# Task Analysis Using IDEF0

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# IDEF0 Standard
## http://www.itl.nist.gov/fipspubs/idef02.doc

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**Draft Federal Information**
**Processing Standards Publication 183**

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**Announcing the Standard for**

**INTEGRATION DEFINITION FOR FUNCTION MODELING (IDEF0)**

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# IDEF0

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- Integrated DEFinition language 0
  - Originally SADT
    - System Analysis and Design Technique
    - Developed by Douglas T. Ross, SofTech
  - Used in USAF's Integrated Computer Aided Manufacturing (ICAM) Program to model manufacturing and logistics activities
- Generally used for modeling complex processes (activities, functions)

# IDEF0 Concepts

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- Box and arrows language with syntax and semantics
- Provides systems engineering approach to
  - performing system/process analysis at all levels (multiple levels of abstraction).
  - producing reference documentation:
    - box & arrow diagrams
    - English text (descriptions/glossaries)
    - node indexes
  - communicating among analysts, designers, users, and managers.
  - promoting shared understanding.
  - managing large, complex projects.
  - providing a reference architecture for enterprise analysis, information engineering and resource management.

# Other Concepts & Characteristics of IDEF0

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- Gradual exposition of detail
- Limitation of detail
- Diagrams supported with text
- Rigor and precision
  - detail exposition control
  - bounded context (no omissions or additional out-of-scope detail).
  - syntax rules for graphics (boxes and arrows).
  - uniqueness of names and labels on a diagram.
  - diagram connectivity data/object connectivity.
  - rules for determining role of data or objects.
  - arrow label requirements (minimum labeling rules).
  - purpose and viewpoint.

# Syntax and Semantics

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- Syntax of a representation
  - elements
  - structure
  - form
  - e.g., grammar
- Semantics
  - meaning

# Syntax: Boxes

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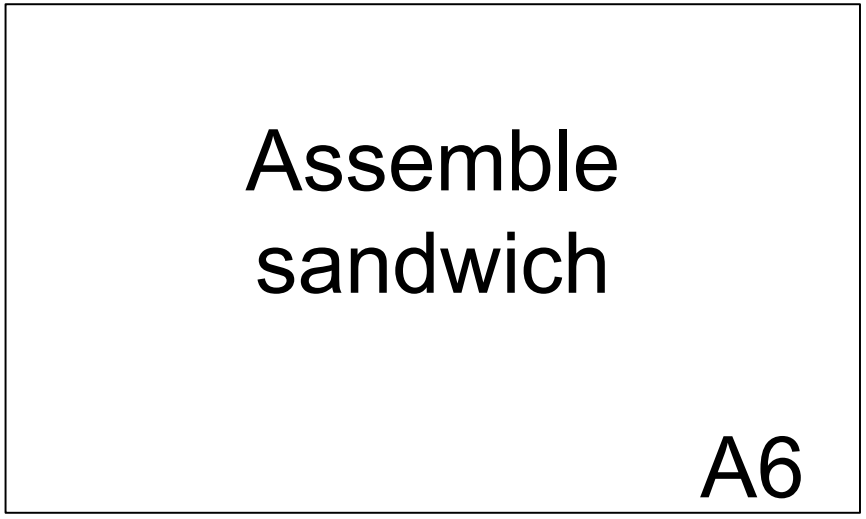
- Solid lines
- Verb or verb phrase
- Box number



# Syntax: Arrows

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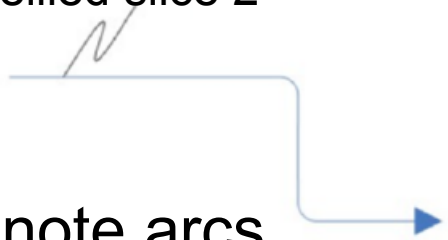
Stored bread

Straight

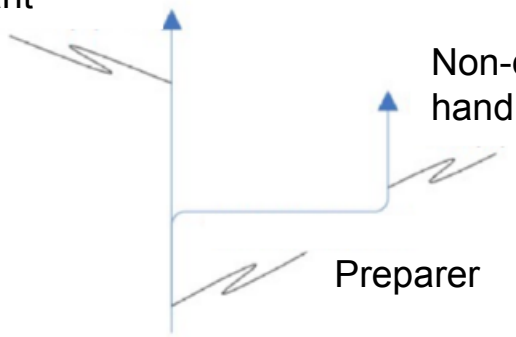
Jellied slice 2



Bent- note arcs

Dominant hand

Non-dominant hand

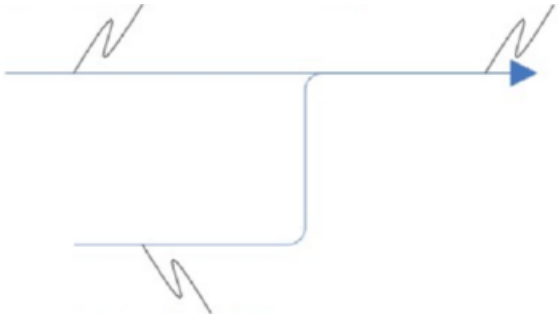


Preparer

Fork

J slice progress

Progress



Assembly progress

Join

# Box and Arrow Syntax Rules

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- Boxes
  - Boxes shall be sufficient in size to insert box name.
  - Boxes shall be rectangular in shape, with square corners.
  - Boxes shall be drawn with solid lines.
- Arrows
  - Arrows that bend shall be curved using only 90 degree arcs.
  - Arrows shall be drawn in solid line segments.
  - Arrows shall be drawn vertically or horizontally, not diagonally.
  - Arrow ends shall touch the outer perimeter of the function box and shall not cross into the box.
  - Arrows shall attach at box sides, not at corners.

# Semantics

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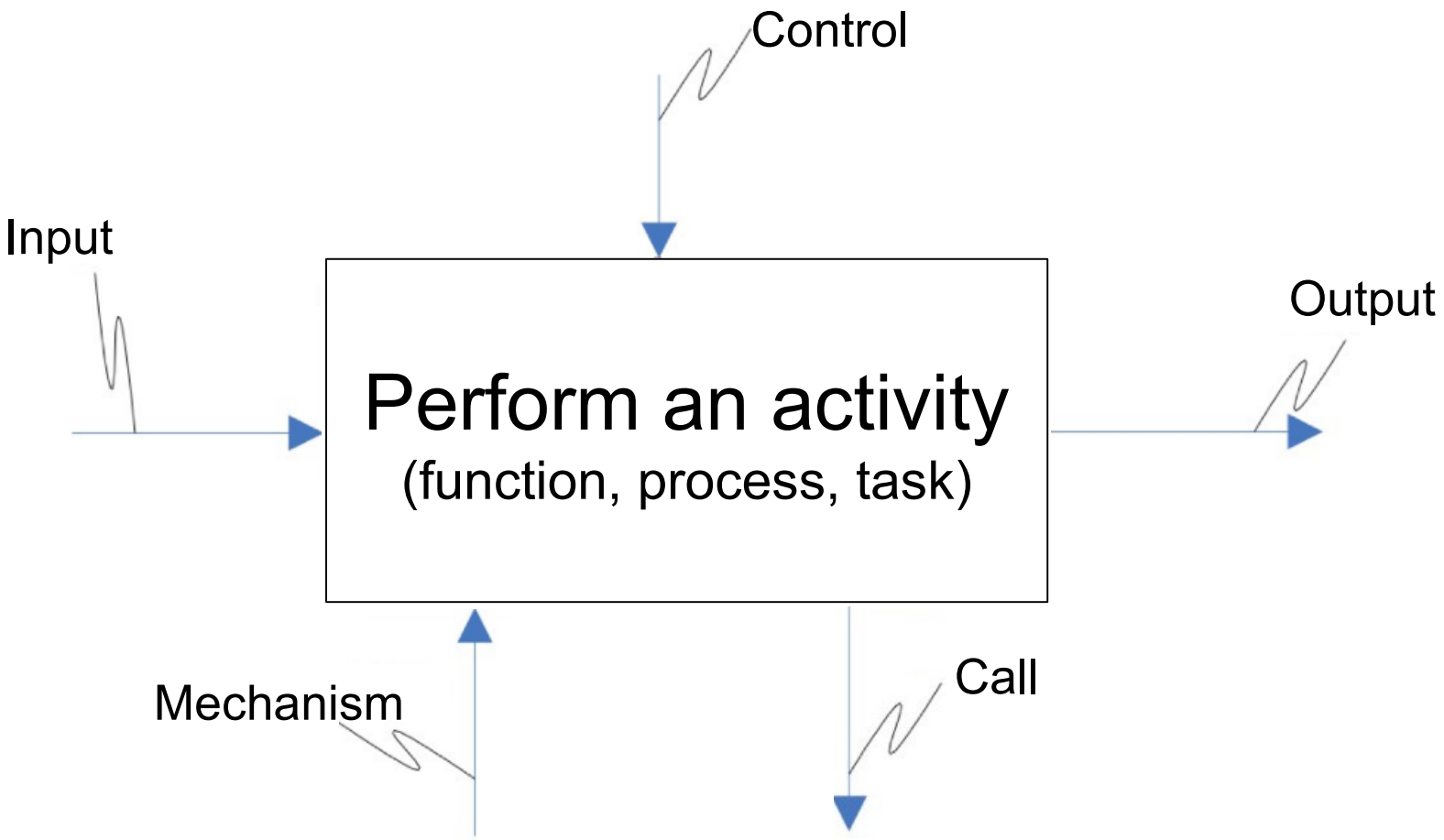

# Semantics

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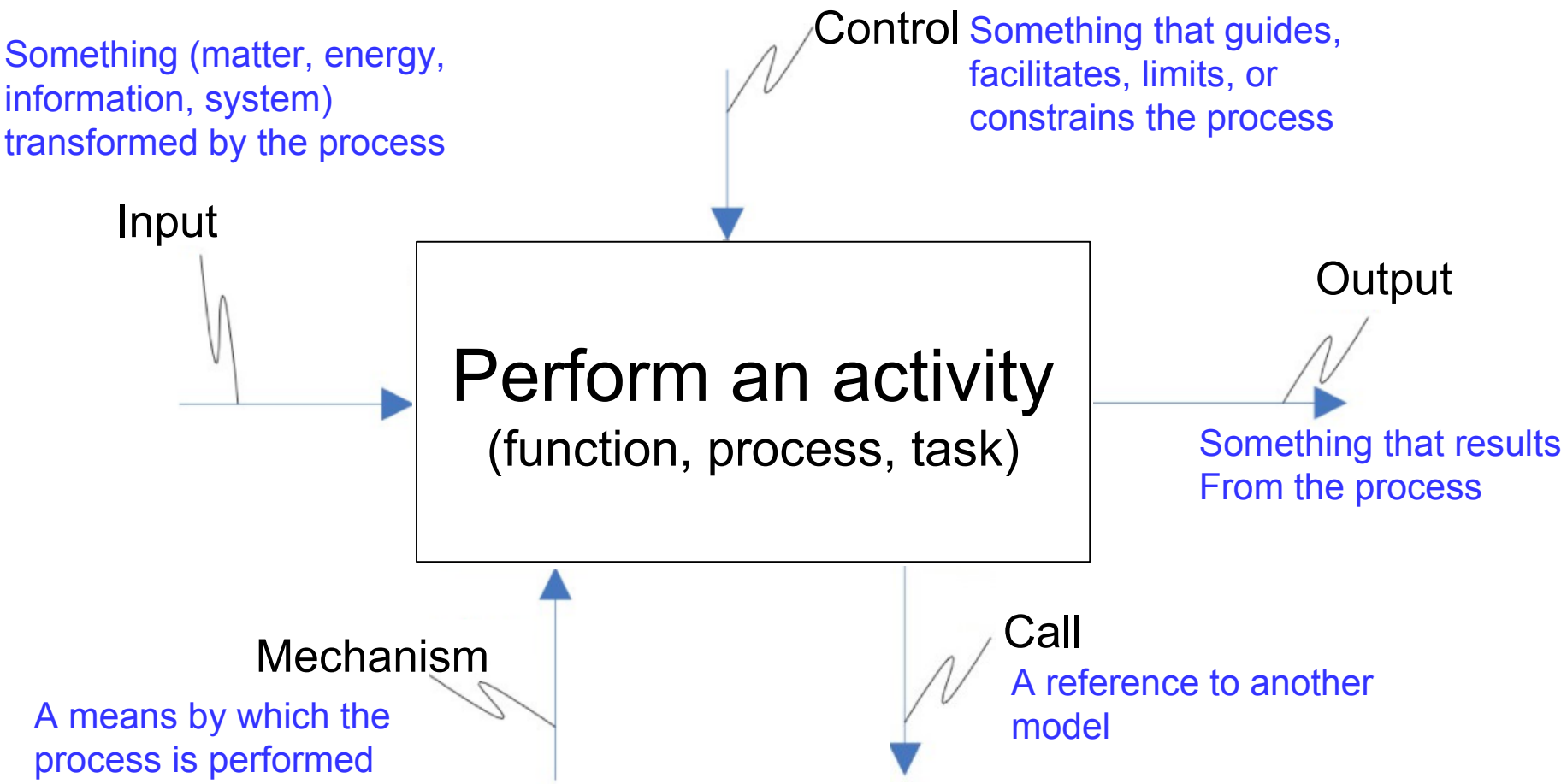

# Example

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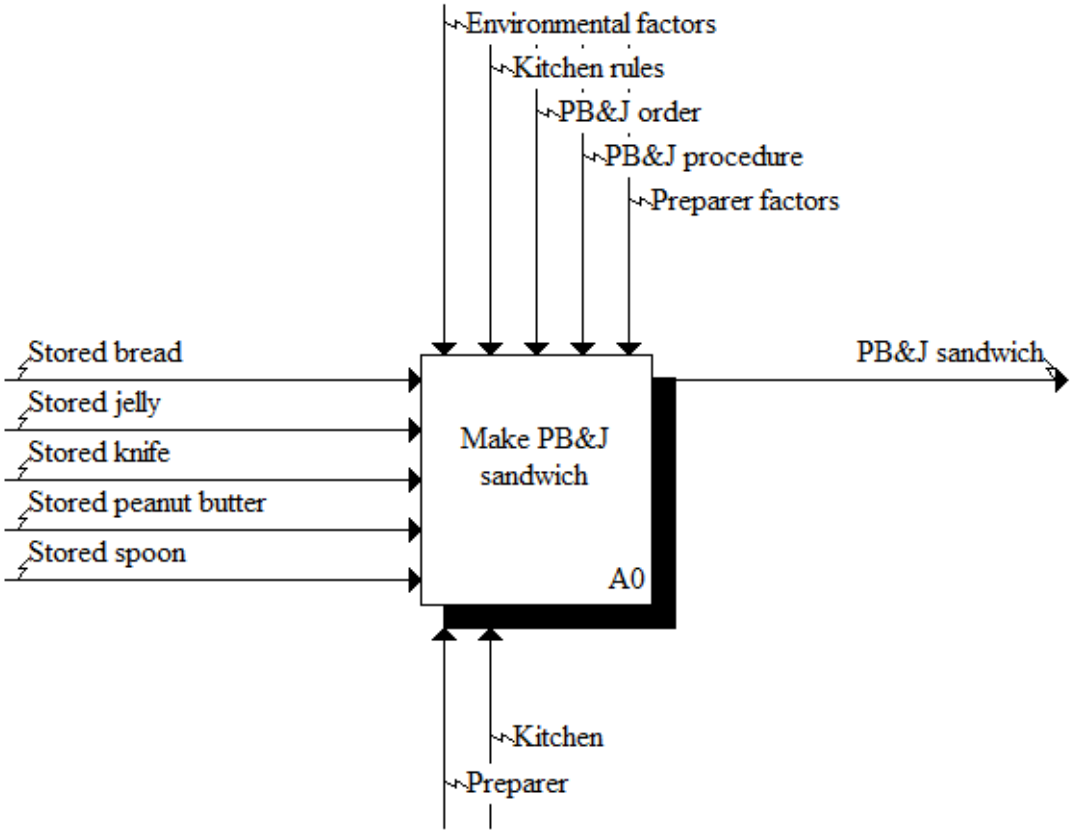

# More Box and Arrow Syntax Rules

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- A box shall be named with an active verb or verb phrase.
- Each side of a function box shall have a standard box/arrow relationship:
  a. Input arrows shall interface with the left side of a box.
  b. Control arrows shall interface with the top side of a box.
  c. Output arrows shall interface with the right side of the box.
  d. Mechanism arrows (except call arrows) shall point upward and shall connect to the bottom side of the box.
  e. Mechanism call arrows shall point downward, shall connect to the bottom side of the box, and shall be labeled with the reference expression for the box which details the subject box.
- Arrow segments, except for call arrows, shall be labeled with a noun or noun phrase unless a single arrow label clearly applies to the arrow as a whole.
- A "squiggle" shall be used to link an arrow with its associated label, unless the arrow/label relationship is obvious.
- Arrow labels shall not consist solely of any of the following terms: function, input, control, output, mechanism, or call.

# IDEF0 Diagrams and Text

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- Top-Level Context Diagram
- Child Diagram
- Parent Diagram
- Text and Glossary
- For Exposition Only Diagrams

# Top-Level Context Diagram

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- 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 Context Diagram: A-0 Make PB&J sandwiches

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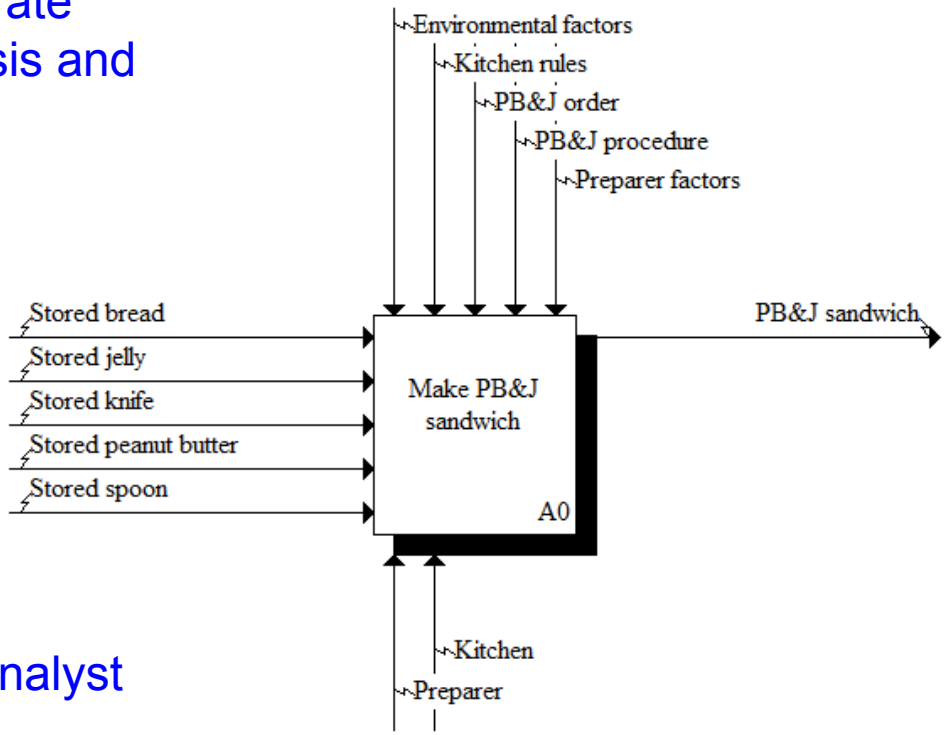
Purpose: To illustrate IDEF0 task analysis and modeling.




Viewpoint: Task analyst

# Child Diagram

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

# Parent Diagram

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- Diagram that contains one or more parent boxes, i.e., boxes detailed on child diagrams.

# Process Decomposition

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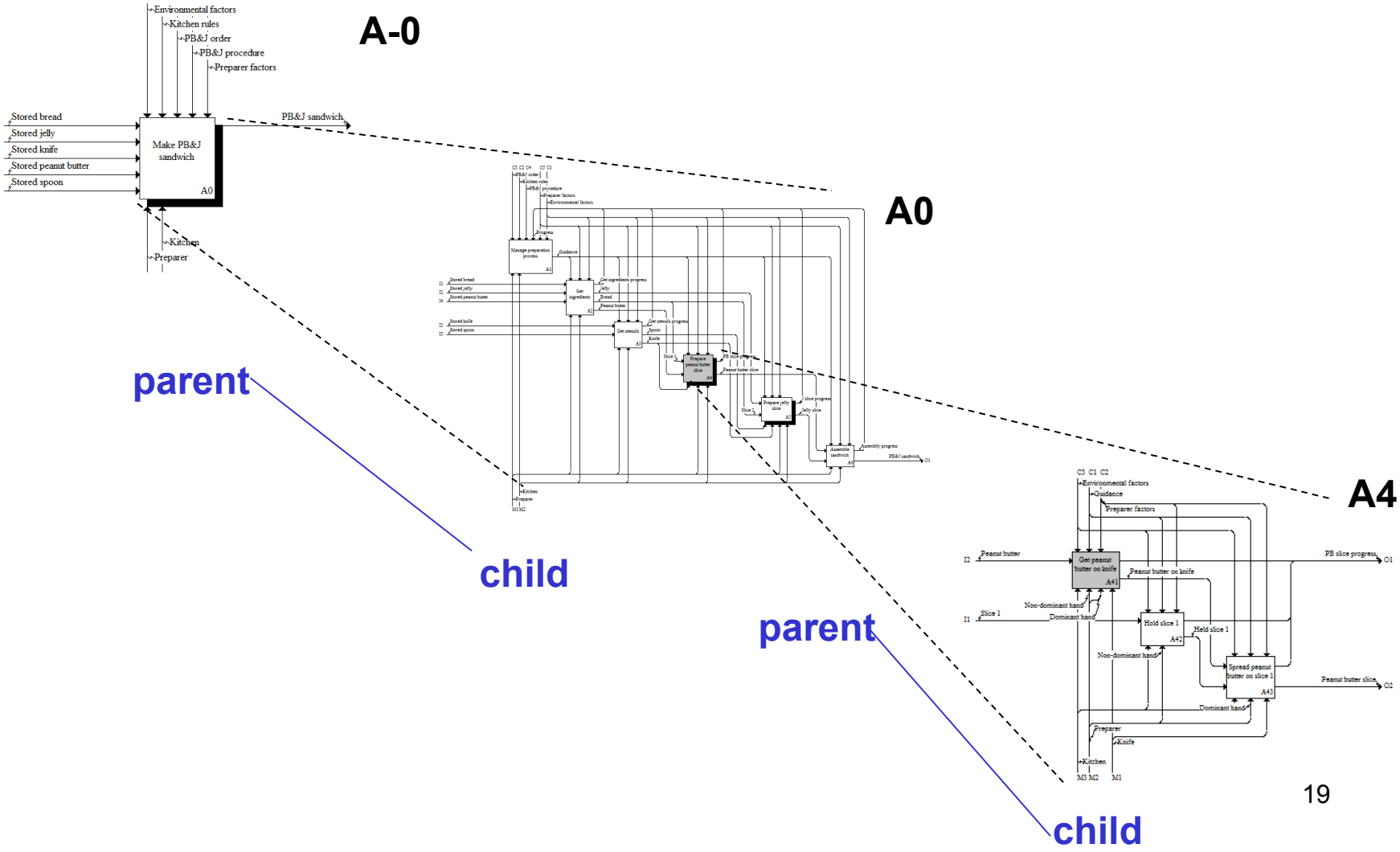

# Text and Glossary

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- Text
  - Associated textual information used to clarify model.
- Glossary
  - Definitions of
    - processes (activities, functions)
    - inputs
    - controls
    - outputs
    - mechanisms
  - Examples
    - Prepare peanut butter slice (task/process)
      - The process of spreading peanut butter on one slice of bread, in preparation for final assembly of the sandwich.
    - Peanut butter slice (output)
      - One slice of bread spread with peanut butter and ready for assembly with the jelly slice into the finished sandwich.

# For Exposition Only Diagram

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- FEO (“fee-oh”)
- Provides supplementary information to help reader understand model.
- Need not comply with IDEF0 rules
- Example: Flowchart to describe a procedure (action/decision sequence) that can be used to perform the process.

# Diagram Features

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- Arrows As Constraints
- Concurrent Operation
- Arrows As Pipelines
- Branching Arrows
- Inter-Box Connections
- Boundary Arrows
- Tunneled Arrows
- Call Arrows

# Arrows As Constraints

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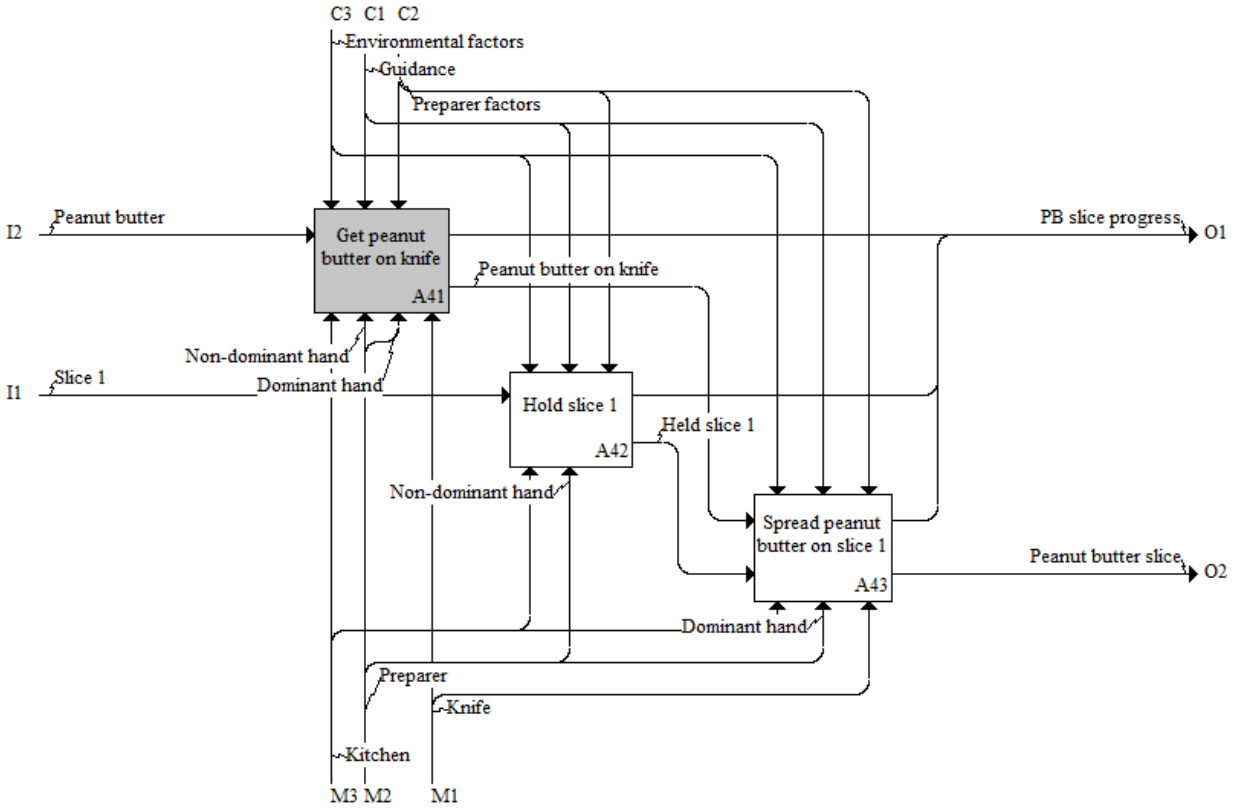
- Connecting output of a box representing a process that is input/control/mechanism to another box means that the second process is constrained by the first.



# Concurrent Operation

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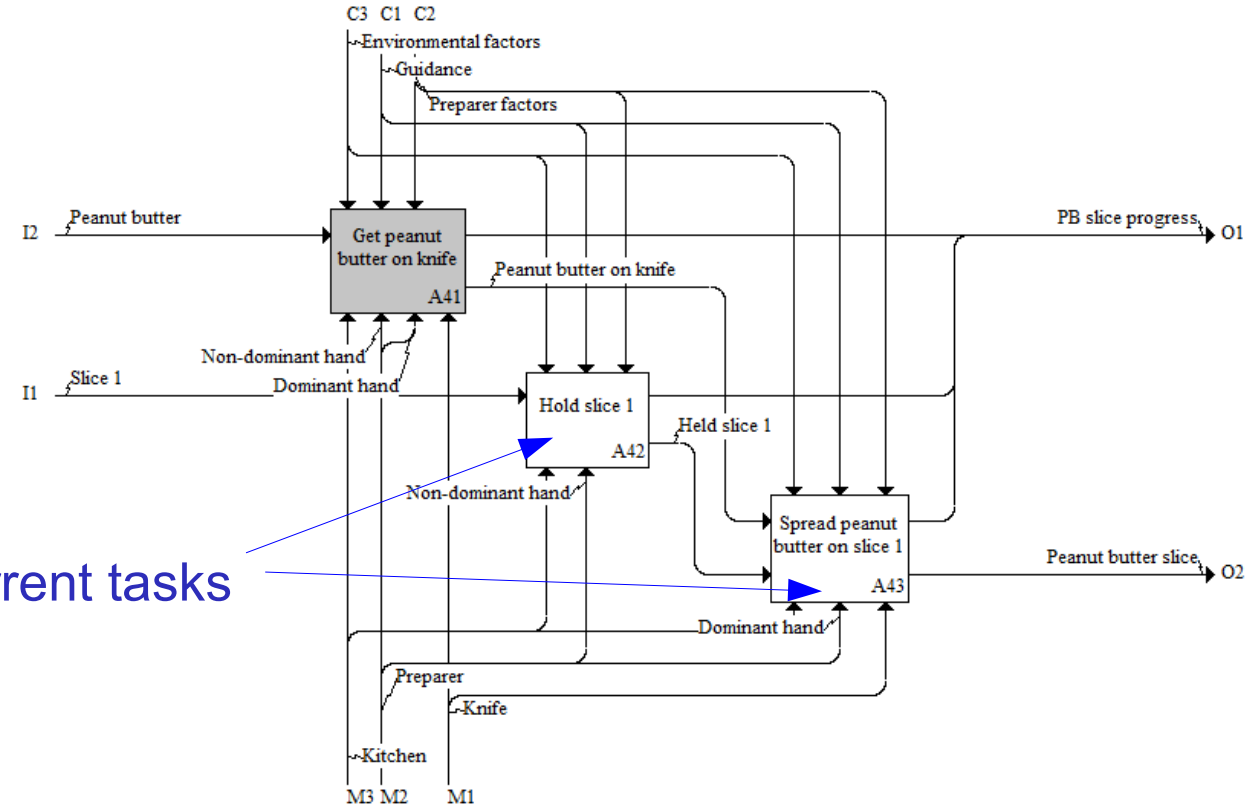
- Box order and connections do not necessarily imply sequence!
- Processes may proceed concurrently.




Concurrent tasks

# Arrows As Pipelines

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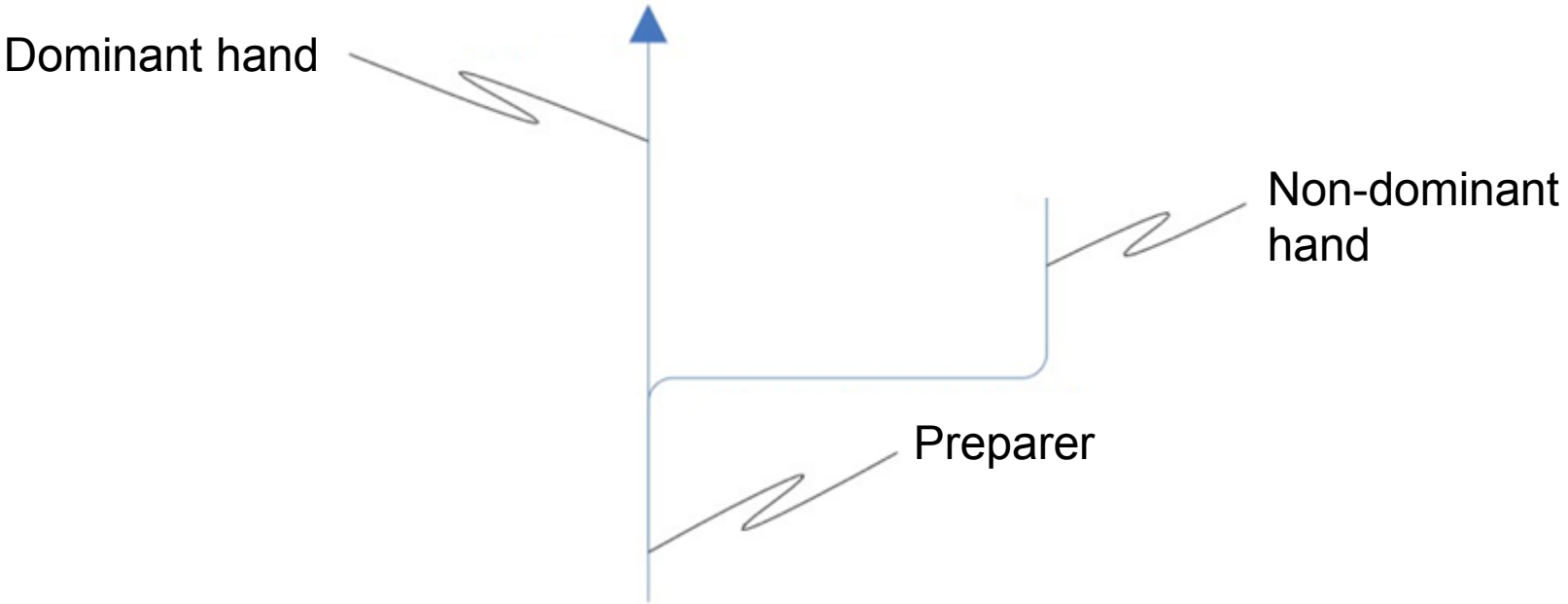
- Think of arrows as pipelines or conduits.
- High-level arrows have general labels.
- Low-level arrows have specific labels.
- If an arrow forks, the branches may have more specific labels.



# Branching Arrows

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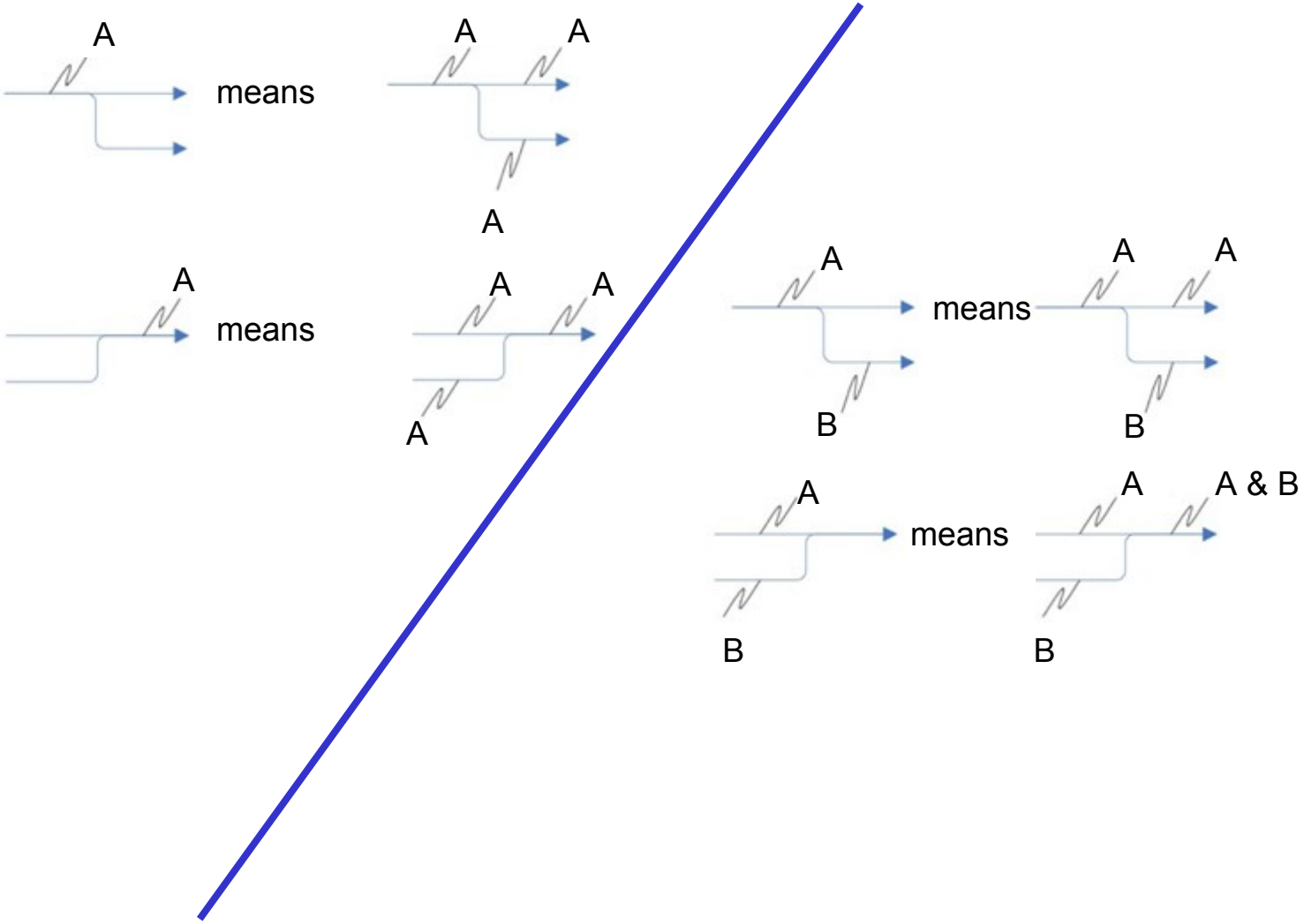

# Inter-Box Connections

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- Except for A-0, diagrams contain 3 – 6 boxes.
- Normally organized on diagonal (“staircase”).
- Any output of one box may be input, control, or mechanism of another box.
- If box is detailed on child diagram, every arrow connected to the box appears on the child diagram (unless it is tunneled).

# Inter-Box Connections

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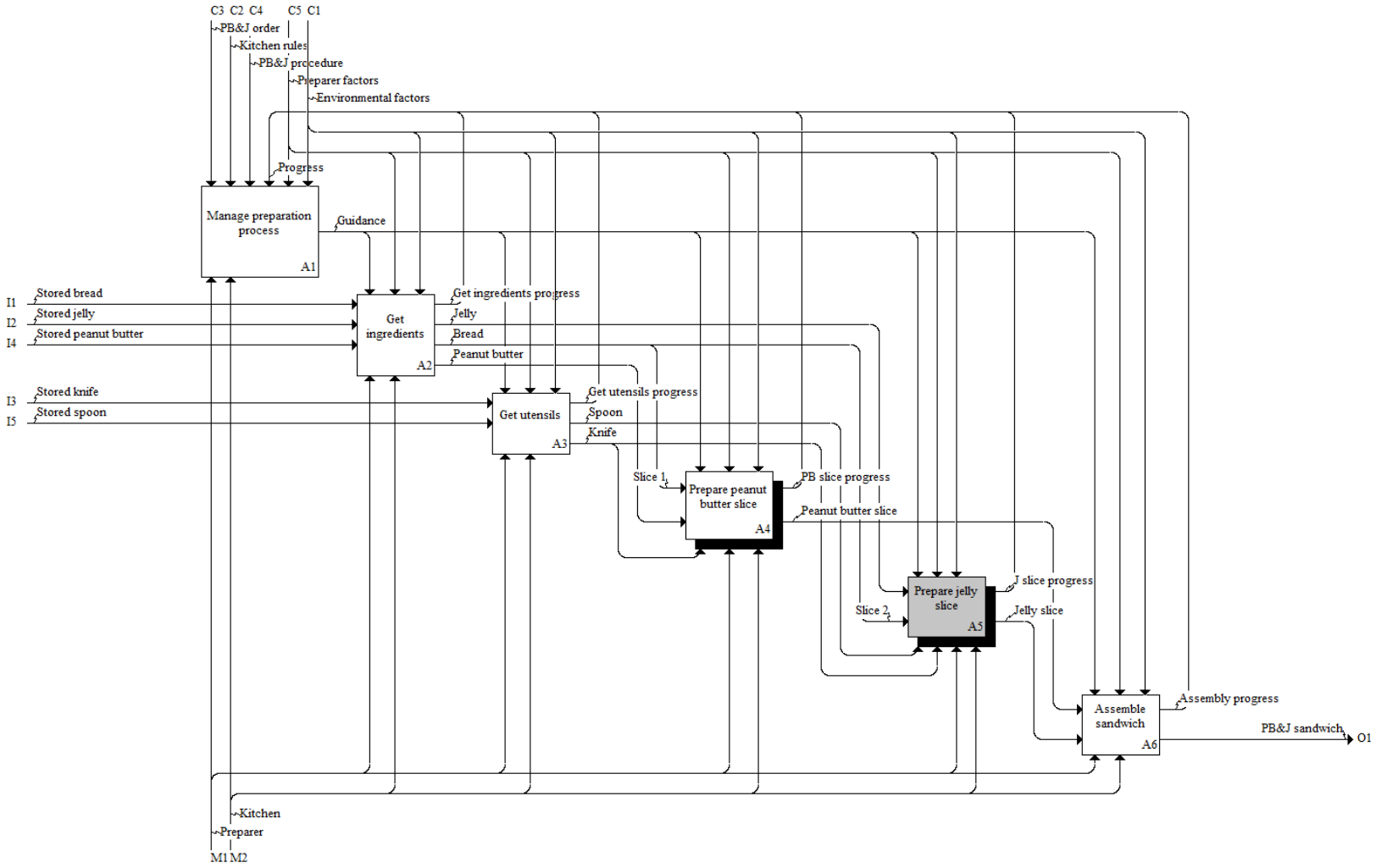

# Inter-Box Connections (arrows for child diagram)

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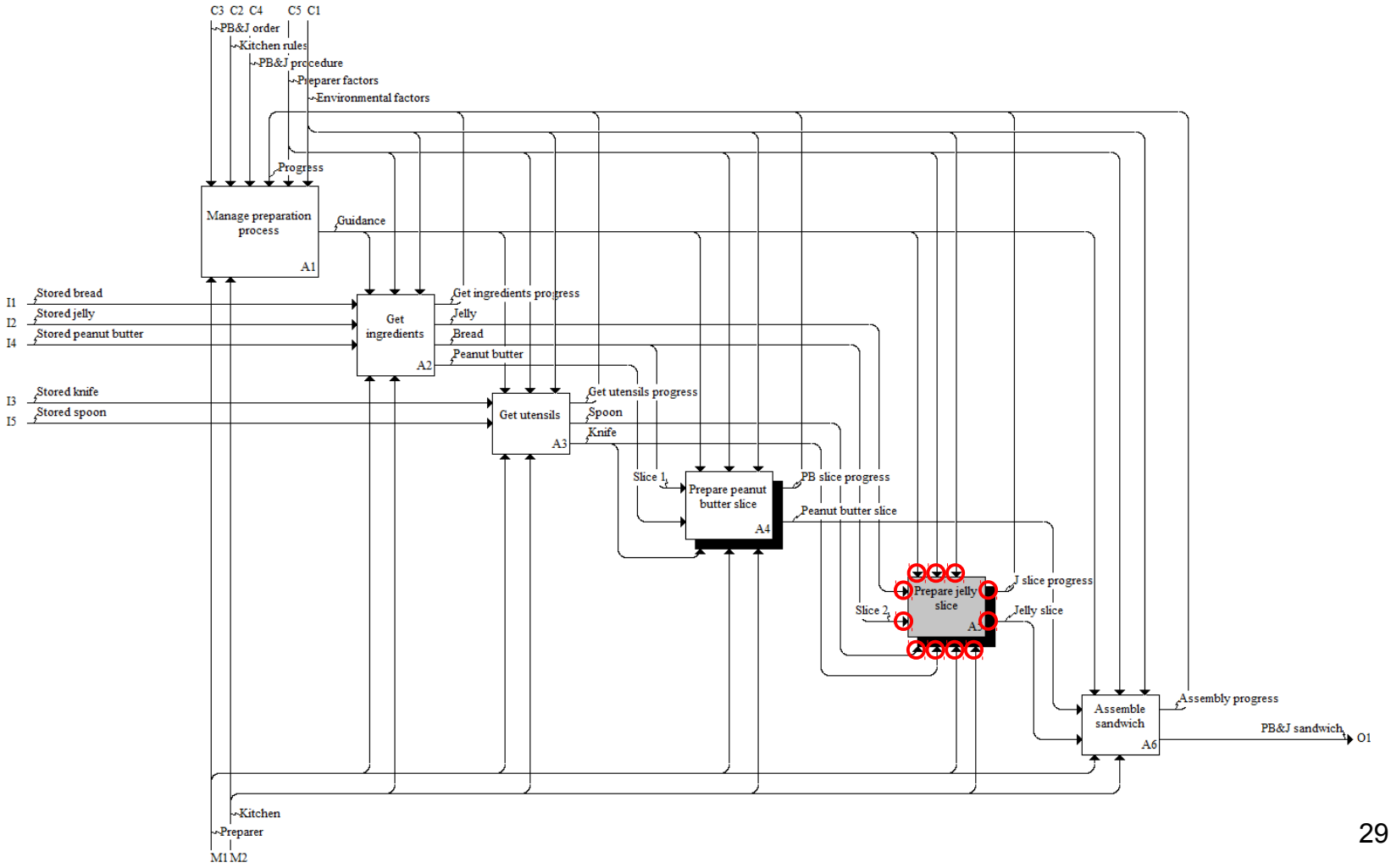

# Boundary Arrows:
## Arrows from parent box on parent diagram

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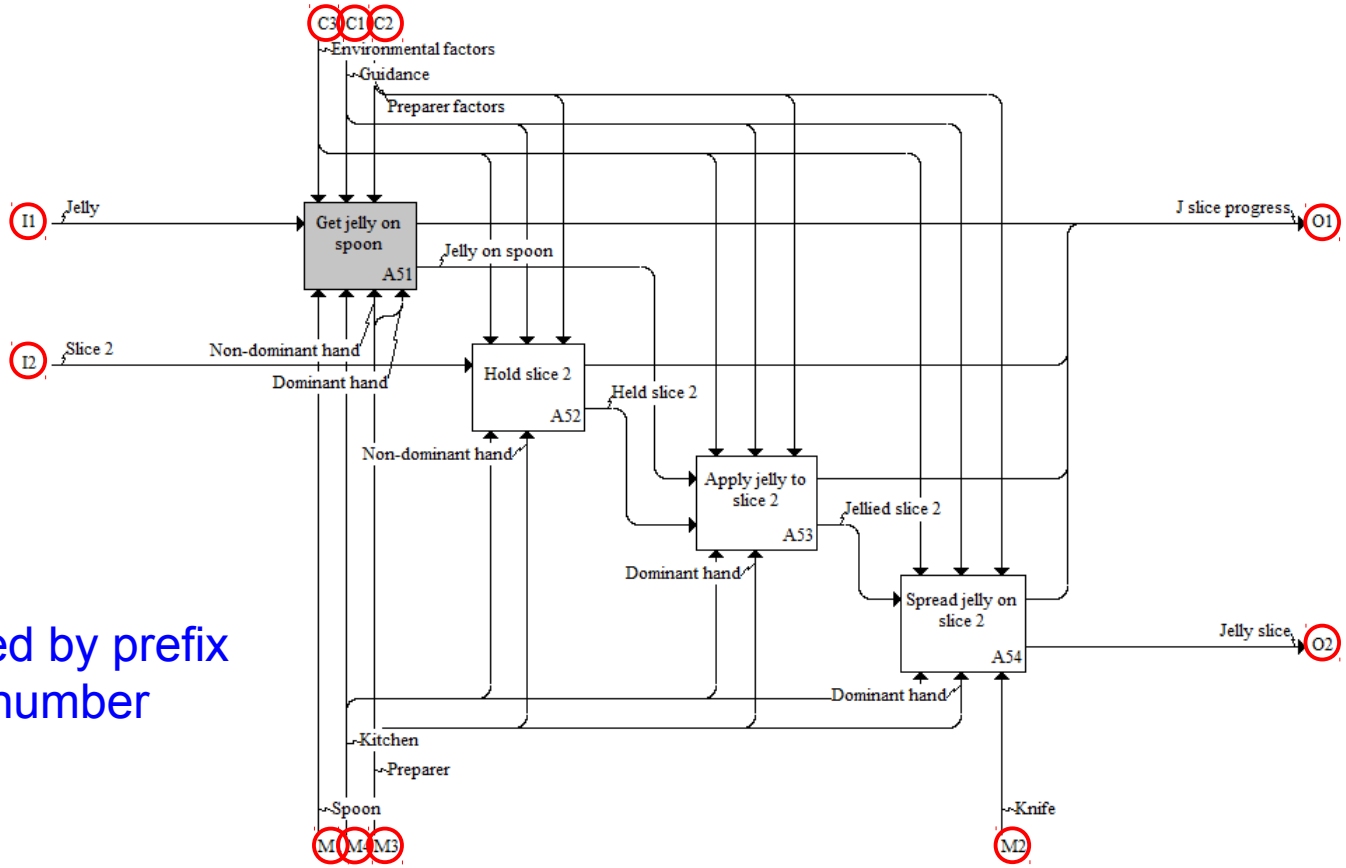


Coded by prefix and number

# Tunneled Arrows

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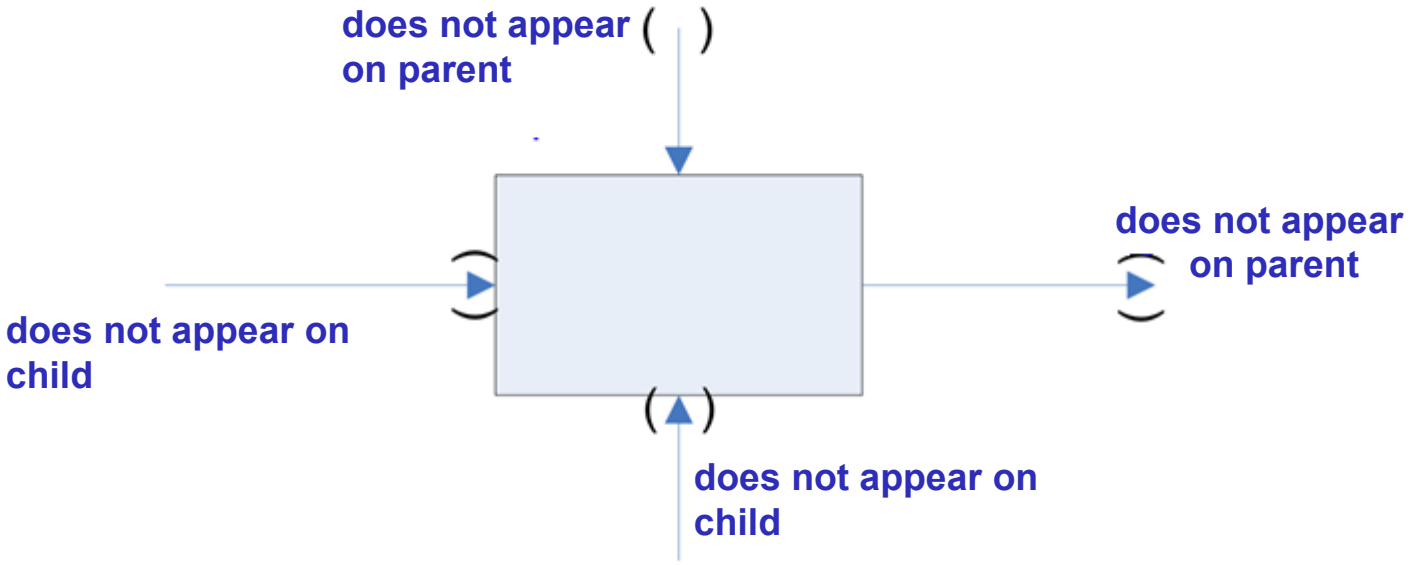
- Arrows that provide information at one level of decomposition but are not needed at another (parent, child) level.



# Call Arrows

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Special case of mechanism arrow.

Caller box does not have its own child diagram.

Detailed by another box in same or other model.

Example: same “Fly aircraft” model called by

- “Fly aircraft in climb”
- “Fly aircraft in cruise”
- “Fly aircraft in descent”

# Box Numbers and Node Numbers

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Box numbers

- Single box in context (A-0) diagram numbered A0 (“Activity” 0).
- Boxes in context diagram’s child numbered A1, A2, A3, … [A6].
- Boxes in A1’s child diagram numbered A11, A12, …
- Boxes in A2’s child diagram numbered A21, A22, …
- Boxes in A21’s child diagram numbered A211, A212, …
- and so on …

Node – Activity/task box and its diagram (if one exists).

Node numbers

- Context node is node A-0
- A-0’s child node is node A0
- A0’s children are nodes A1, A2, …
- In general, a node bears the same number as the box in the parent node it details.

# Node A-0 (Context)

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PB&J.pdf (1 page)

| Used At: | Author: | Date: 9/26/2014 | x | Working | READER | DATE | Context: |
|---|---|---|---|---|---|---|---|
| | Repository: | Rev: | | Draft | | | NONE |
| | Notes: 1 2 3 4 5 6 7 8 9 10 | Time: 08:59:30 | | Recommended | | | |
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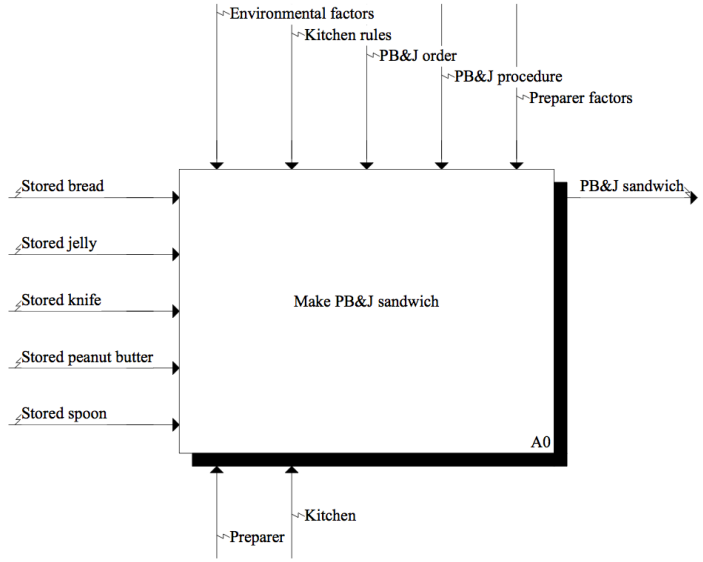


| Node: A-0 C1 | Title: PB&J | Number: Pg 1 |
|---|---|---|

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# Node A0

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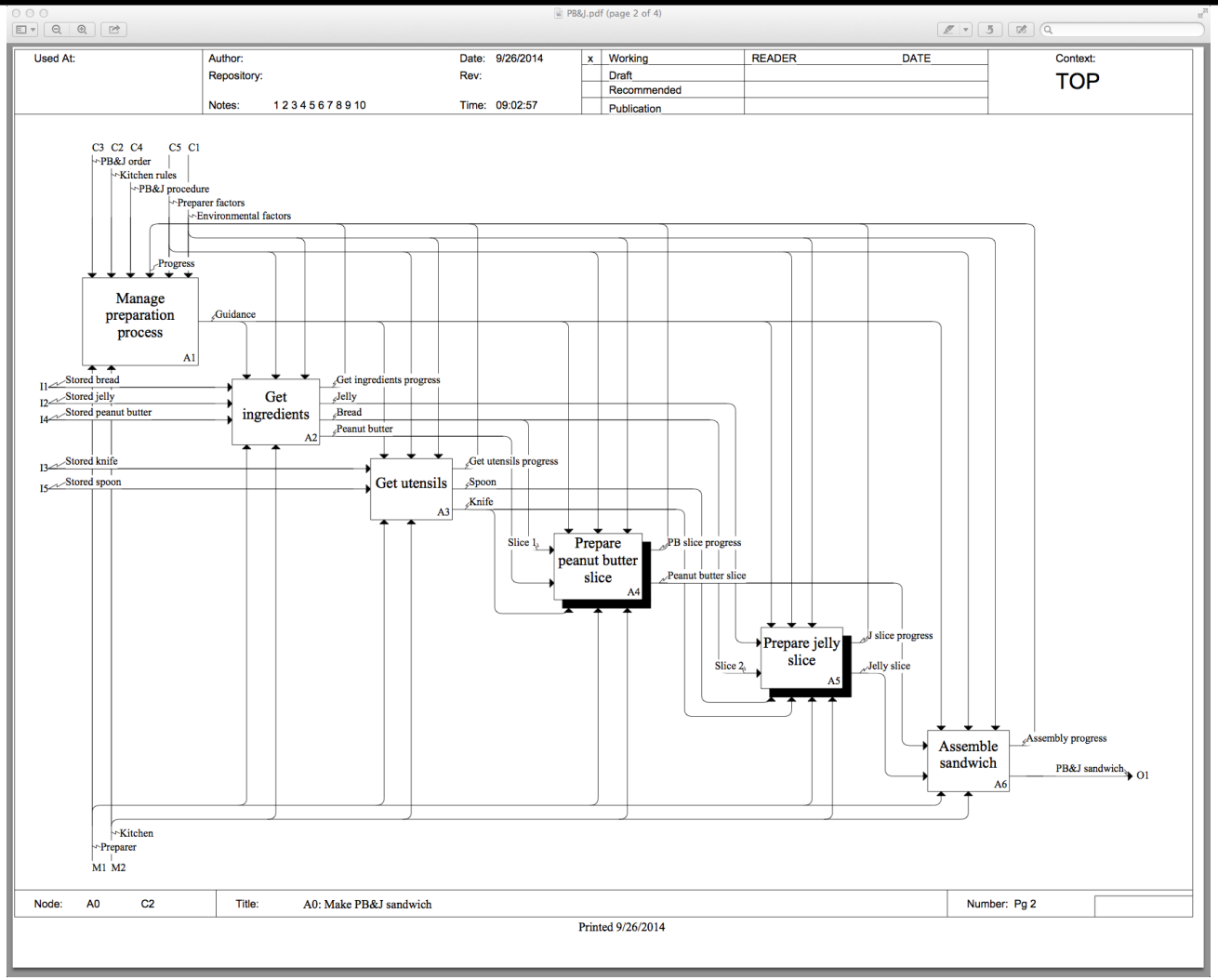

# Node A4

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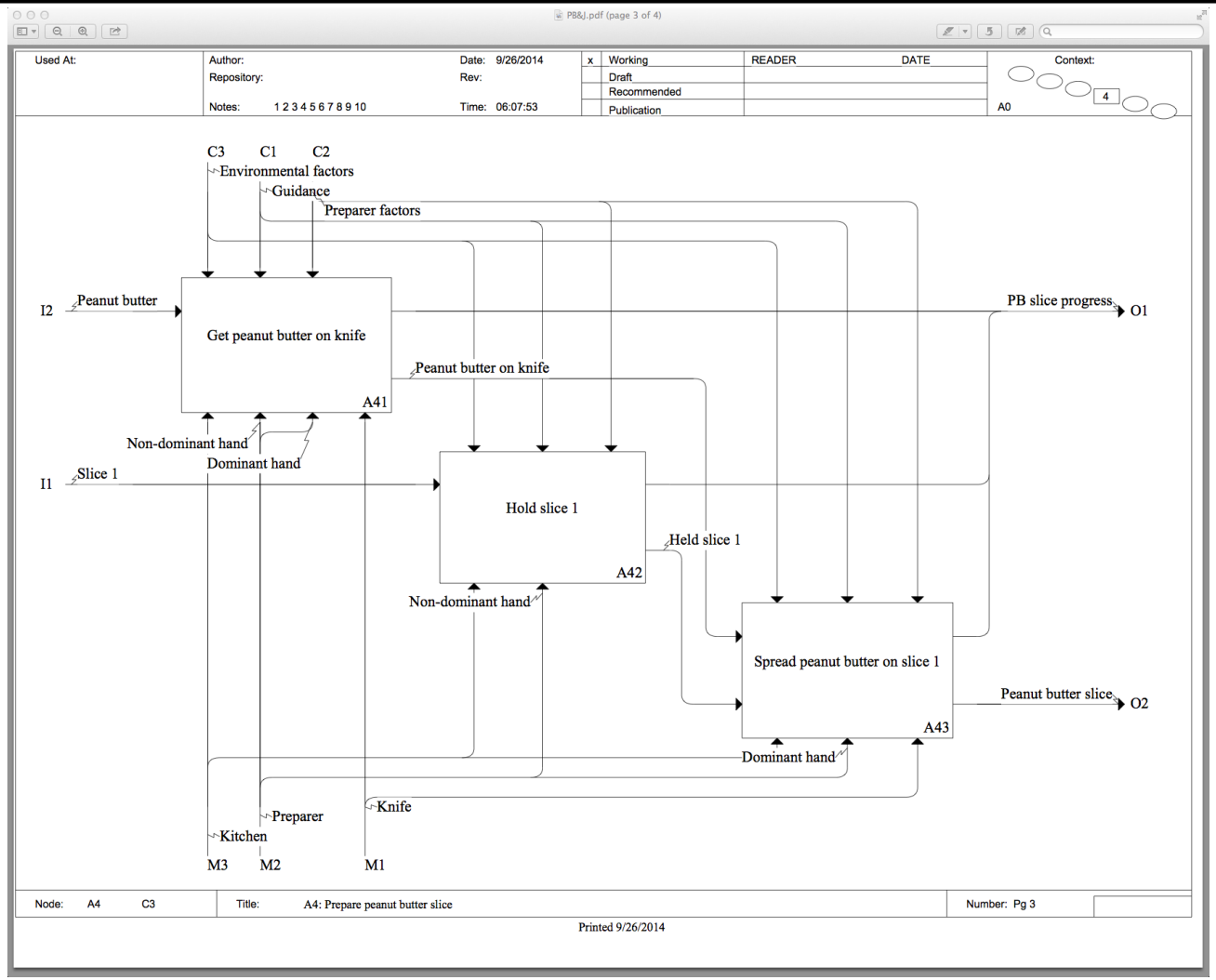

# Node A43

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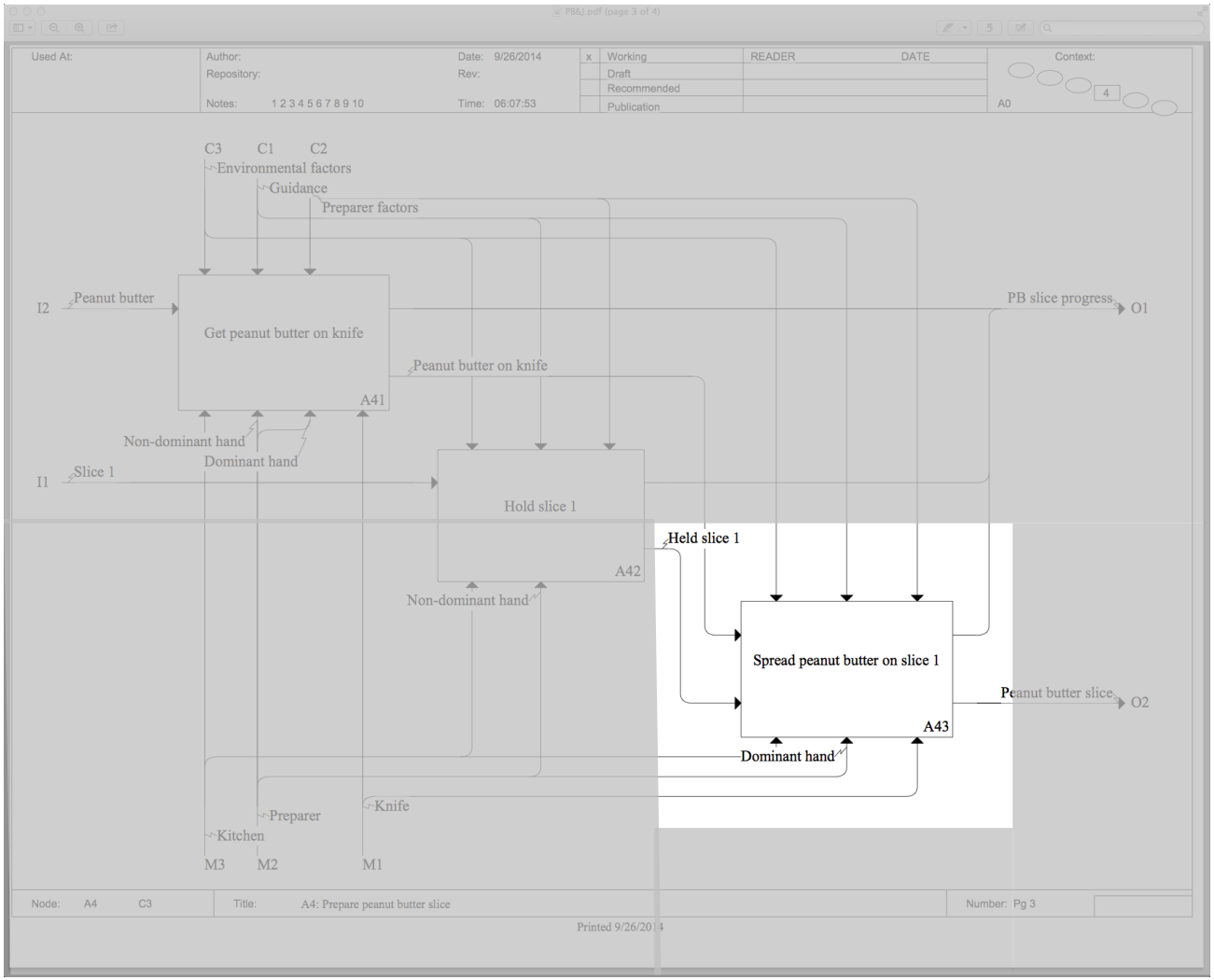

# Node List

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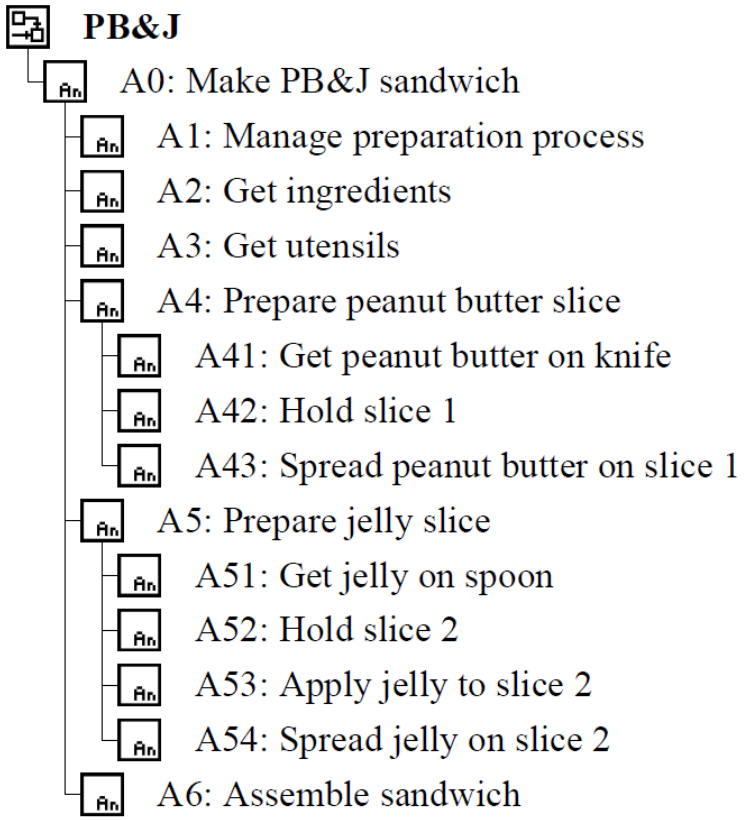

# Node Tree

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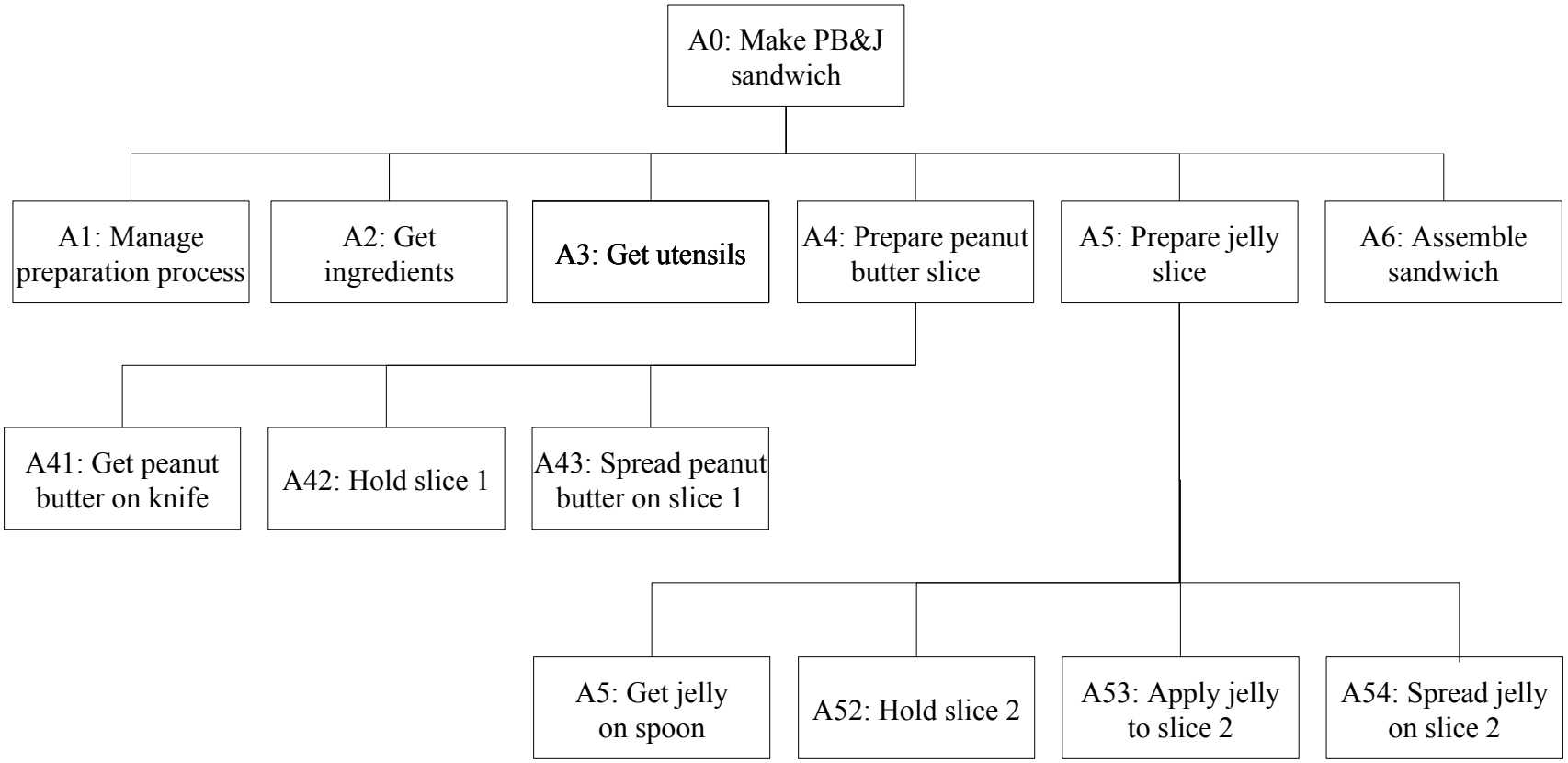

# Reading IDEF0 Diagrams

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1. Scan boxes of diagram to gain impression of what is being described.
2. Refer to parent diagram.
   - Note arrow connections to parent box.
   - Try to identify “most important” input, control, output.
3. Consider arrows of current diagram.
   - Try to determine if there is a main path linking “most important” input or control and "most important" output.
4. Mentally walk through the diagram, from upper left to lower right.
   - Note how arrows interact with each box.
   - Determine if there are secondary paths.
   - Check story being told by diagram by considering how familiar situations are handled.
5. Check to see if a related FEO diagram exists.
6. Read text and glossary, if provided.

# Creating IDEF0 Diagrams

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Select Context, Viewpoint, Purpose.

Create Context (A-0) Diagram.

Create topmost (A0) diagram.

- 3-6 subprocess boxes.
- May be necessary to switch back and forth between A0 and A-0 several times to get a good start.

Create child diagrams

- Detail each A0 process box into 3-6 subprocess boxes.
- May be necessary to redraw several times.
- Split and cluster boxes until satisfied.

Create supporting materials: text, glossary, FEOs.

# Detailing Boxes

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Select a box:

- Select the hardest part.
- Select the box whose detail will give the most information.

Gather data.

Structure: draw and re-draw.

Write text carefully.

Draw boxes.

- Make process box names verbs or verb phrases.
- Lay out diagonally, upper left to lower right.
- Place boxes that “dominate” in the upper left.
- All boxes should have a consistent “flavor”.

# Drawing interface arrows.

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Think control and constraint, not flow.

- Don’t worry about sequence.
- All boxes may be active simultaneously.

Bundle groups of arrows, when possible.

Don’t clutter with arrows.

All boxes must have control arrows, but they don’t require input arrows.

Give arrows noun or noun phrase names.

# Developing IDEF0 Models With AlWin0

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