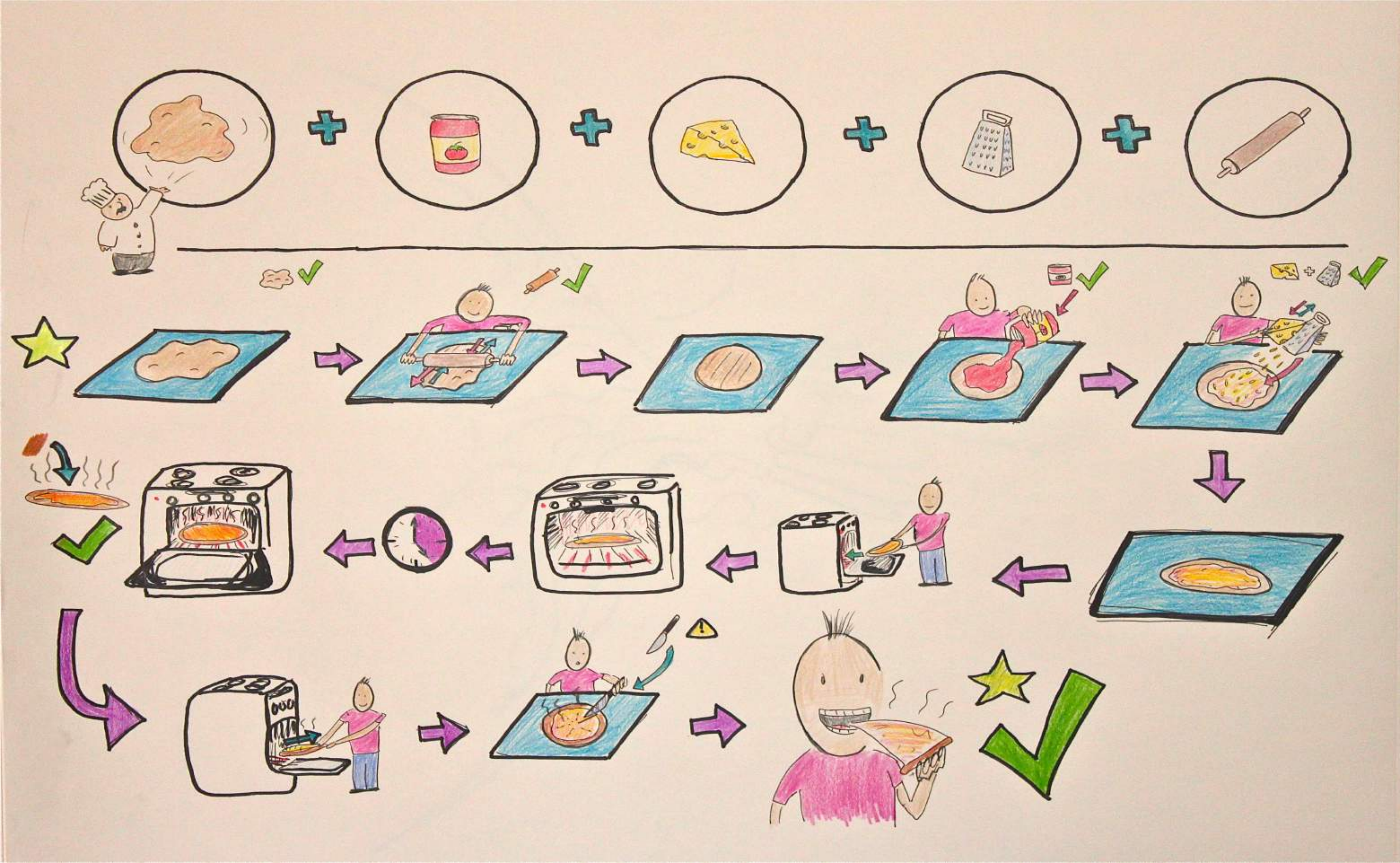
SADT — Structured Analysis & Design Technique

Yuling Li

12/5/16

How to Make a Pizza?

Workshop: SADT: Structured Analysis & Design Technique

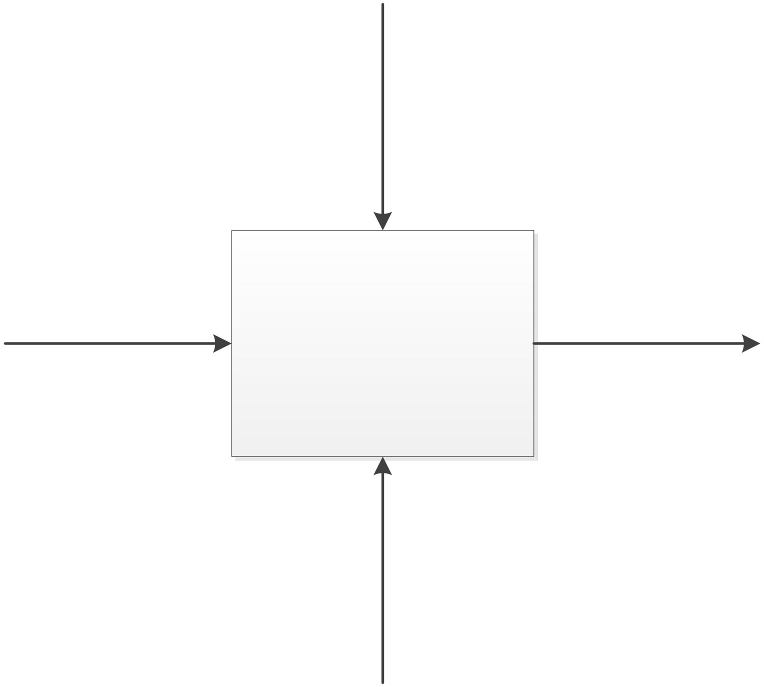


How to Make a Pizza (Process/Activities) Systematically?

Analysis	Determine what the system will do
Design	Define subsystems and their interfaces
Implementation	Create the subsystem independently
Integration	Combine the subsystems into a single unit
Testing	Verify the system workings
Installation	Make the system operational
Operation	Use the system

“**M** models **A** if **M** answers questions about **A**”

---- Douglas T. Ross



Contents

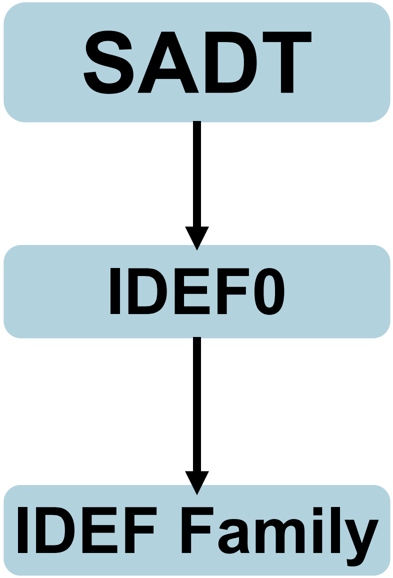
1 Overview of SADT

2 Syntax and Semantics

3 SADT Diagrams

4 Cases

1 Overview of SADT



Emergent

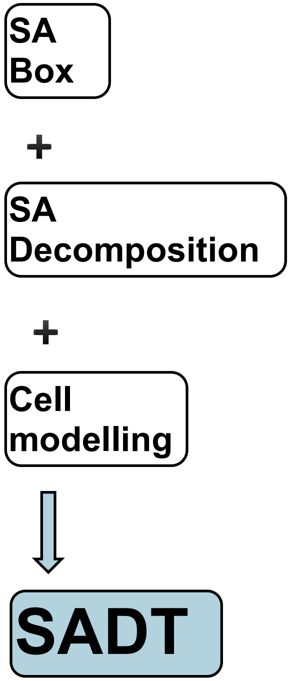
1950s “hierarchic, layered modular system”

1960s “system of systems for building systems”

“top-down hierarchic decomposition”

1970s “Hori’s Human-directed activity cell model”

“language for blueprinting systems”



SA Box

+

SA Decomposition

+

Cell modelling

SADT

- Douglas T. Ross developed SADT (1969-1973)
- SADT is a trademark of SofTech, Inc. (After 1973)

Develop

- During the 1970s, the U.S. Air Force Program for Integrated Computer Aided Manufacturing(ICAM) sought to increase manufacturing productivity through systematic application of computer technology.

⇩

1970s **government (US Department of Defense) version IDEF0 introduced**

1980s **“under the name of IDEF0, SADT has been used in military and industrial organisations”**

1990s **renamed in 1999 as Integration DEFinition**

IDEF family of methods

IDEF Family

- **IDEF0 : Function modeling**
- IDEF1 : Information modeling
- IDEF1X : Data modeling
- IDEF2 : Simulation model design
- IDEF3 : Process description capture
- IDEF4 : Object-oriented design
- IDEF5 : Ontology description capture
- IDEF6 : Design rationale capture
- IDEF7 : Information system auditing
- IDEF8 : User interface modeling
- IDEF9 : Business constraint discovery
- IDEF10 : Implementation architecture modeling
- IDEF11 : Information artifact modeling
- IDEF12 : Organization modeling
- IDEF13 : Three schema mapping design
- IDEF14 : Network design

SADT Structured Analysis and Design Technique

Structured Analysis and Design Technique, is **a graphical language for describing systems together with a methodology** for producing such descriptions.

An SADT model contains **a set of diagrams that describe a system** from an identified **viewpoint** and for **a particular purpose**.

SADT as a language and as a methodology directs and disciplines **the analysis and design of systems**. (Dickover, 1977)

Structured Analysis and Design Technique, is **a graphical notation and an approach** to system description. (David A. Marca, 1988)

Model

IDEF0 models comprising system functions (actions, processes, operations), functional relationships, and the data and objects that support systems analysis and design, enterprise analysis, and business process re-engineering.

Integrated Computer-Aided Manufacturing (ICAM) Function Modeling

2 Syntax and Semantics

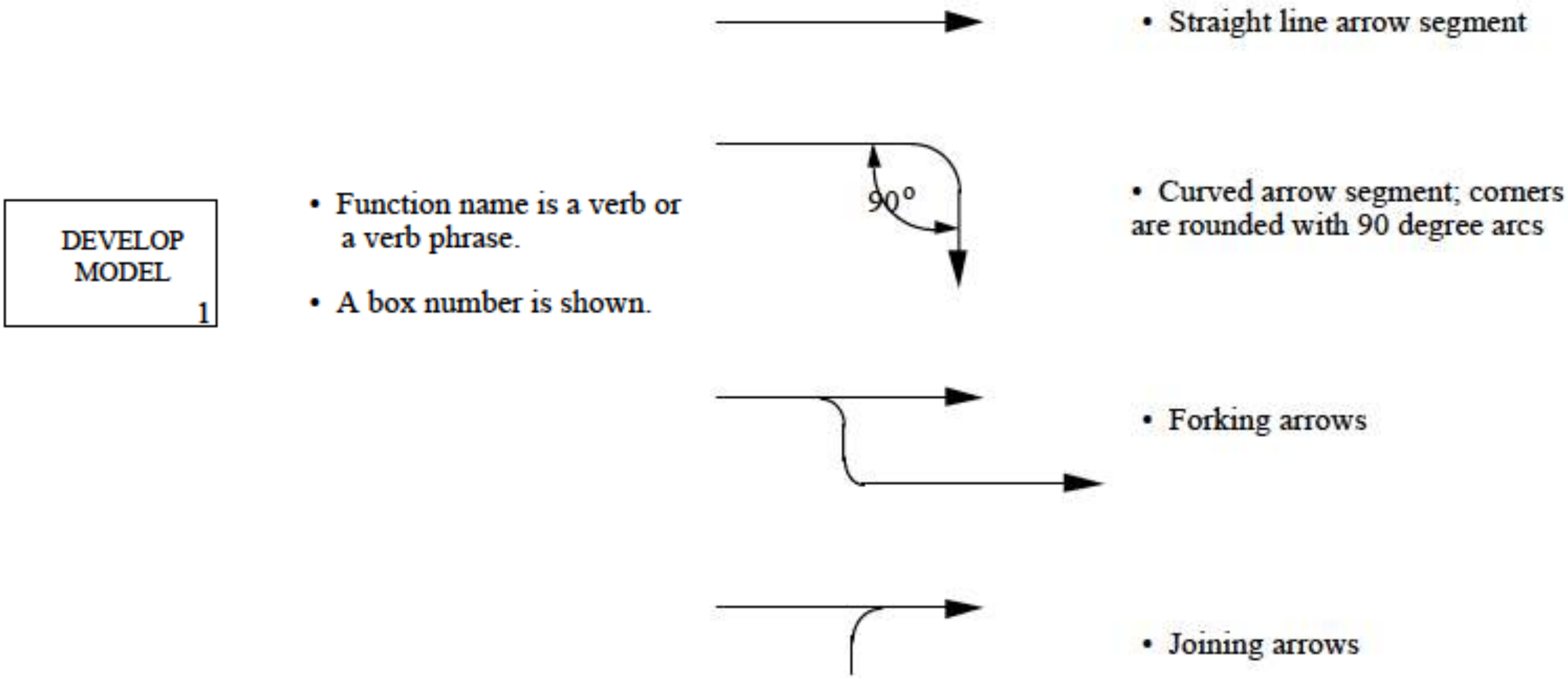
❑ Syntax

- The structure components and features of language and the rules that define relationships among them.
- Boxes represent functions, defined as activities, processes or transformations.
- Arrows represent data or objects related to functions.

❑ Semantics

- Semantics refers to the meaning of syntactic components of a language and aids correctness of interpretation.

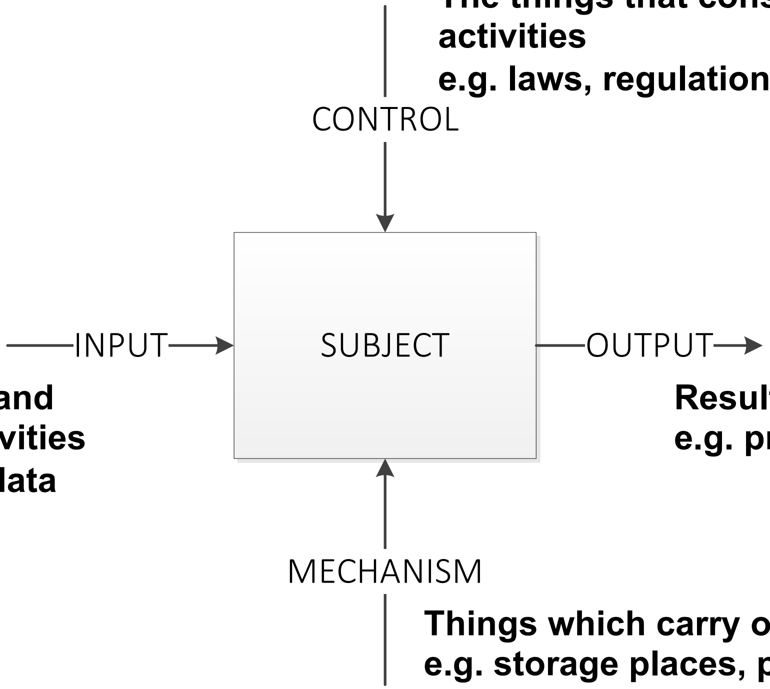
Boxes and Arrows



- Function name is a verb or a verb phrase.
- A box number is shown.
- Straight line arrow segment
- Curved arrow segment; corners are rounded with 90 degree arcs
- Forking arrows
- Joining arrows

Fig. Box and Arrow Syntax (Standard, 1993)

Box and Arrow Semantics
—— SA box



The things that constrains activities
e.g. laws, regulations

CONTROL

INPUT

SUBJECT

OUTPUT

Those things used and transformed by activities
e.g. raw materials, data

Result of activity
e.g. products, service

MECHANISM

Things which carry out the activity
e.g. storage places, people, organisations, devices

Under control, input is transformed or consumed into output by the mechanism.

Labels and Names

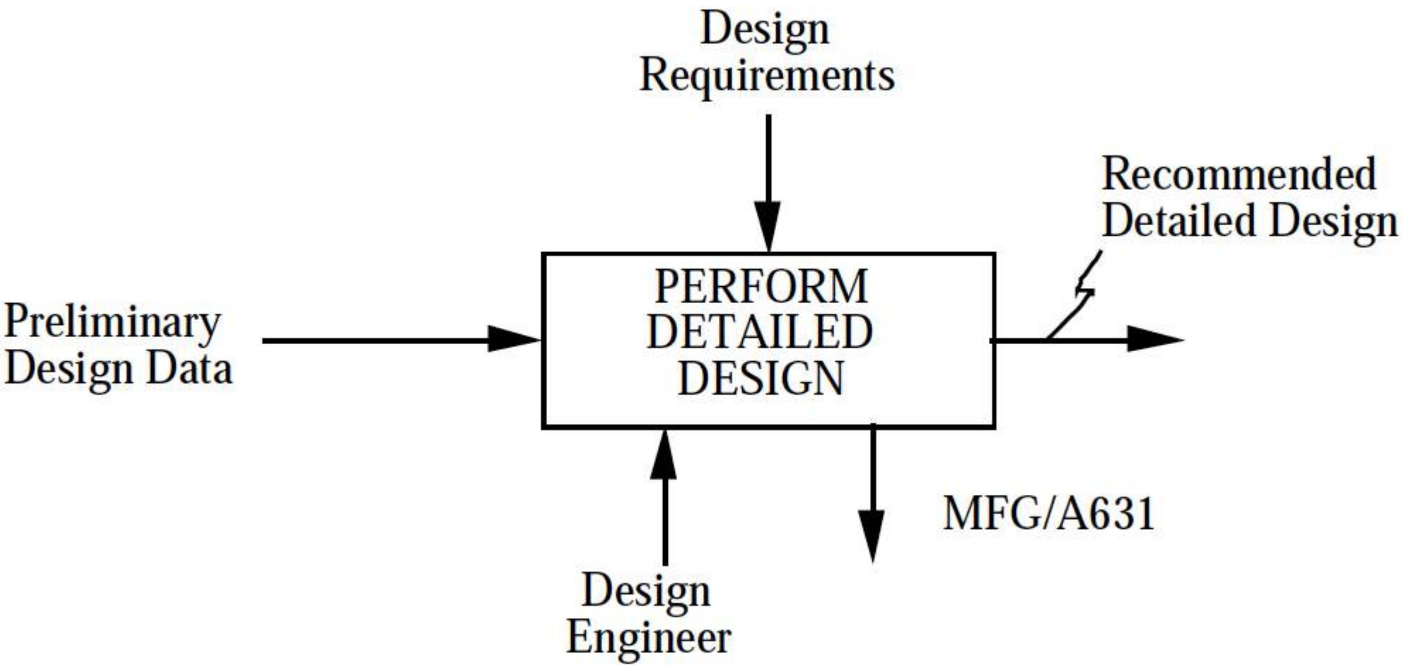
- A function name shall be an active verb or verb phrase, such as:

process parts, plan resources, conduct review, monitor performance, design system provide maintenance, develop detail design, fabricate component, inspect part…

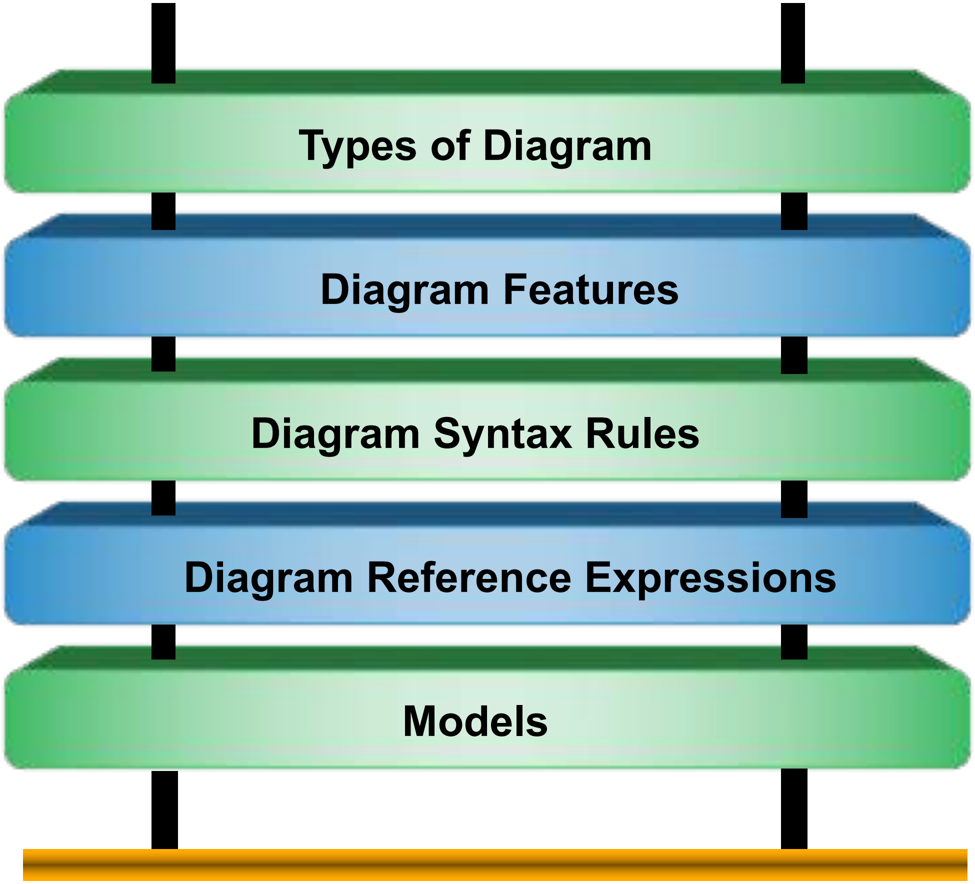
- The arrows shall be labeled with a noun or noun phrase, such as:

specifications, test report, budget, design requirements, detail design, directive, design engineer, board assembly, requirements…

Example


Design
Requirements
Recommended
Detailed Design
Preliminary
Design Data
PERFORM
DETAILED
DESIGN
MFG/A631
Design
Engineer

3 SADT Diagrams

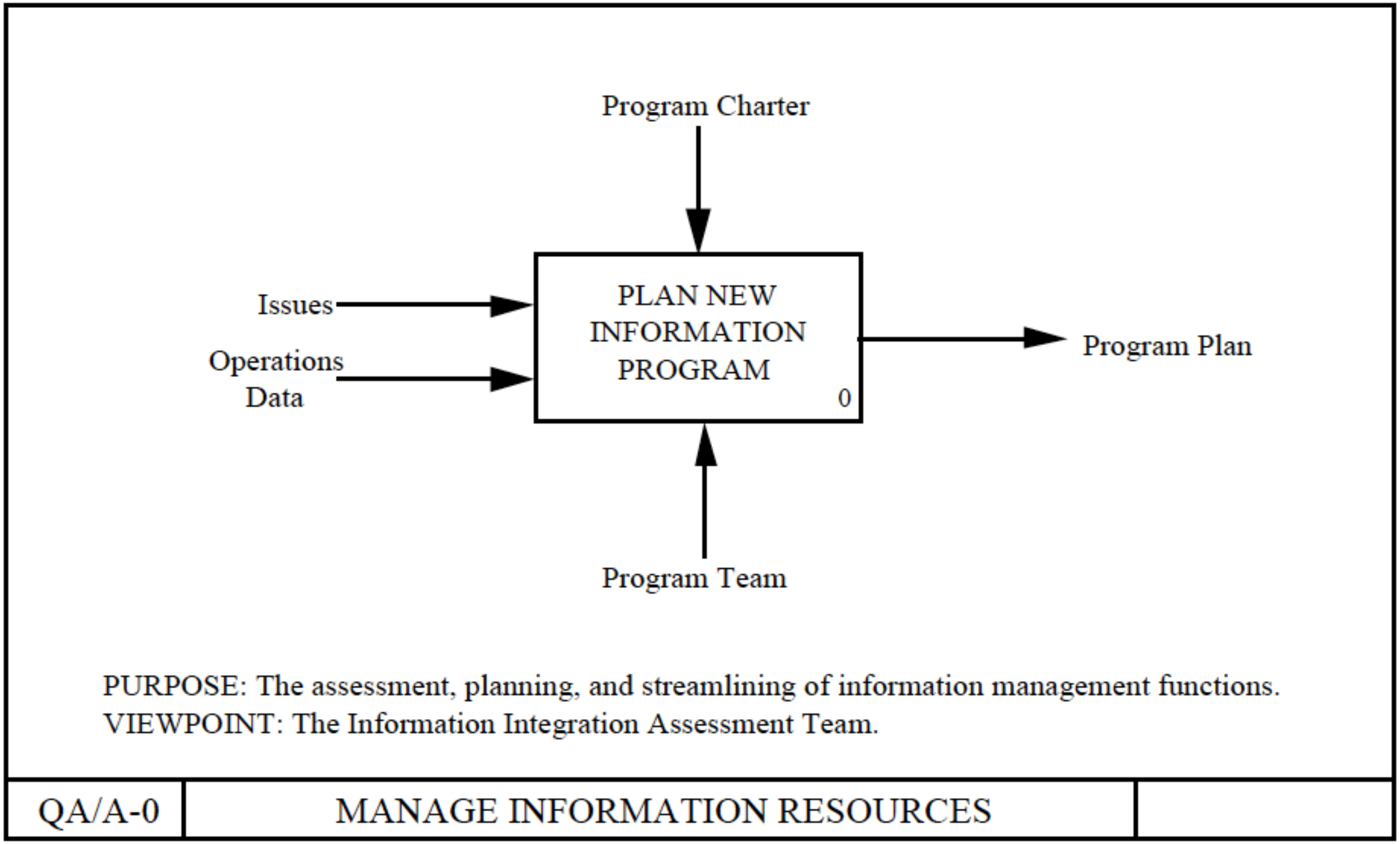


❖ Type of Diagram

Top-Level Context Diagram

- Subject of model represented by single box with bounding arrows.
- Called A-0 (“A minus zero”)
- Box and arrows are very general
- Sets model scope or boundary and orientation.
- Should include
  - Purpose
  - Viewpoint

Example



Program Charter

Issues

Operations Data

PLAN NEW INFORMATION PROGRAM

0

Program Plan

Program Team

PURPOSE: The assessment, planning, and streamlining of information management functions.
VIEWPOINT: The Information Integration Assessment Team.

QA/A-0	MANAGE INFORMATION RESOURCES	

Child Diagram

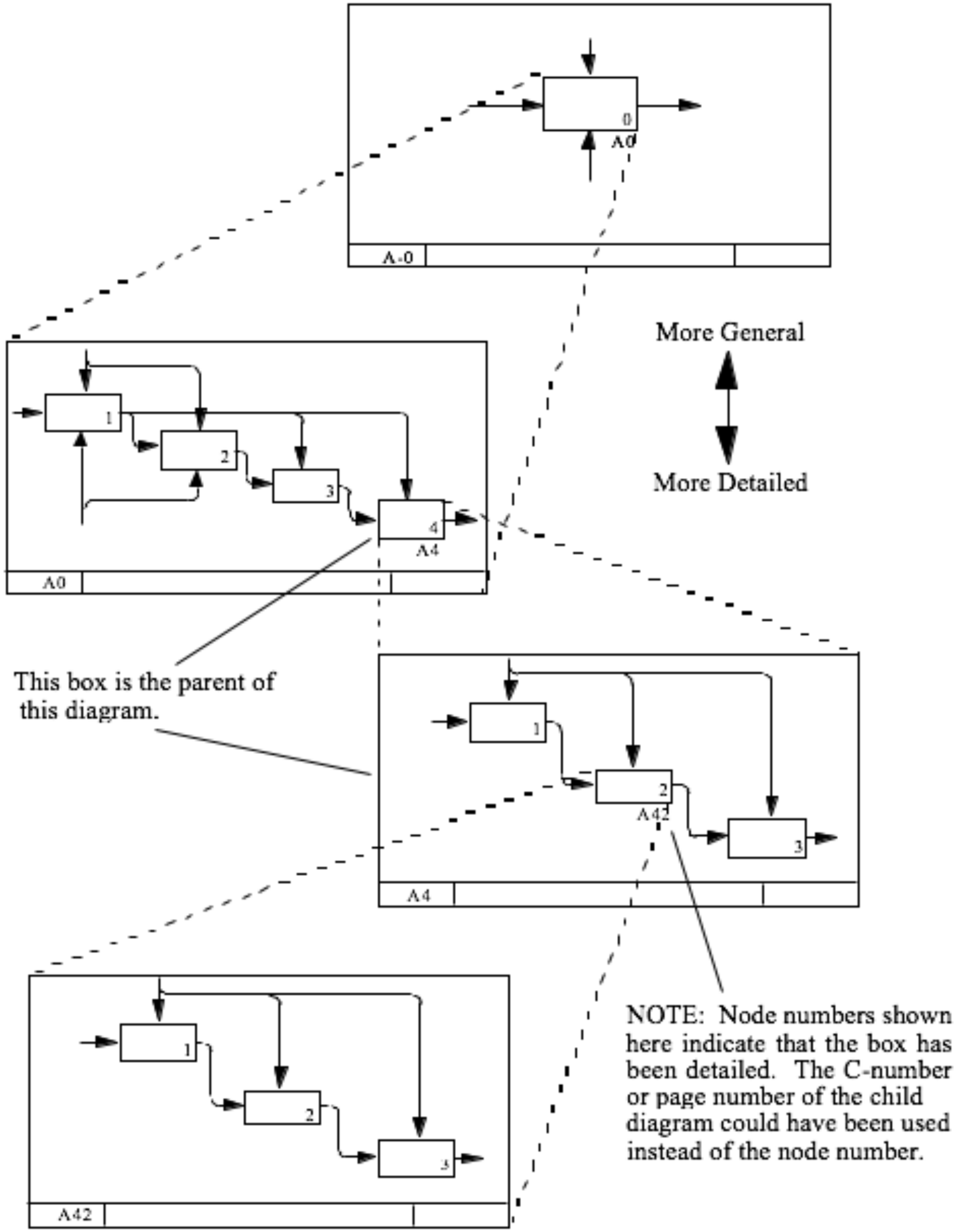
- Single process in Context Diagram (A-0) may be decomposed into sub-processes and modeled in a child (A0) diagram.
- Each process in the A0 diagram may be decomposed further into sub-processes and modeled in (grand-) child (A1, A2, … A6) diagrams.
- Each (grand-) child process may be decomposed further into sub-processes and modeling (great-grand-) child diagrams.

Parent Diagram

- A parent diagram is one that contains one or more parent box.

Parent

Child



This box is the parent of this diagram.

NOTE: Node numbers shown here indicate that the box has been detailed. The C-number or page number of the child diagram could have been used instead of the node number.

Parent

Child

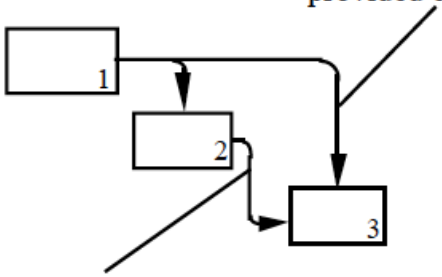
Parent

Child

❖ Diagram Features

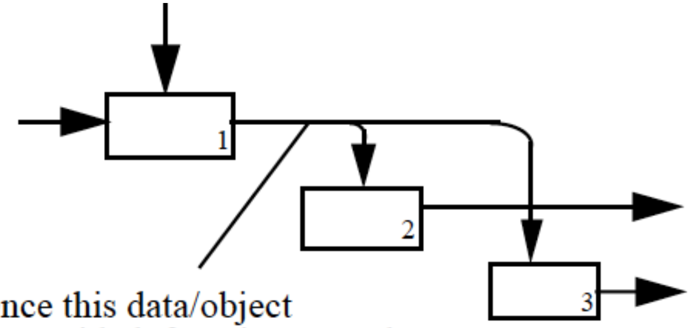
Arrow as Constraints

...and this data/object provided by function 1.



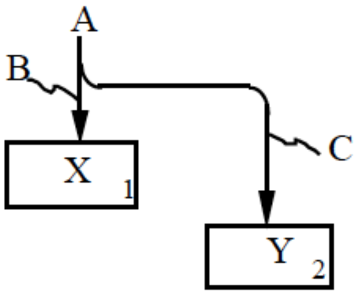
Performance of function 3 requires this data/object output from function 2...

Concurrent Operation



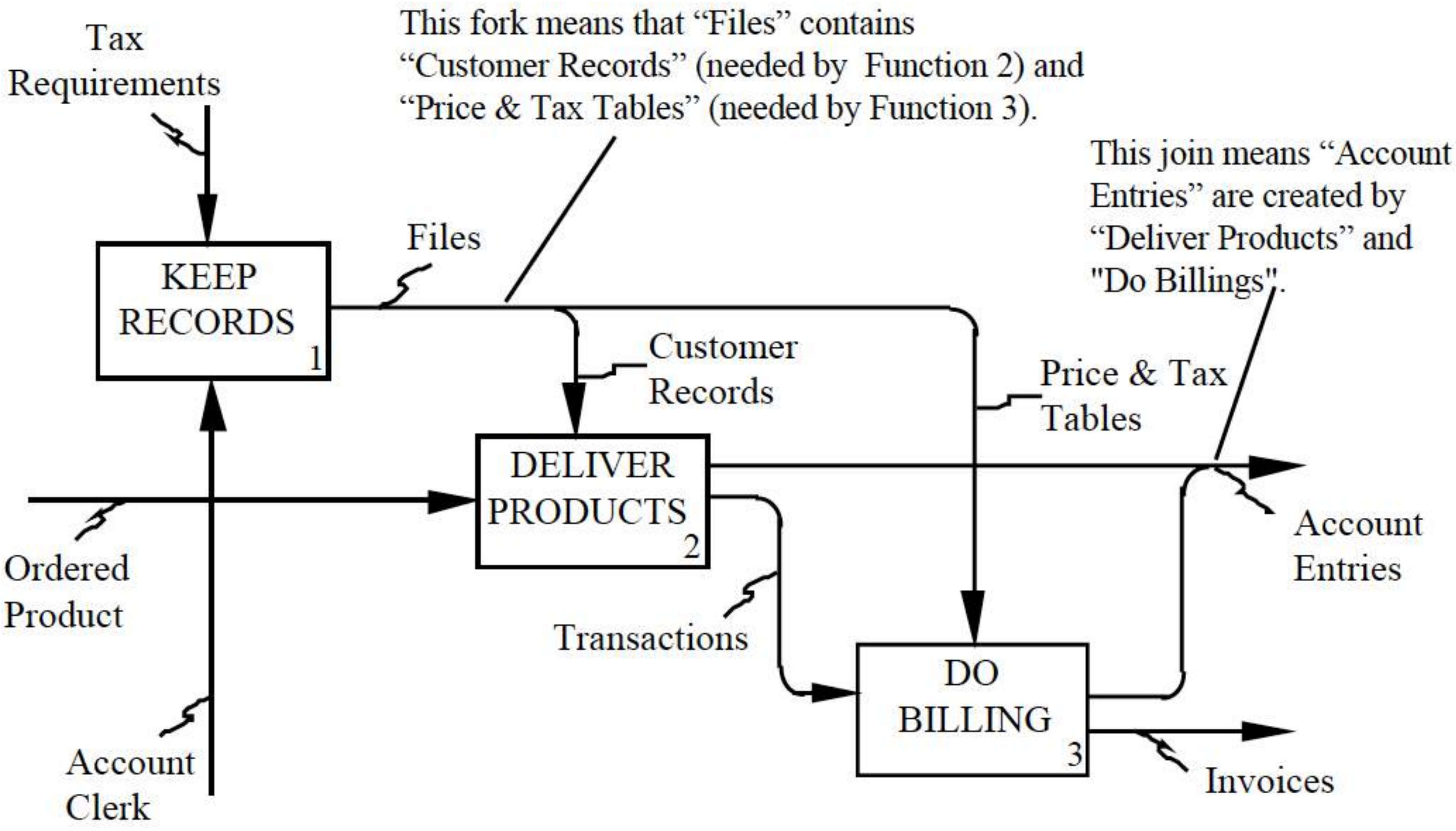
Once this data/object is provided, functions 2 and 3 may operate concurrently.

Arrow as Pipelines



Pipeline A splits into B and C to provide controls to X and Y.

Arrow Between Boxes



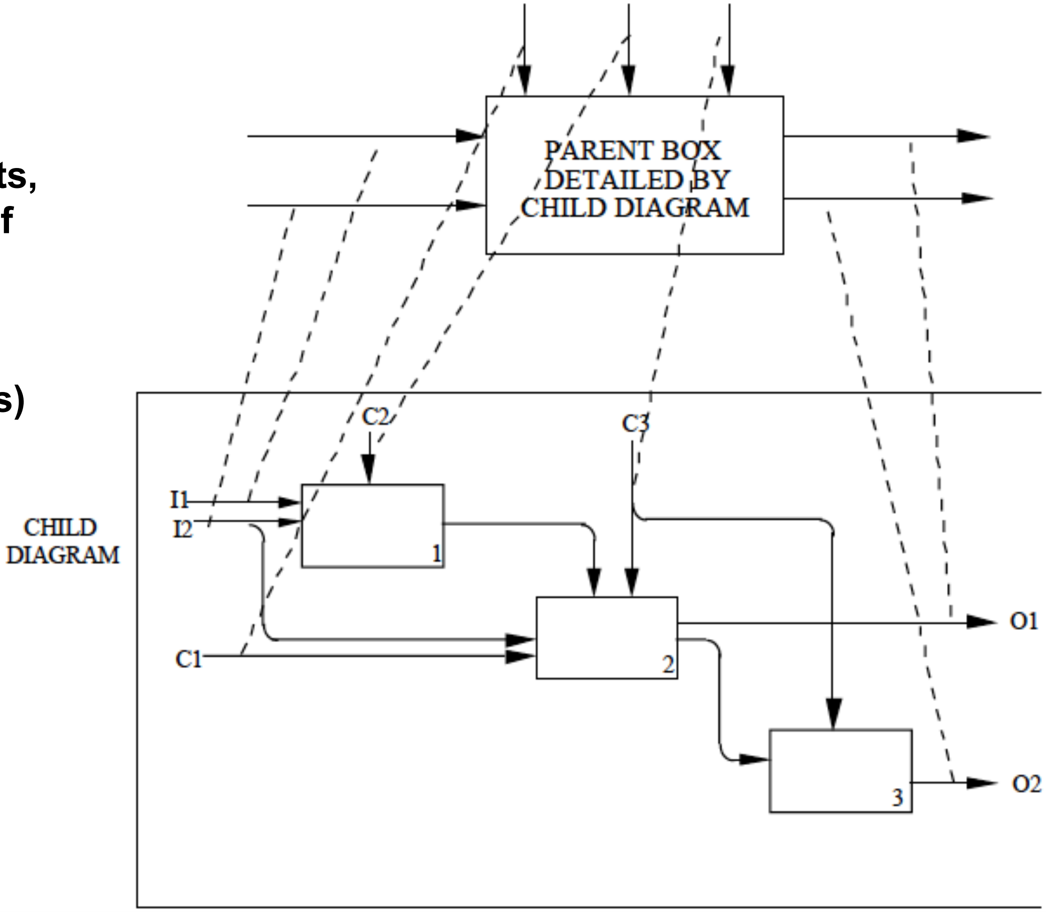
This fork means that "Files" contains "Customer Records" (needed by Function 2) and "Price & Tax Tables" (needed by Function 3).

This join means "Account Entries" are created by "Deliver Products" and "Do Billings".

Boundary Arrows and Coding

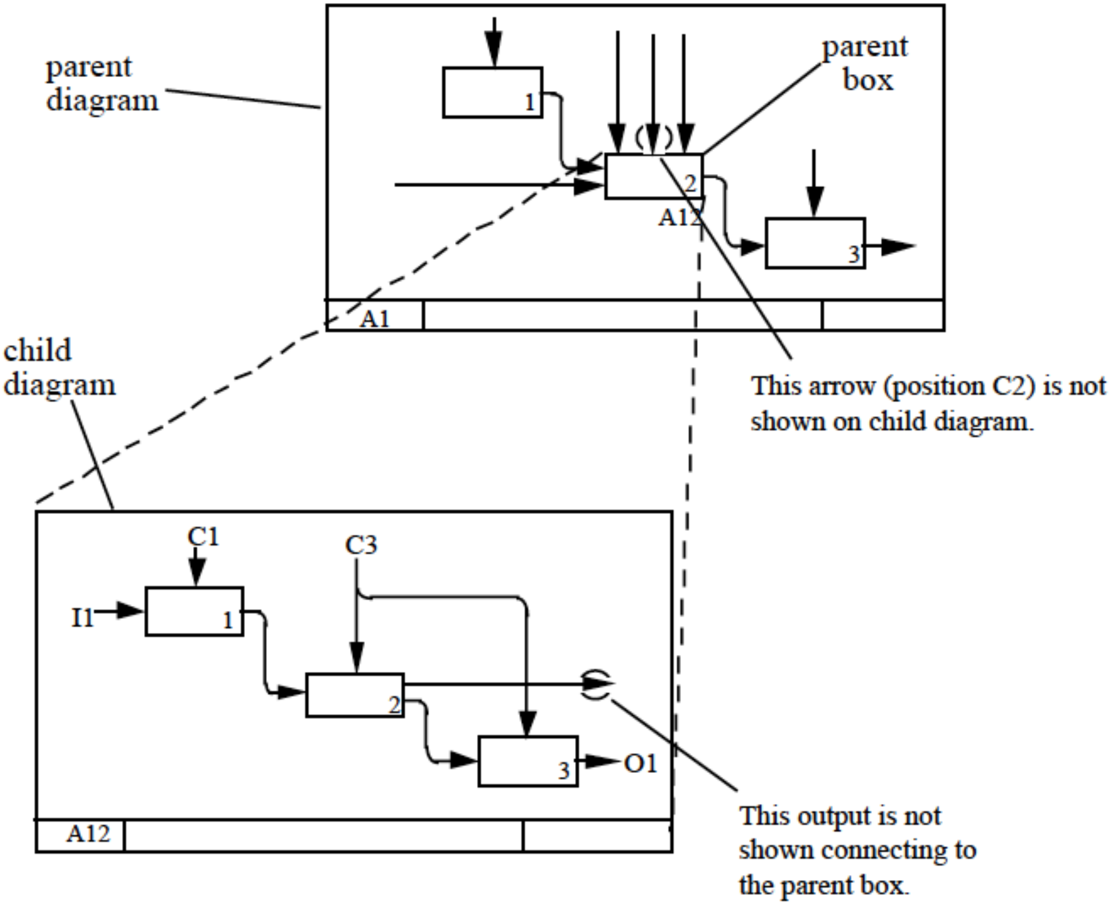
- Boundary arrows on an ordinary graphic diagram represent the inputs, controls, outputs, or mechanisms of the diagram's parent box.

- All boundary arrows on a child diagram (except for tunneled arrows) shall correspond to the arrows that connect to its parent box.



Tunneled Arrows

- Provide information at a specific level of decomposition that is not required for understanding at some other levels



This arrow (position C2) is not shown on child diagram.

This output is not shown connecting to the parent box.

❖ Diagram Syntax Rules

- Diagrams have boxes and arrows
- Box represent activities
- Boxes have dominance
- Arrows represent things
- Arrows represent interconnections among boxes
- Arrows are collections of things: branches and joins

❖ Diagram Reference Expressions

...	Optional higher-level context diagrams
A-1	Optional context diagram
A-0	Required top-level context diagram
(contains A0 top box)	
A0 Top level child diagram	
A1, A2, ..., A6	Child diagrams
A11, A12, ..., A16, ..., A61, ... , A66	Child diagrams
A111, A112, ..., A161, ..., A611, ..., A666	Child diagrams
...	Lower-level child diagrams

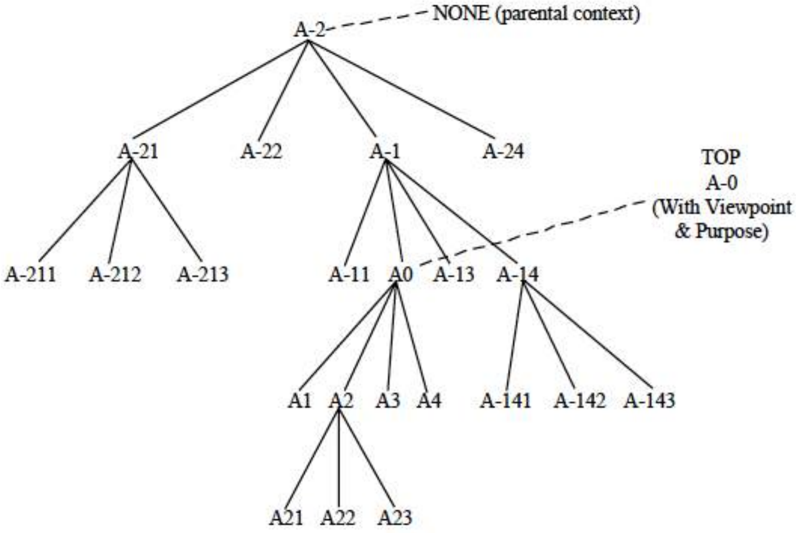
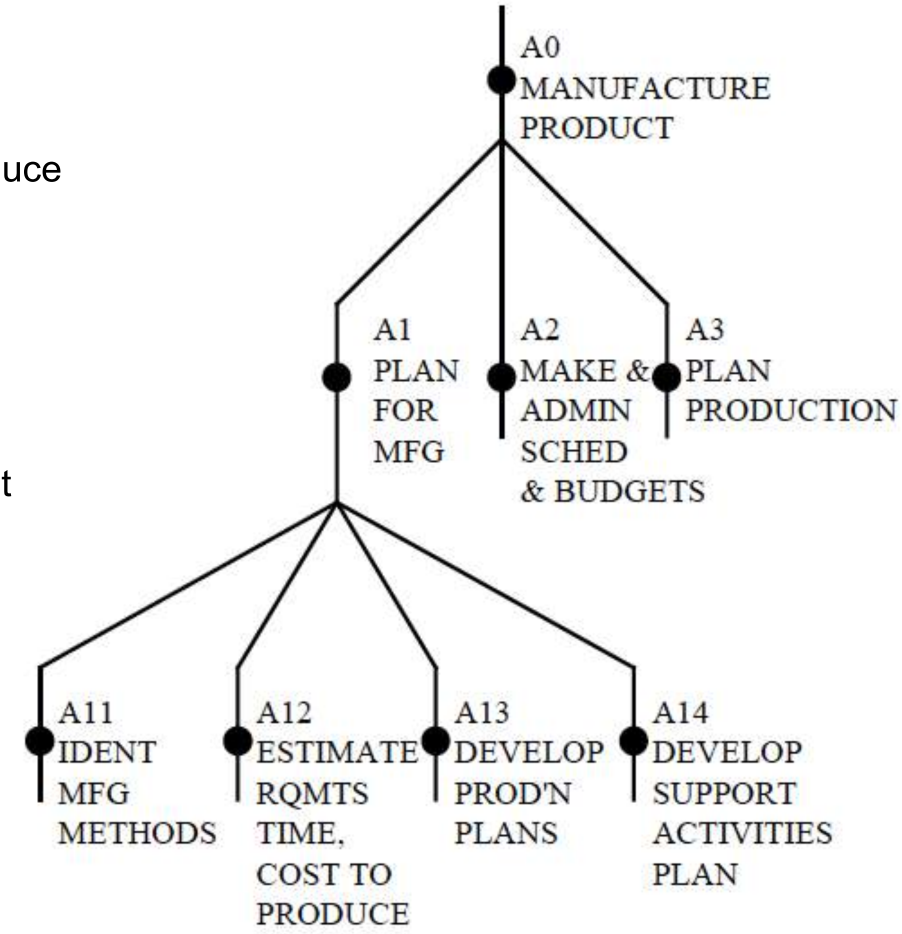


Fig. Negative Node-Numbered Context (Standard, 1993)

Example

- A0 Manufacture Product
    - A1 Plan For Manufacture
        - A11 Identify Manufacturing Methods
        - A12 Estimate Requirements, Time, Cost to Produce
        - A13 Develop Production Plans
        - A14 Develop Support Activities Plan
    - A2 Make and Administer Schedules and Budgets
        - A21 Develop Master Schedule
        - A22 Develop Coordinating Schedule
        - A23 Estimate Costs & Make Budgets
        - A24 Monitor Performance To Schedule & Budget
    - A3 Plan Production

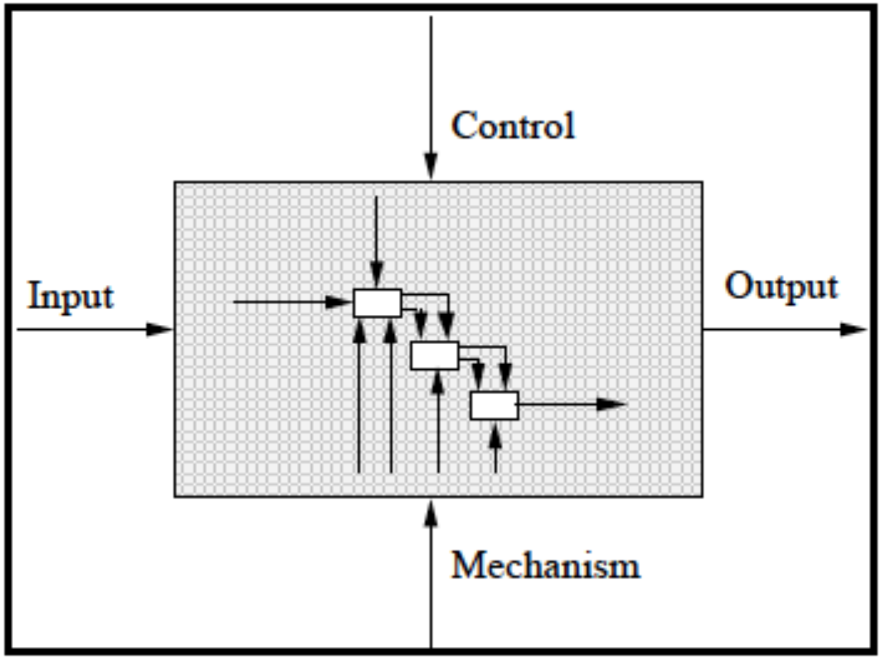


❖ Models

- A model answers questions
- A model has **a single subject**
- A model has **one viewpoint**
- Models **are coordinated** sets of diagrams
- A system is represented by **a single box**
- Identifying **decompositions** with node numbers
- Linking decomposition with C-number

Deposition

“**M** is a model of **S** if **M** can be used to answer questions about **S** with an accuracy of **A**”



Different Viewpoints

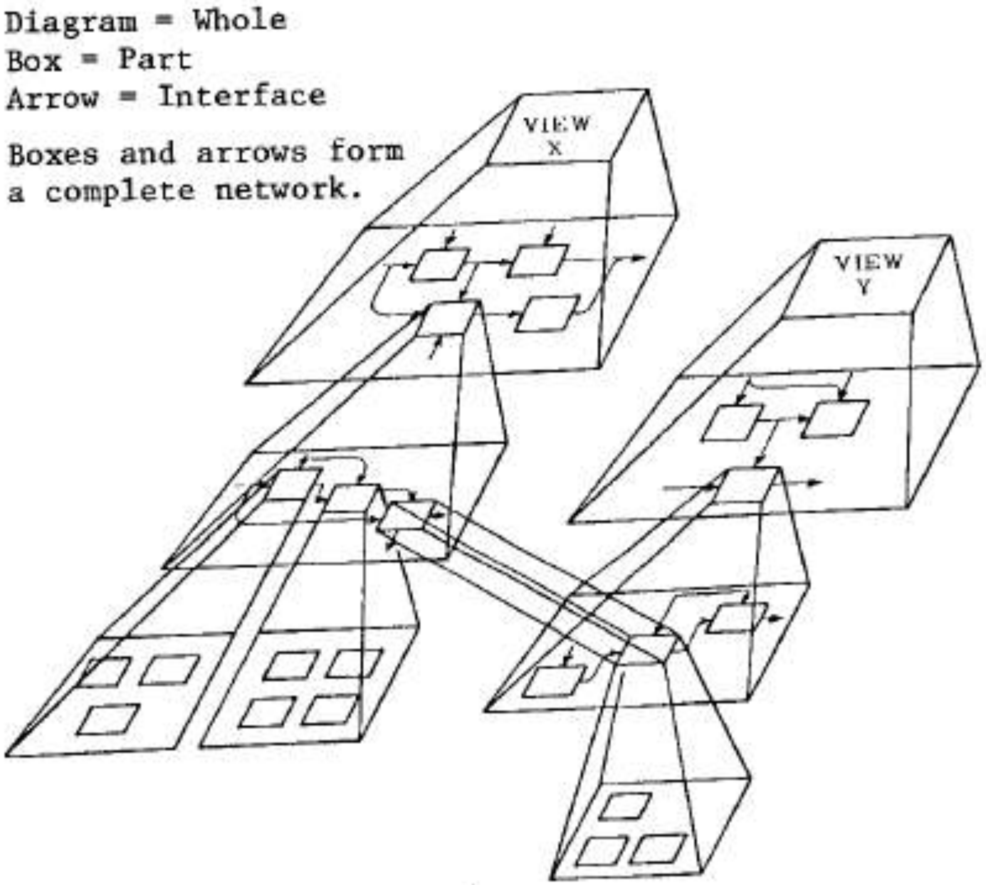


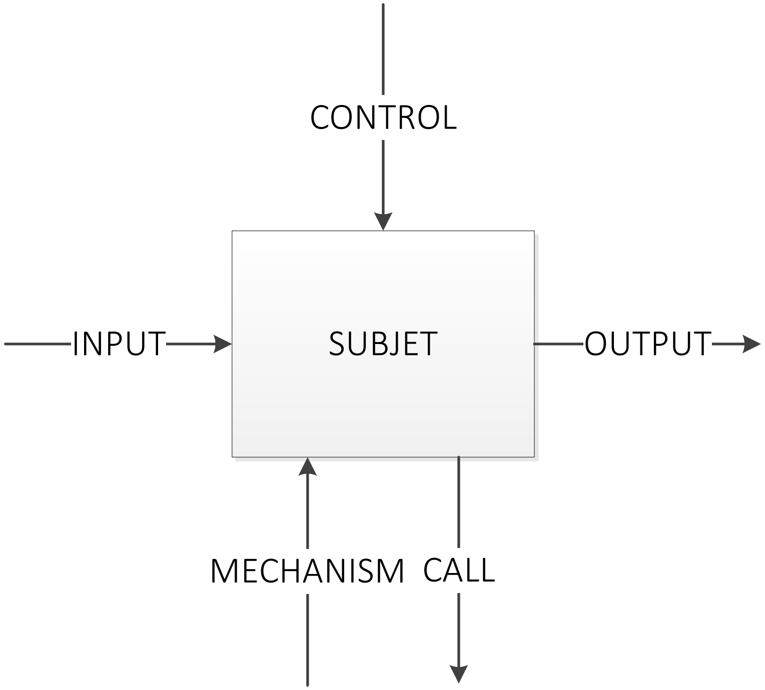
Diagram = Whole
Box = Part
Arrow = Interface

Boxes and arrows form a complete network.

Fig. Two interconnected models of from different viewpoints. (Dickover, 1977)

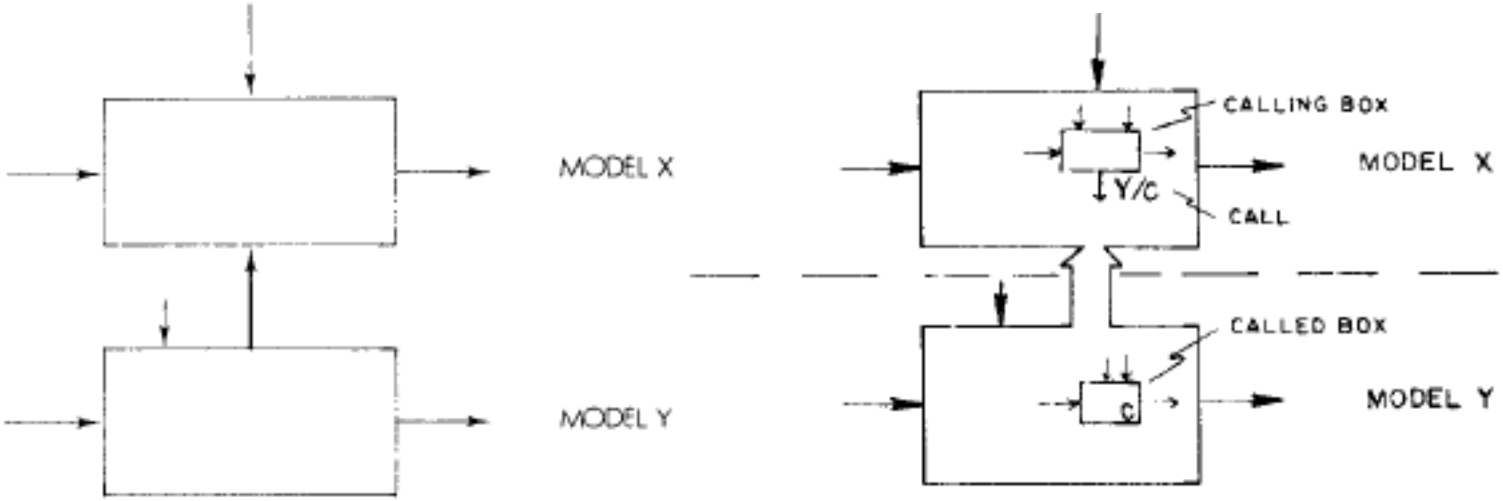
Call Notation

- A call arrow is a special arrow of mechanism;
- The caller box does not have its own child diagram to detail it;
- But rather is detailed by another box in the same or another model;
- Multiple caller boxes may call the same box.



Example

The decomposition of Model X is continued in Model Y; Model Y ”support” model X



Situation1: Model X calling Model Y

Situation2: a box in Model X calling a box in Model Y

Fig. The call notation. (Dickover, 1977)