Systems of Systems Case study

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Abstract

System of Systems case study: a warehouse in a logistics chain.

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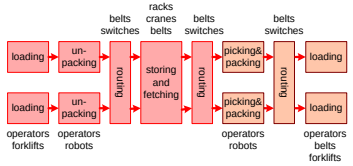
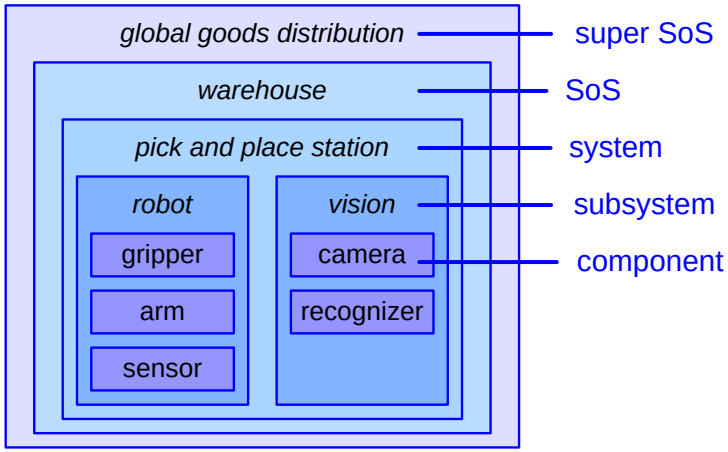
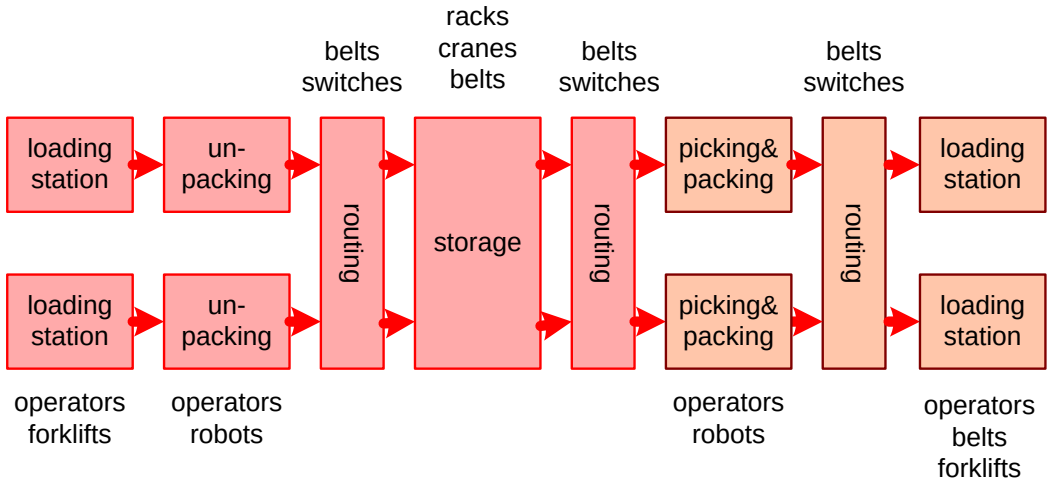


Method

physical partitioning



functional model

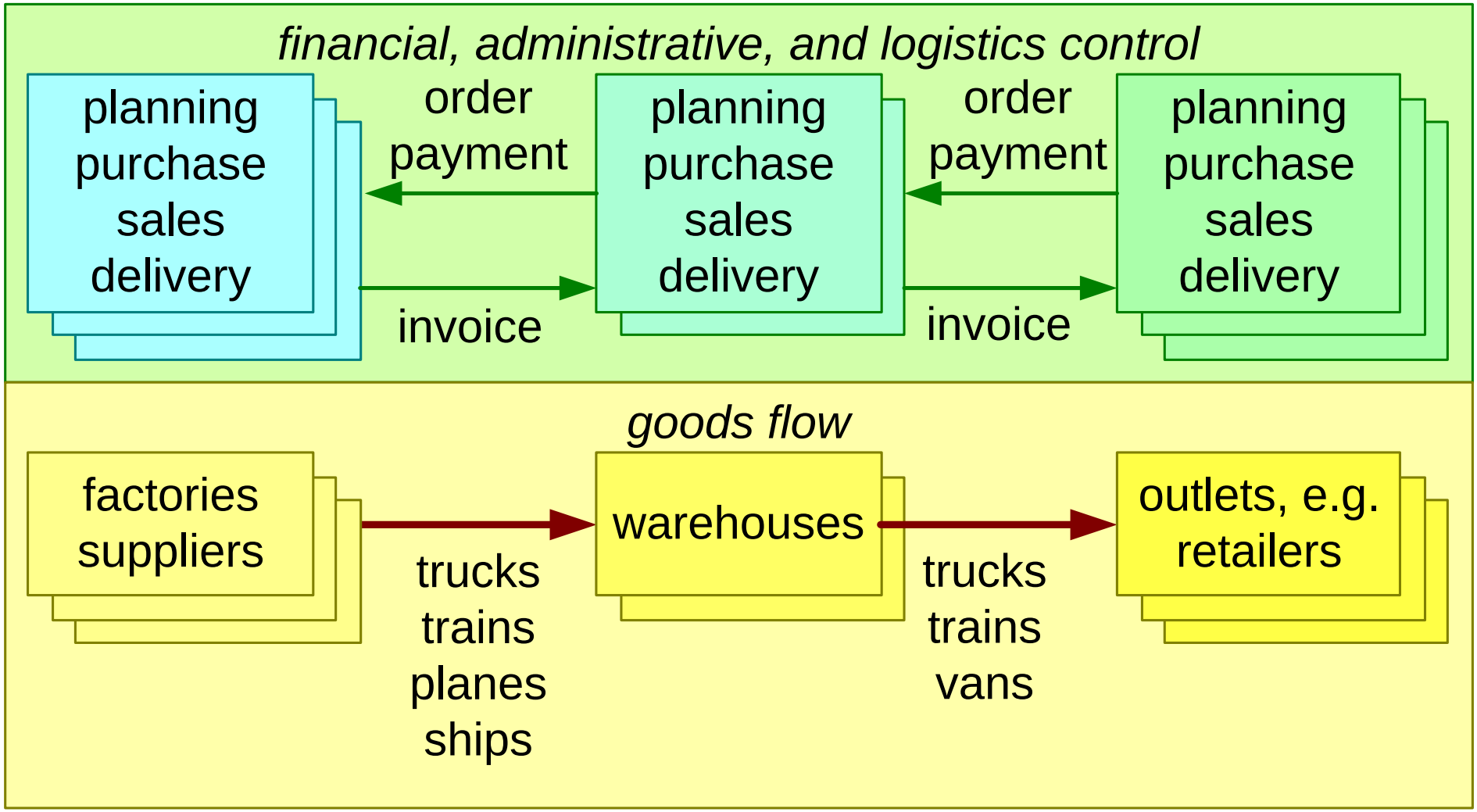


quantification

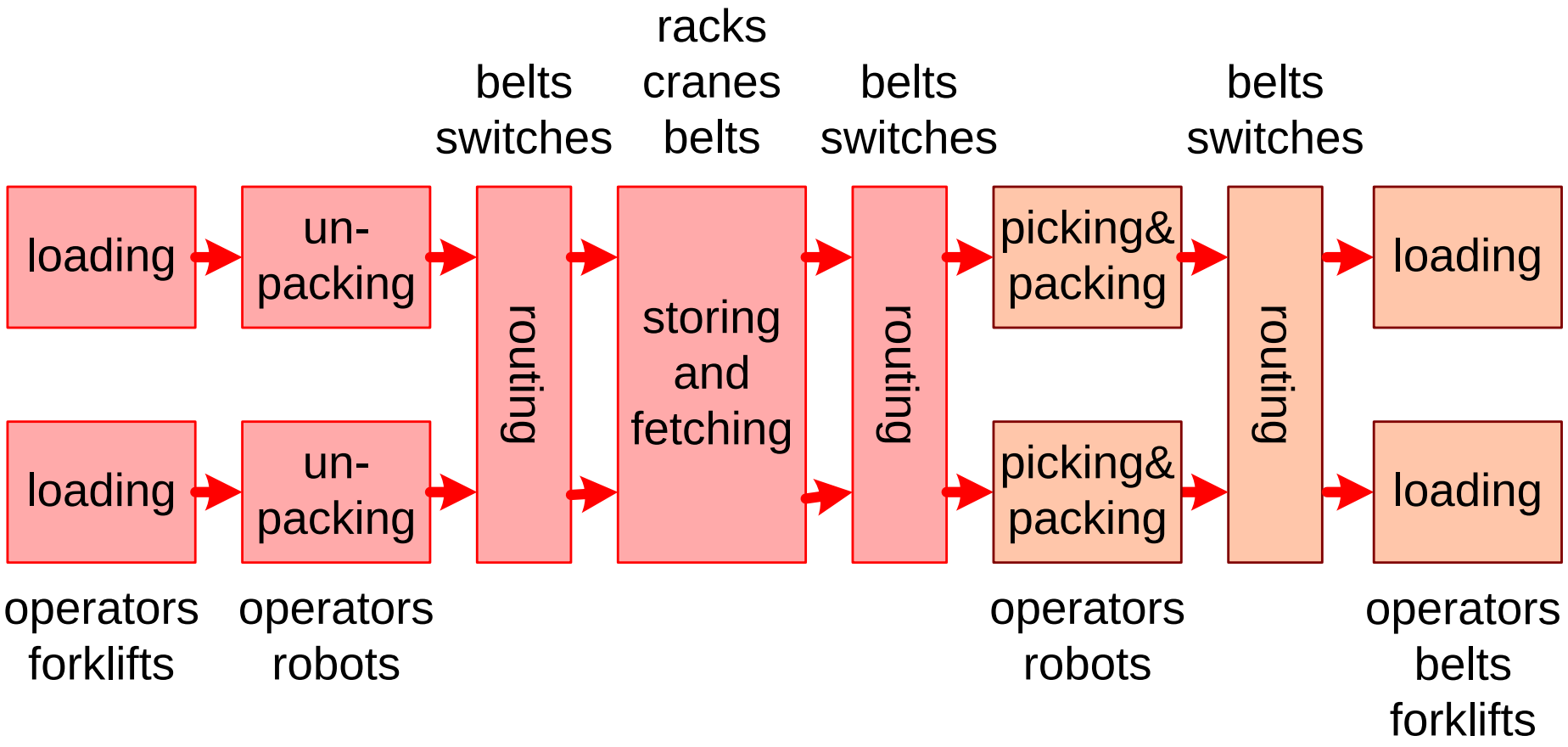
#items/hour, order size, order variation, delivery time, storage capacity, etc.

on many levels

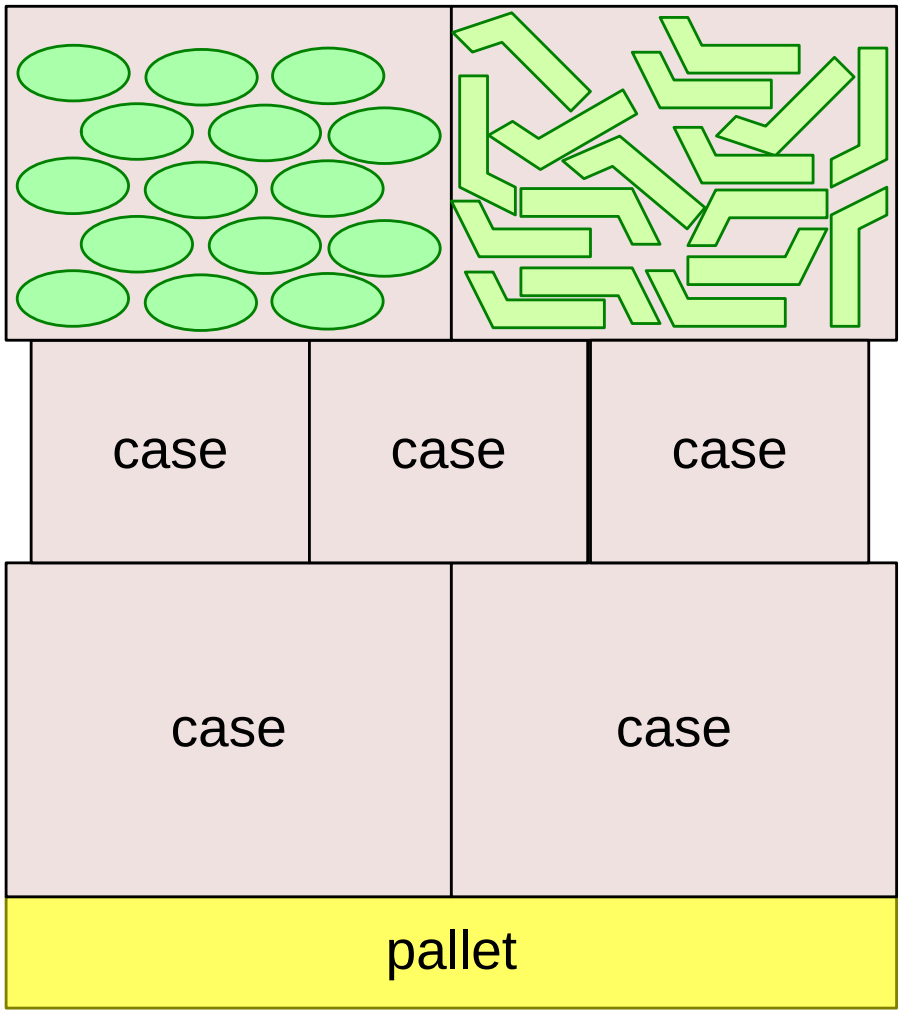
Goods and Information Flow

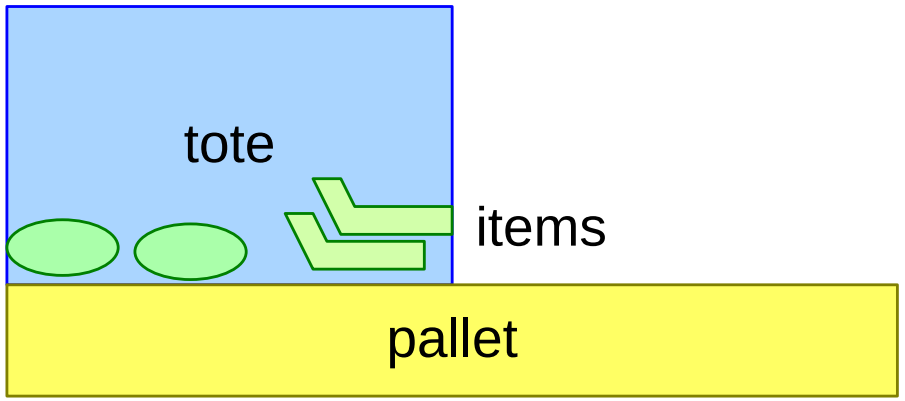


Functional Model Warehouse

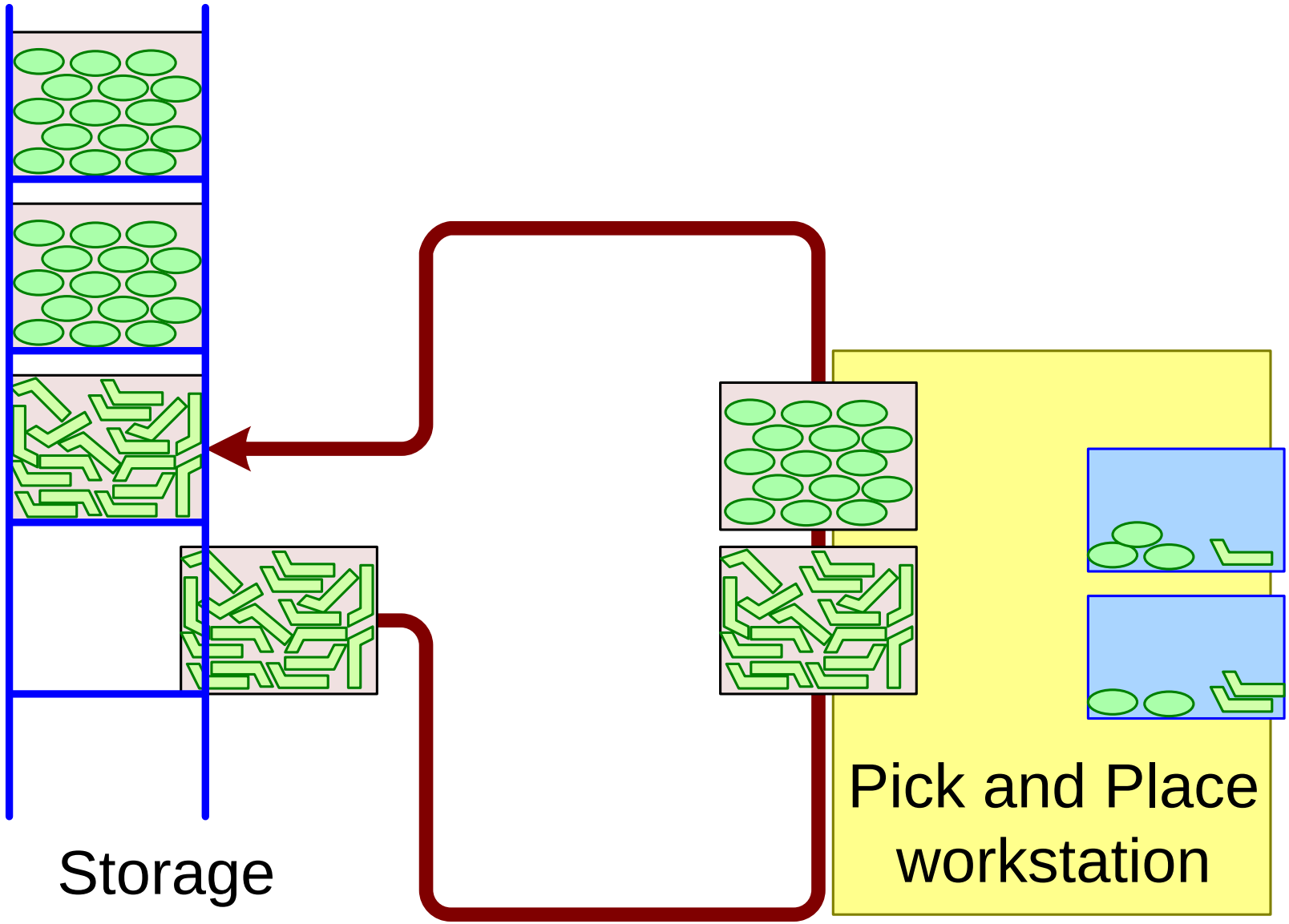


Some Warehouse Jargon





Pick and Place



Pick and Place Design Questions

One order at a time?

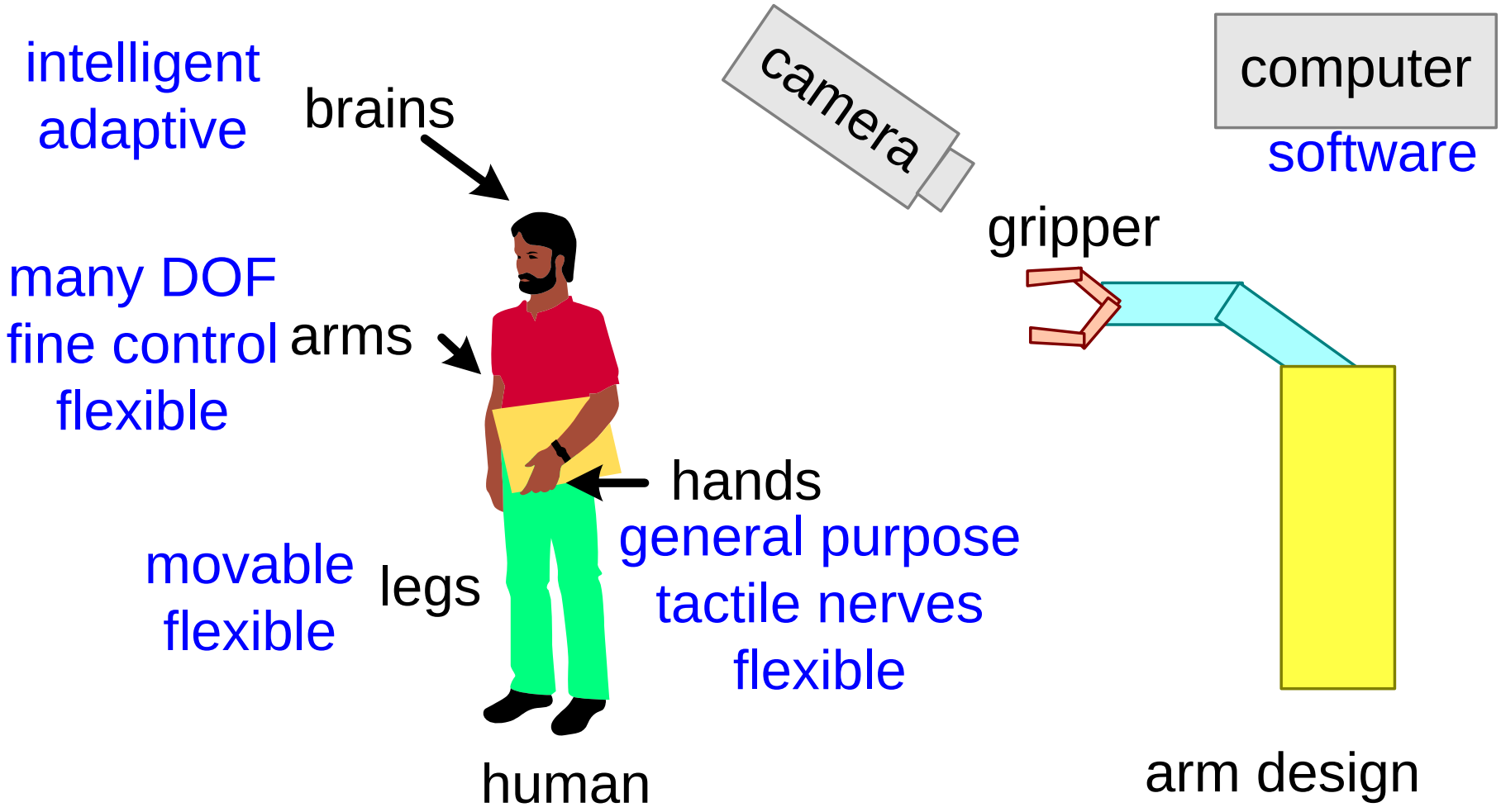
One item at a time?

Stock travels along many workstations?

What are the critical design choices?

What concepts are available?

From Human to Robot



Robot Design Questions

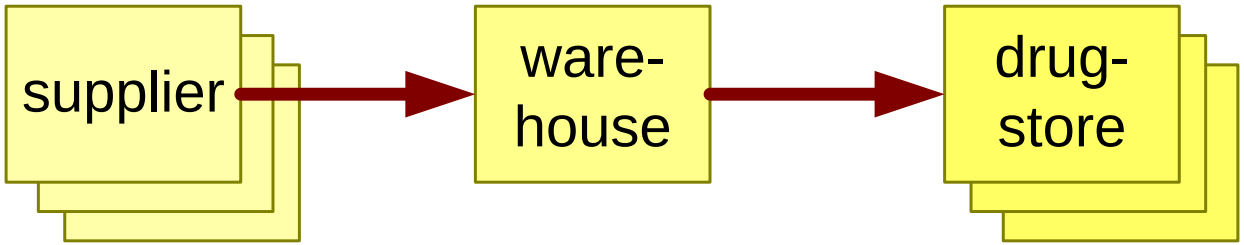
What Gripper and Robot Concepts are appropriate?

What are the desired properties?

What kind of items must be handled, and how?

→ Use examples to explore

Example 1: Large Volume Drugstore

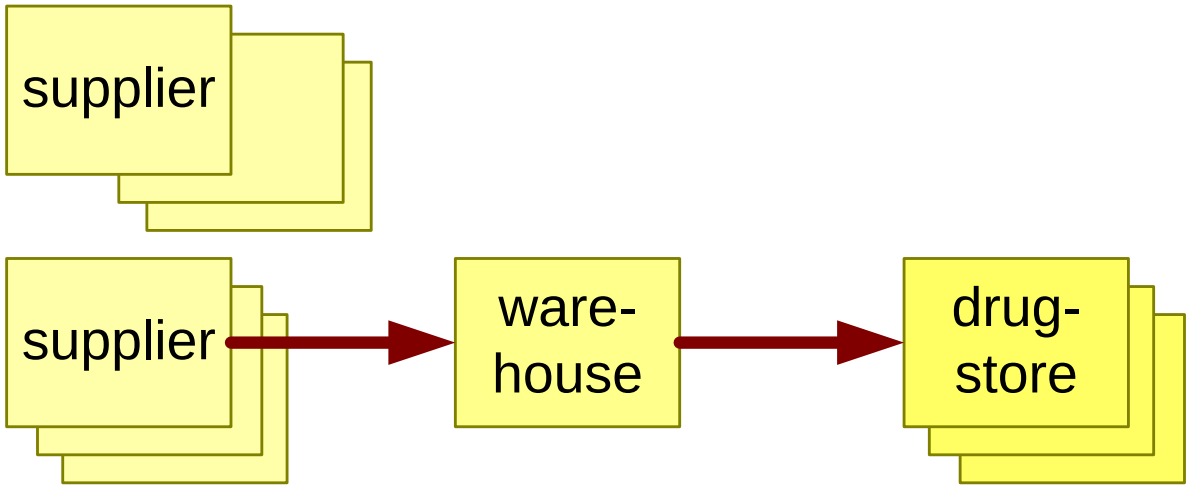


Large quantities
box-like packages
w, l, h: 0.1..0.5m
weight: 1..40 Kg

simple gripper
1 DOF

simple robot
"H" for X, Y, and Z
movements

Example 2: High Dynamics



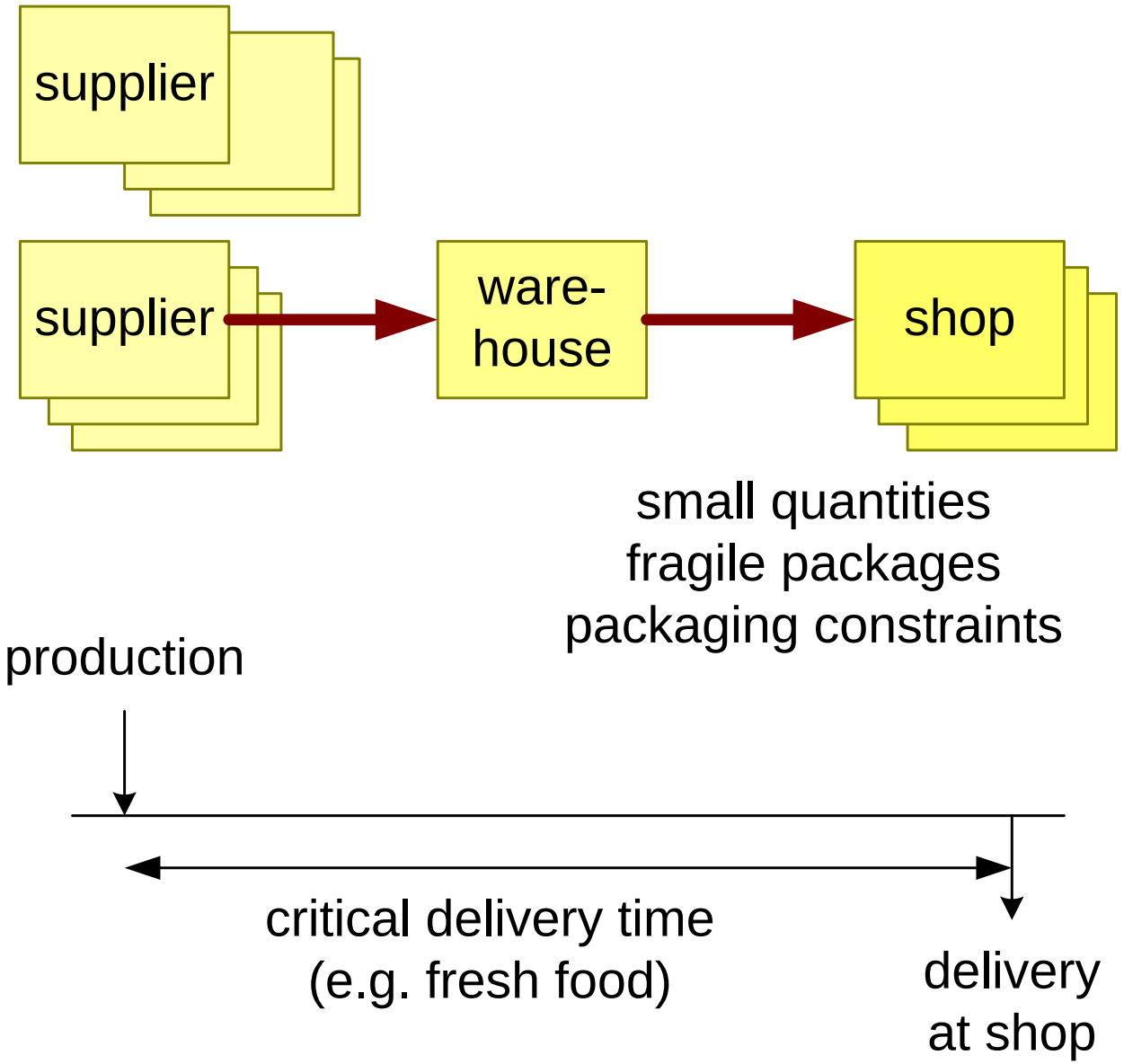
highly dynamic
product mix
and suppliers

large quantities
various packages
w, l, h: 0.1 .. 2.0m
weight: 0.1 .. 50 Kg

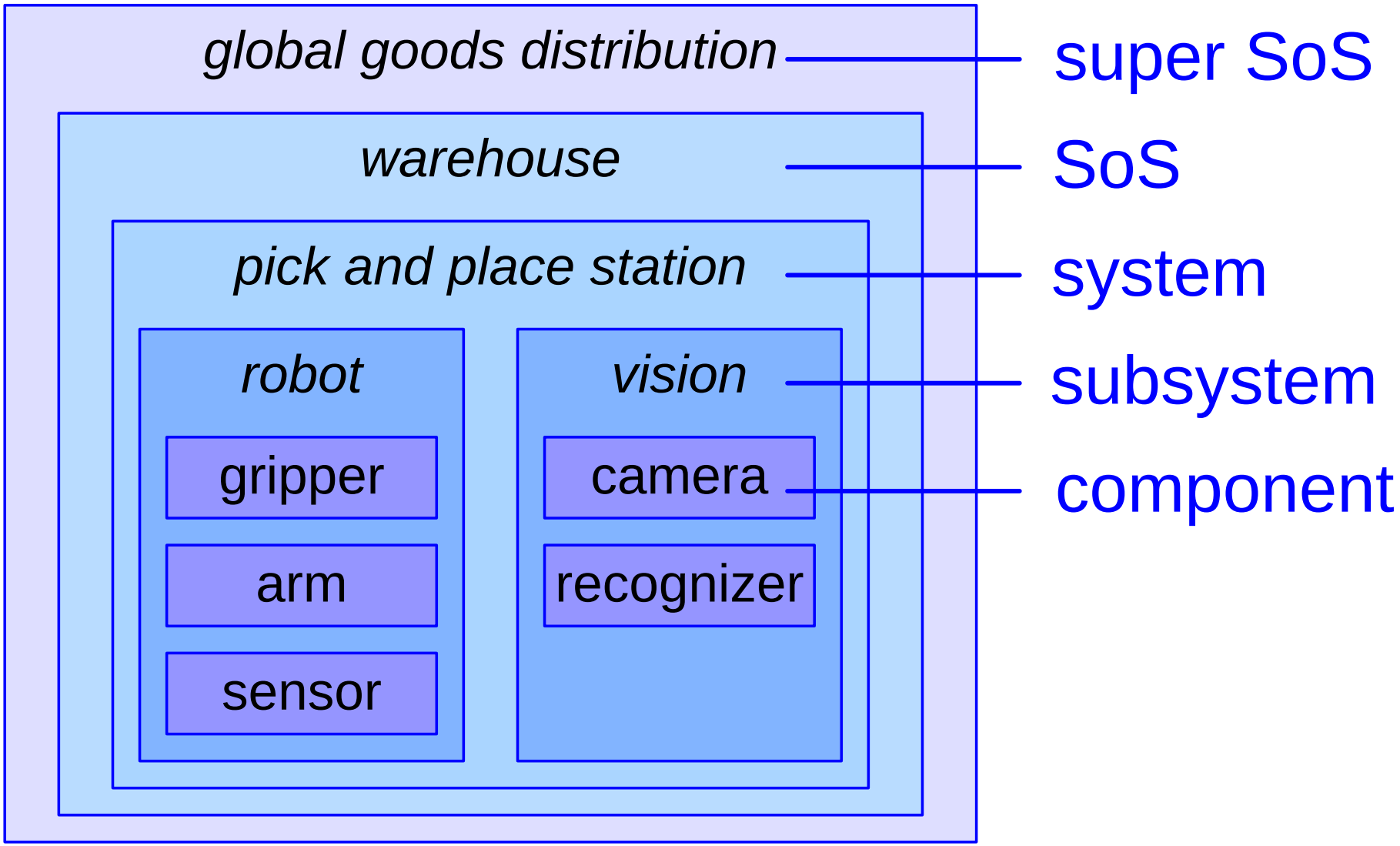
multiple grippers needed?

there is no time to teach (program)
the robots how to handle package variety

And more variants...



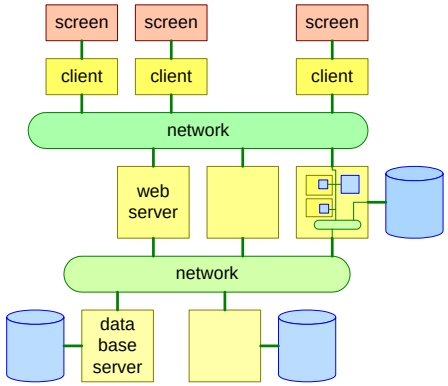
Recap: Levels and Partitioning

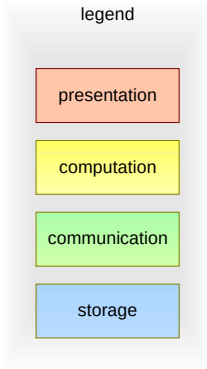


Warehouse Control

planning
purchase
sales
delivery

this is a
SoS in
itself





warehouse
scheduling

local
control

local
control

local
control

local
control

local
control

Typical Project Life Cycle