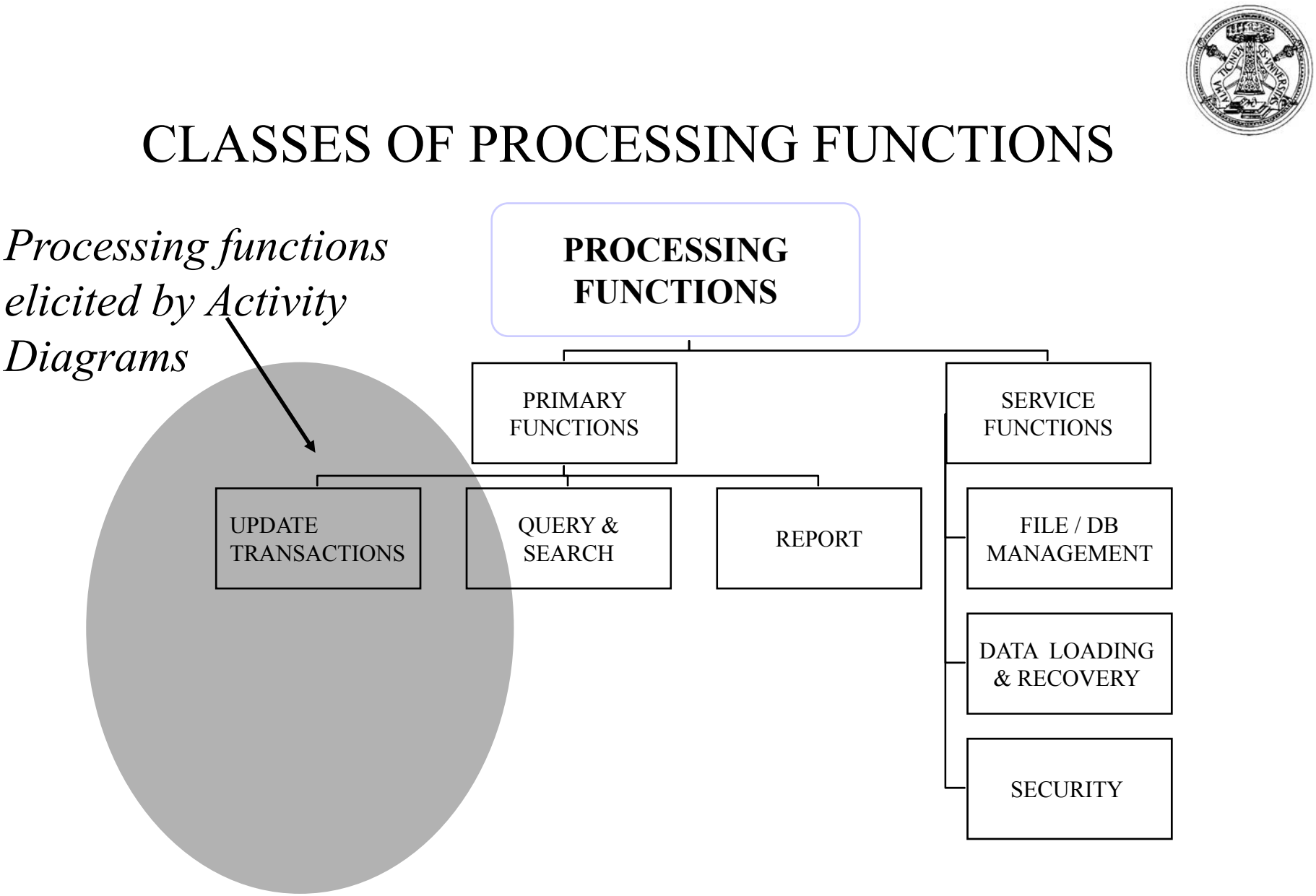
- Verification procedure
  - Define the CRUD table
  - Verify precedences
  - Verify completeness
  - Check and remove anomalies
    - Import
    - Redundancy
    - Deletion

CRUD TABLE : RM CASE STUDY

	FOR	ORFOR	PART/MASTER + INVENTORY	PART / BEN	PART / BSC	PART / UCR	MAP	UNFILLED RPRE
4.1 ENTRANCE	R	U	U	C	---	---	---	---
4.2 INSPECT	---	U	U	R	C	R	---	---
4.3 DISPATCH	---	---	R	---	---	C	---	C/R/U
5.1 SEARCH LOCATION	---	---	R	---	---	U	U	---
5.2 STORE	---	---	L	---	---	---	---	---
5.3 CONFIRM	---	---	R/U	---	---	U	U	---
6.1 PROCESS REQUEST	---	---	R	---	---	U	U	---
6.2 PICK	---	---	---	---	---	---	---	---
6.3 DISTRIBUTE	---	---	U	---	---	U	U	---

RM CASE STUDY

COMPLETION



CLASSES OF PROCESSING FUNCTIONS

Processing functions elicited by Activity Diagrams

PROCESSING FUNCTIONS

PRIMARY FUNCTIONS

SERVICE FUNCTIONS

UPDATE TRANSACTIONS

QUERY & SEARCH

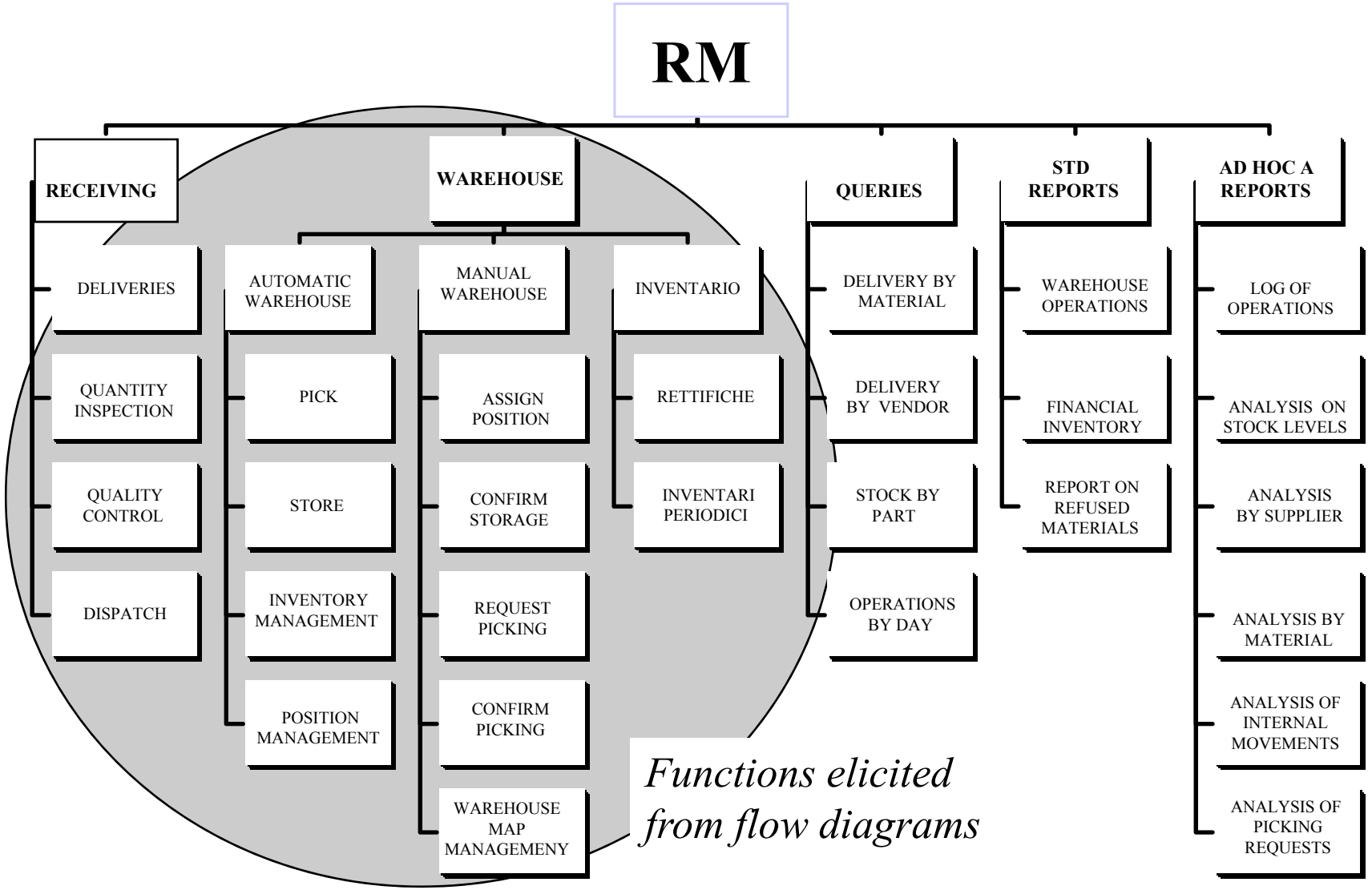
REPORT

FILE / DB MANAGEMENT

DATA LOADING & RECOVERY

SECURITY

FUNCTION TREE: EXAMPLE



ACL CASE STUDY

ACL CASE STUDY - 1

- ***ACL (work centers in Italian) are charge of user installations (business users, retail users)***
- ***2.500 work centers with some 10.000 workstations***
- ***1,5 M transactions a day.***
- ***Data Base with over 300 relations (tables)***

1. **Receive failure notice from customers**. Customers communicate failures by calling a 800 number, and, guided by a recorded message, dial their area code and number. An appropriate device (DTSD) links the customer to the Work Center and forwards customer's phone number.
2. **Test the network**. A UTR (Remote Test Unit) receives the number information, and automatically performs a series of test on subscriber's line, by sending test signals (STPR) and analyzing corresponding acknowledgement signals (RTPR). The RESULT of the test is shown on the screen of the operator who is receiving the failure notice.
3. **Check administrative profile**. At the same time, the operator inquires CUST and FAILURES data files, creates a ticket for the subscriber (SUB) with all customer information, i.e. Name, Subscription, Location, User's status (active, non paying, disconnceted, assigned, expedeting, etc.), failures in last the months etc.

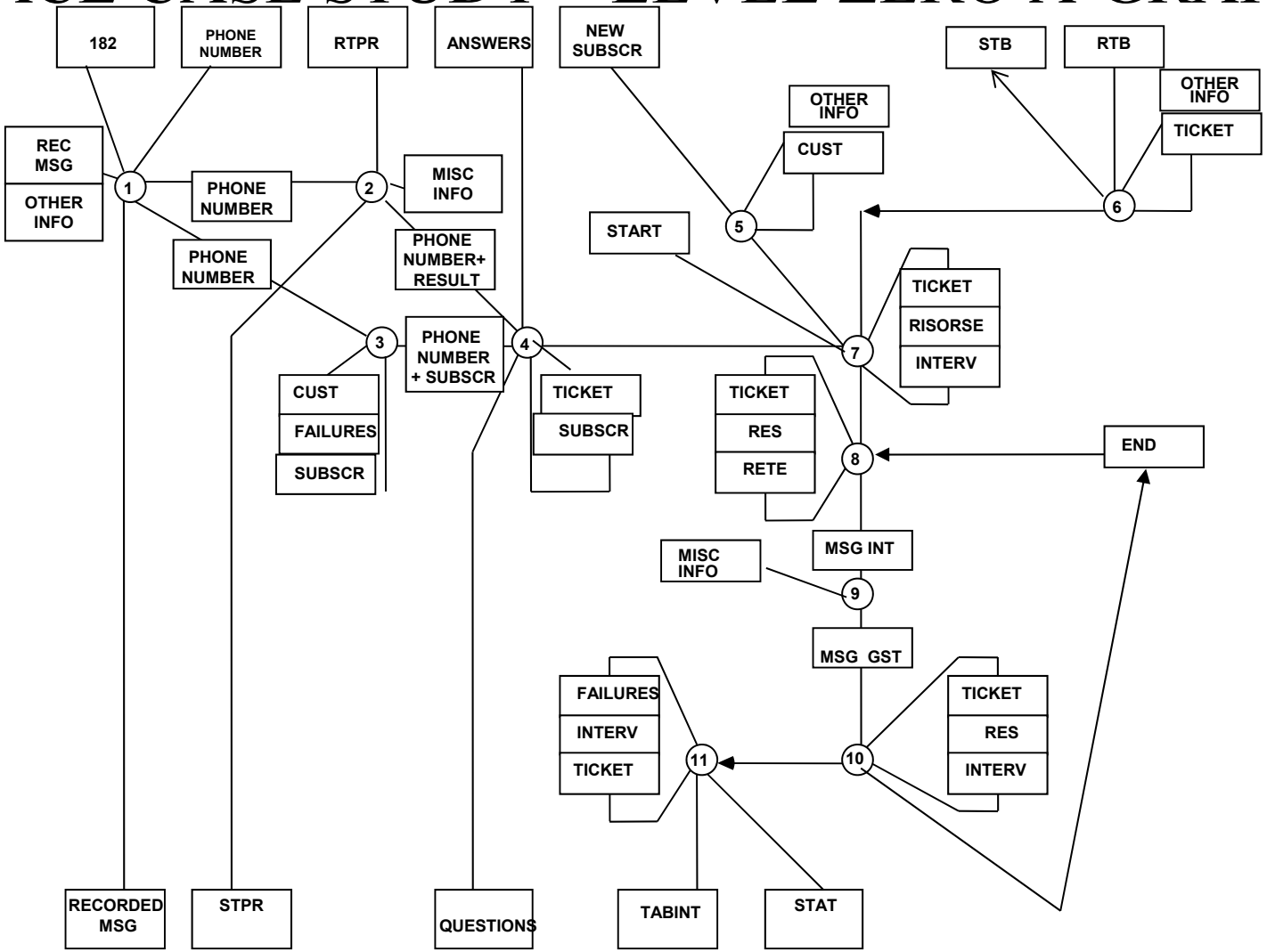
ACL CASE STUDY - 2

4. **Define intervention**. Data of RESULT, PHONE NUMBER e SUBSCR are shown on the operator's screen; based on RESULT data and to ANSWERS the customer gives to the QUESTIONS raised by the operator, the operator identifies the most likely failure and agrees on the repairing date. At this point a TICKET is issued that stores all information (PHONE NUMBER + SUBSCR + RESULT + appointment date + likely failure).
5. **Update CUSTOMER data**. Sales department issues a specific card for new subscriber (NEW-SUBSCR) that is forwarded to the regional work center to update the CUSTOMER database.
6. **Test public phones.** The automatic failure detector of work centers periodically tests the public phones of the area (it sends tests signals called STPB and gathers acknowledgement signals RTPB). The results of the test are stored in a TICKET that is almost identical the one that actvity 4 produces .
7. **Assign interventions.** The managers of Operations Planning select from TICKET file the next intervention to be assigned (typically an intervention is assigned according to a FIFO sequence). The job is assigned to one of the teams receorded in RES file, and an INTERV record is created accordingly.

ACL CASE STUDY - 3

8. **Communicate data to team**. When a team ends an activity, from INTERV the next intervention assigned is forwarded to team trough a meessage called MSGINT, that includes data of the TICKET and information on subscriber's installation (telephone box, switchboard, couples etc.) that are extracted froom the data of NETWORK. The team is connected by a mobile terminal (called SFIL) that can handle multimedia information and communication.
9. **Execute the assignment .** The team executes its assignment, with the support of the mobile terminal that proposes a checklist of potential failures and related tests. Once the failure is identified and fixed (or not fixed) SFIL transmits to the work center a predefined message on results – fixed, to be fixed, further analysis needed etc.
10. **Close repair activity**. The work center receives MSGGST from the team, and upadates FAILURE and INTERV, and triggers acctivity 8 by a message UOEND (intervention ended).
11. **Analyze**. Dayly a report TABINT on the interventions is produced for Sales department. Also, in any moment, it is possible to monitor the operations of work centers and watch on line the assignments (Activity 7).

ACL CASE STUDY – LEVEL ZERO A-GRAPH



ACL CASE STUDY - SYSTEM BLOCKS