

MAAS-Hub

Scalable homogenous architecture for multi agent systems

Moazzam Abdullah Khan

Daiem Nadir Ali

Nour Soufi

Segun Ajibola

Challenge

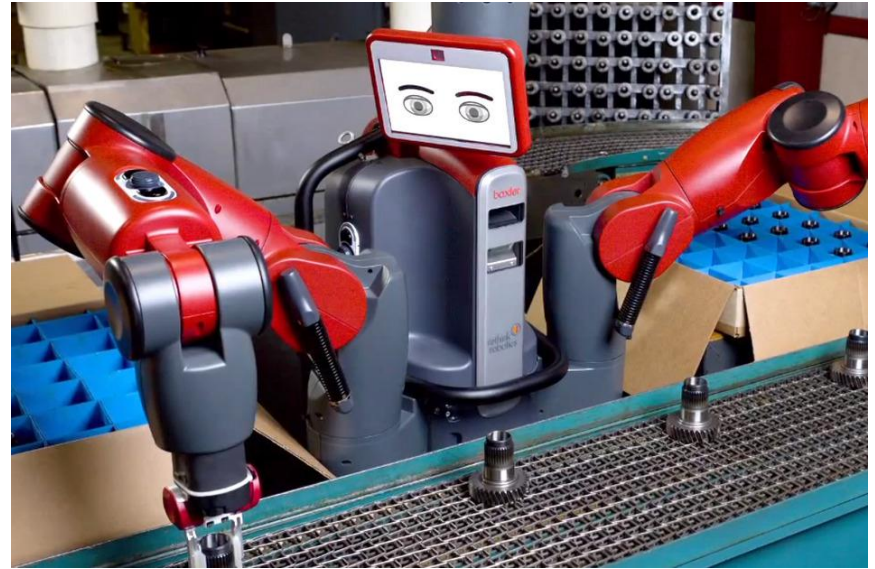
- Customer places order
 - Orders require multiple steps to complete
- Agents have to complete the order
 - Agents have specializations
 - Transporting
 - Can move
 - Painting
 - Can paint
 - Fastening
 - Can fasten two objects together
- Deliver finished order to customer

Assumptions

- Unlimited resources
 - All orders can be completed
 - No need to prioritize orders to maximize profit
- Release time
 - Orders are released with individual specified delays
- No deadlines
 - Orders don't have a deadline attached
 - No need to prioritize orders to maximize profit
- Fixed processing time
 - Each step has a specific completion delay
 - Location and distance doesn't affect step completion time

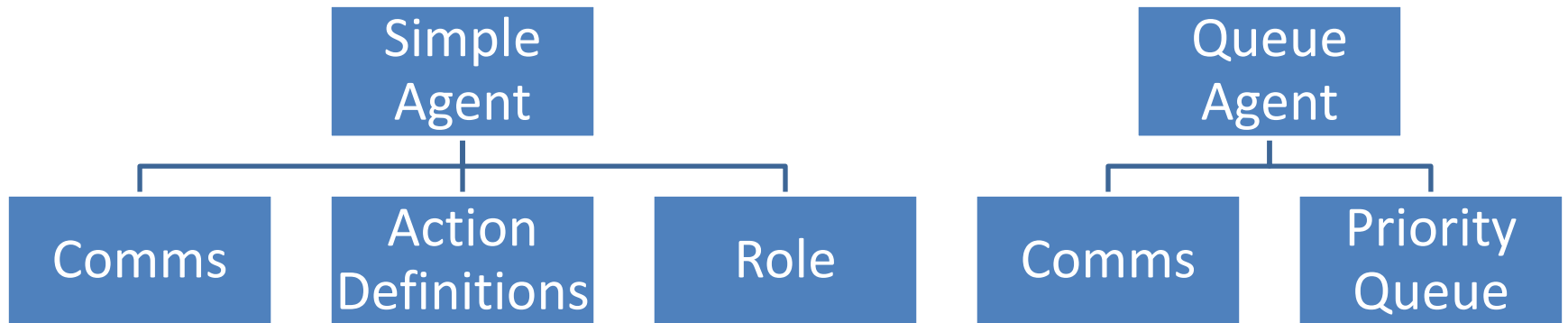
Our Motivations

- Keep agents
 - Homogenous
 - Versatile
 - Indefinitely scalable

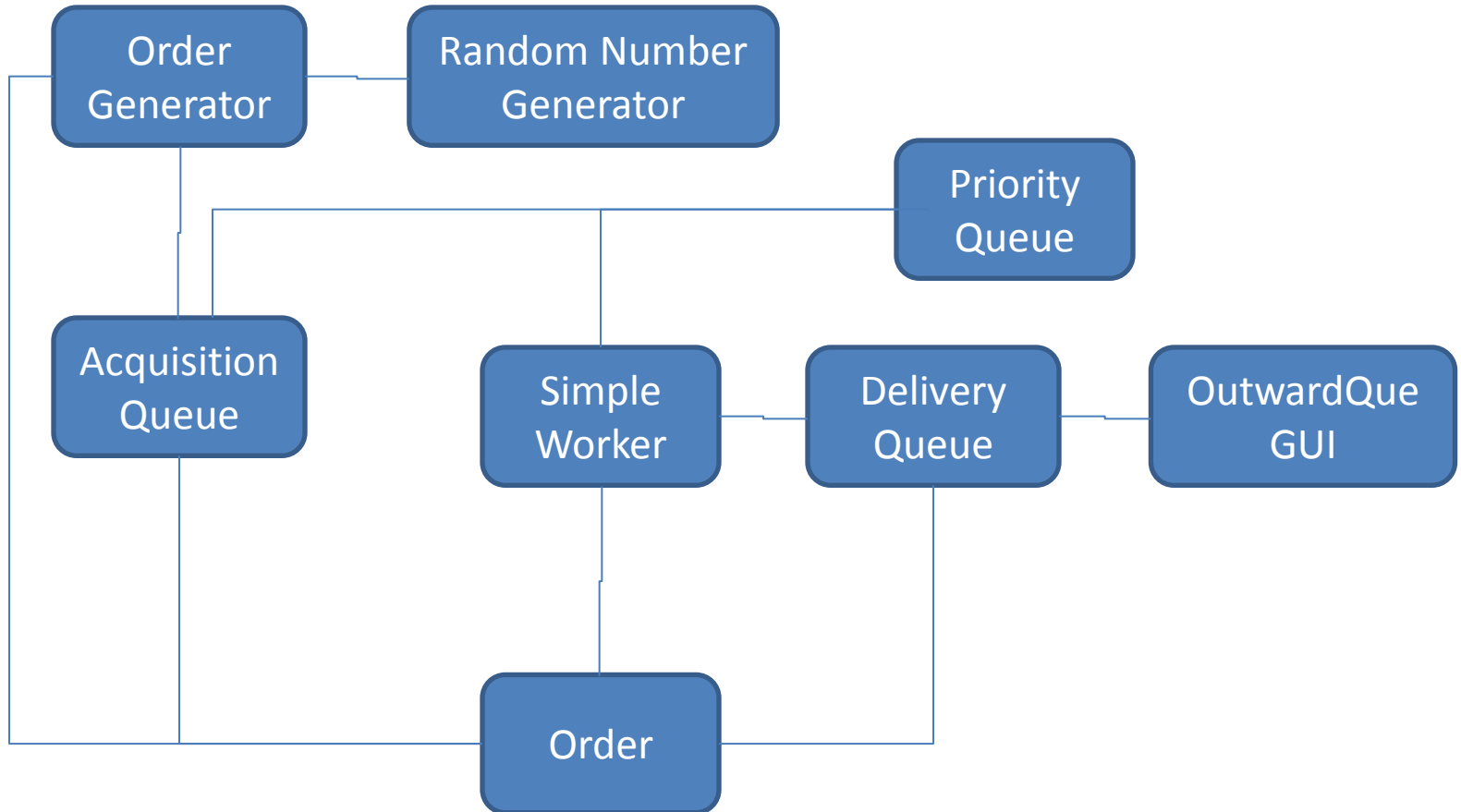


Baxter Robot: A versatile robot worker capable of doing complex tasks

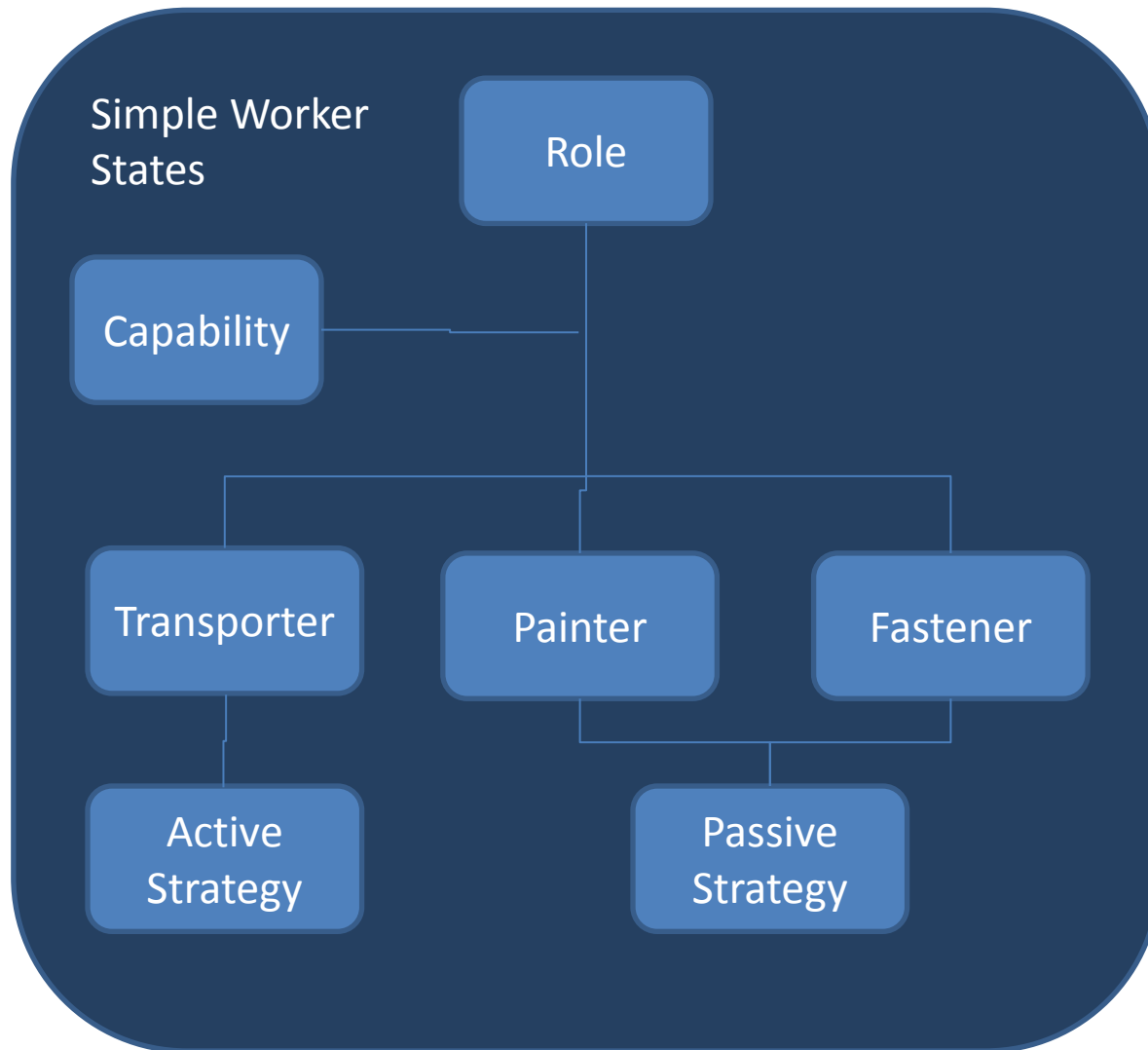
Structure



Class Diagram

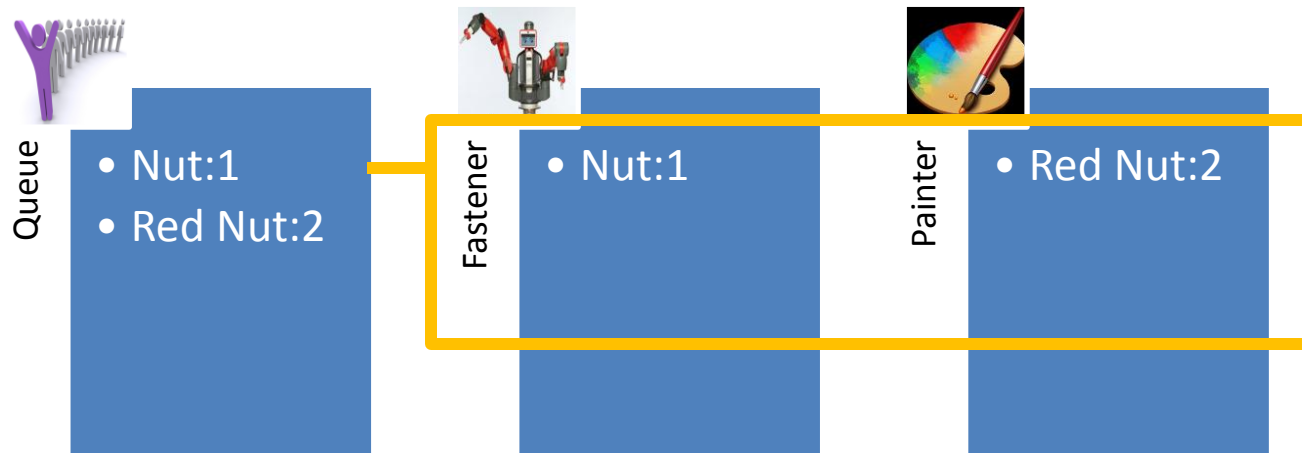


Worker Roles



Command and Control

- Every agent registers on yellow pages
- Queue holds information on agent inventories
- Objects have a number representing overall progress (step number) which is currently treated as priority



Flow



Flow



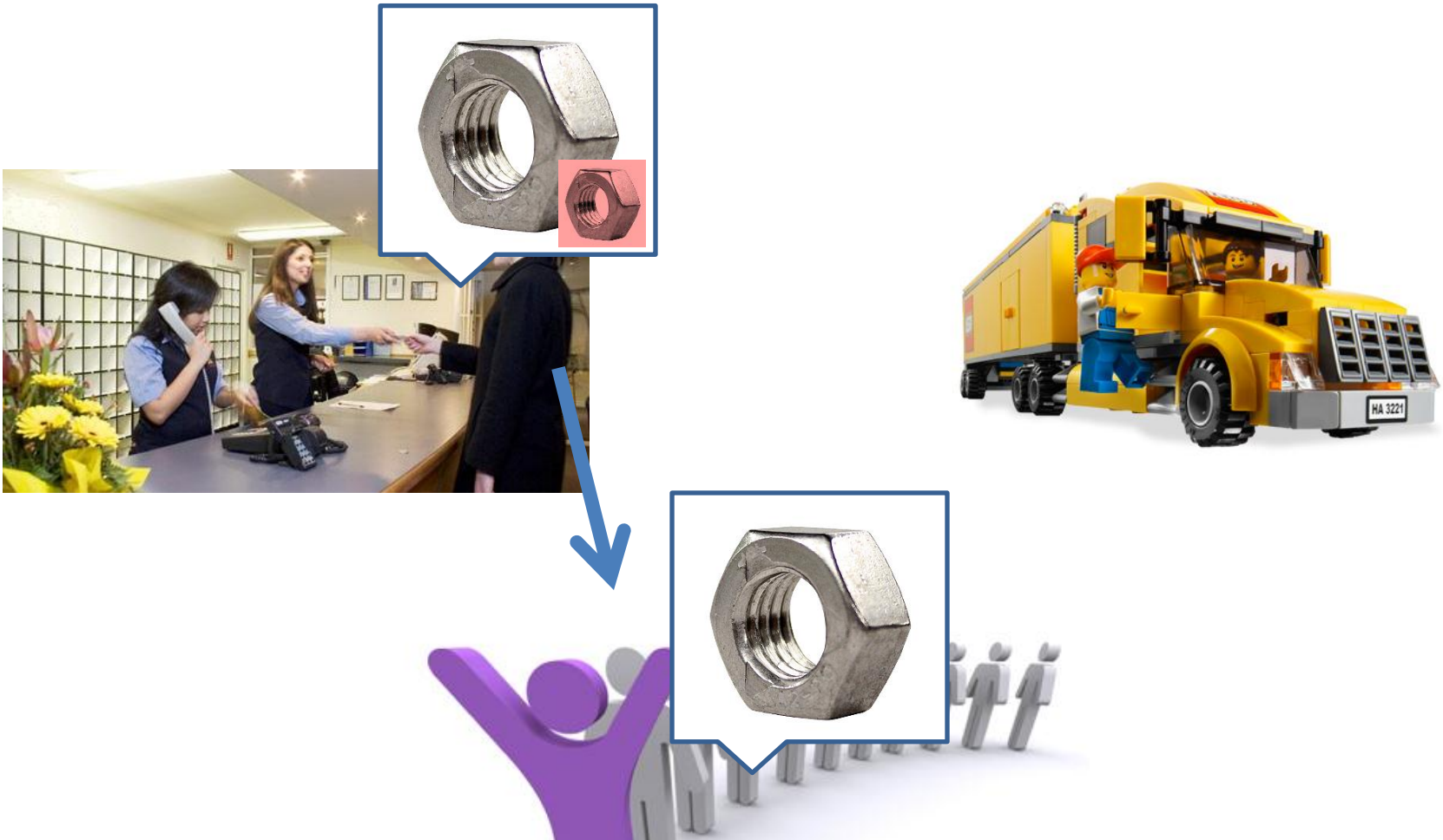
Flow



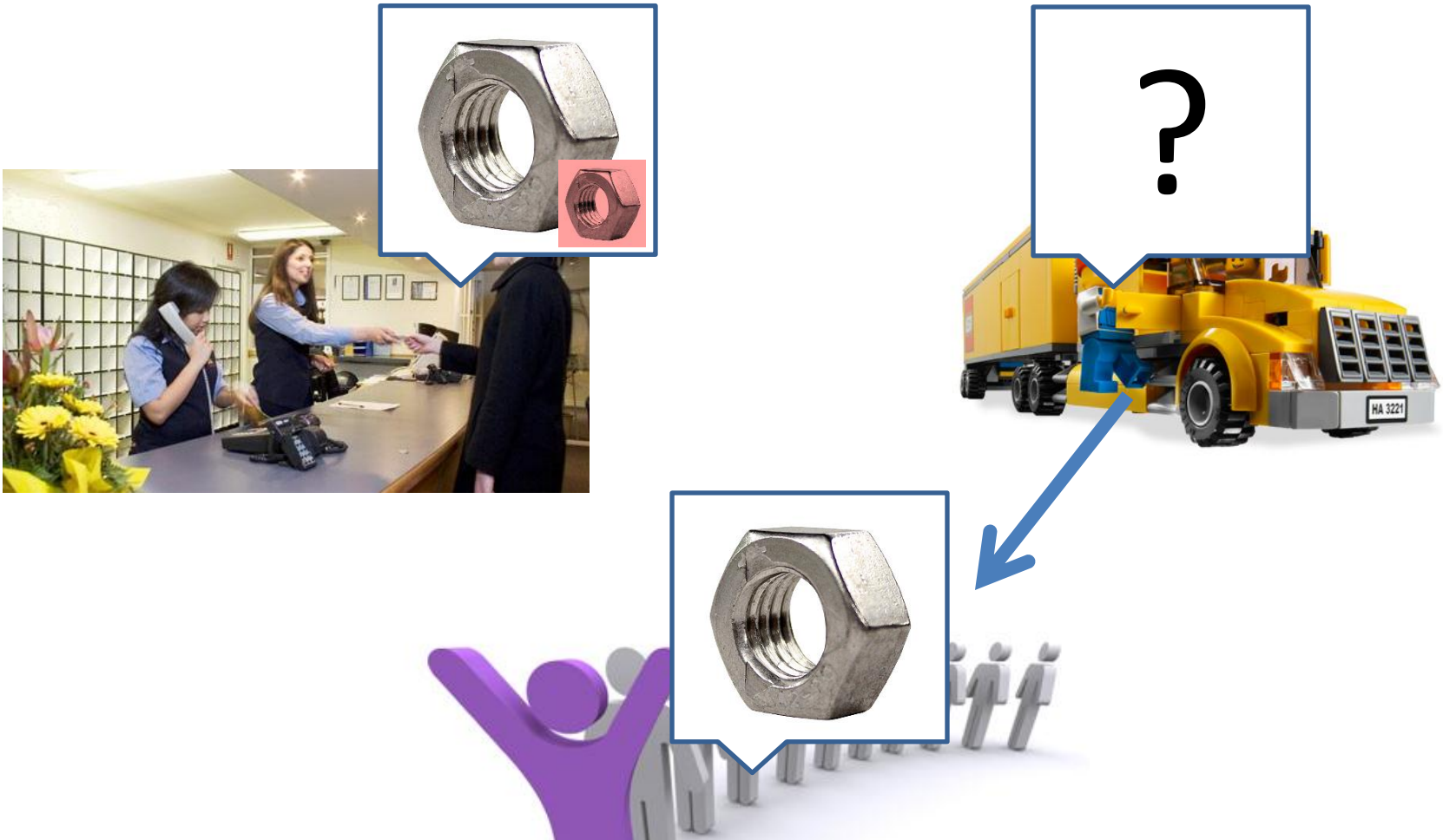
Flow



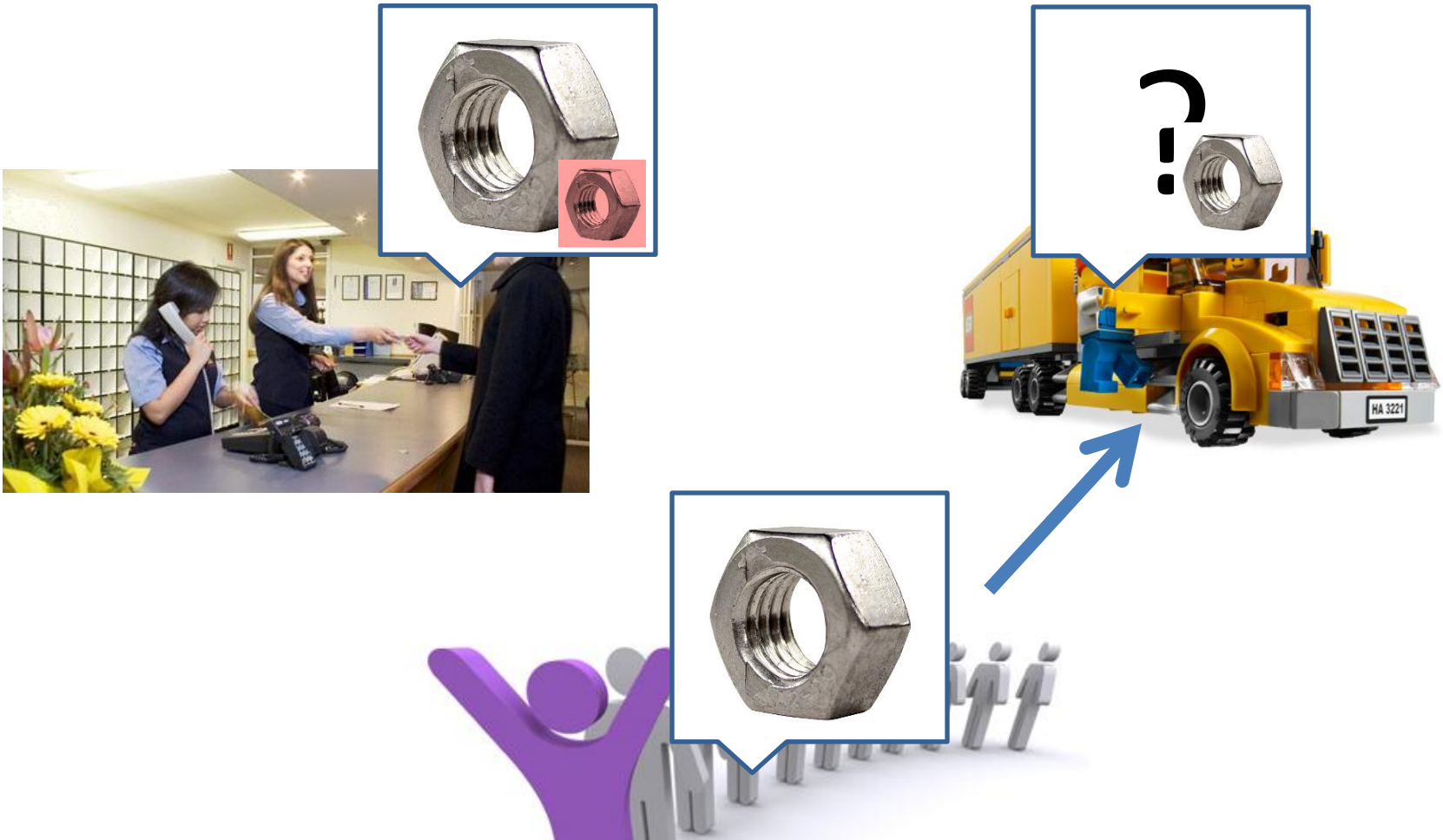
Flow



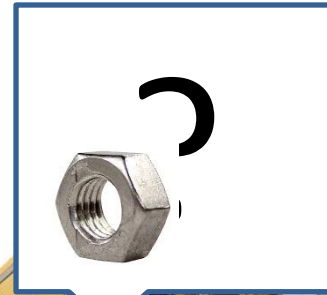
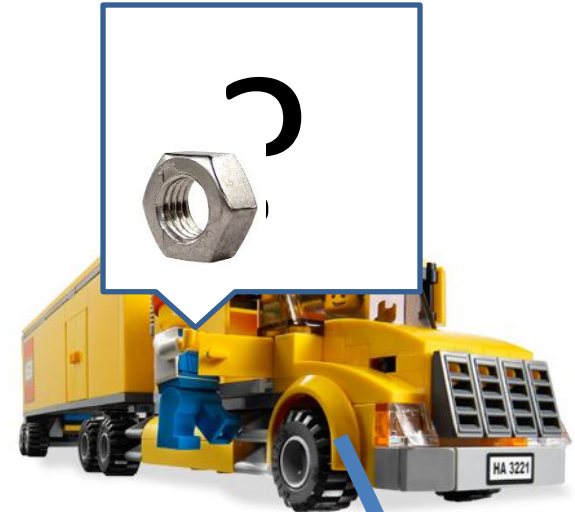
Flow



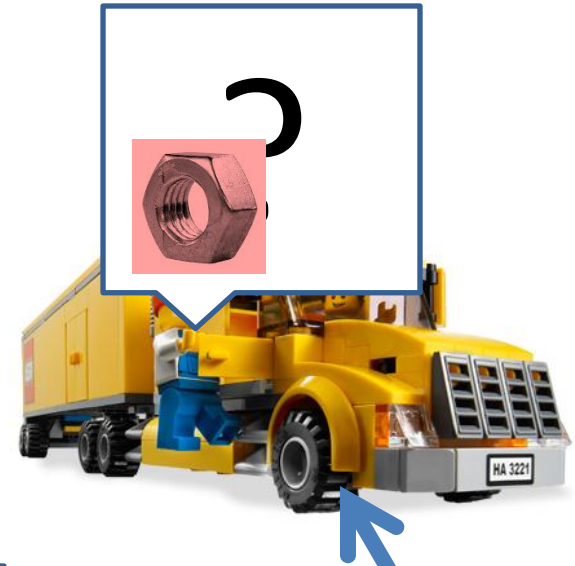
Flow



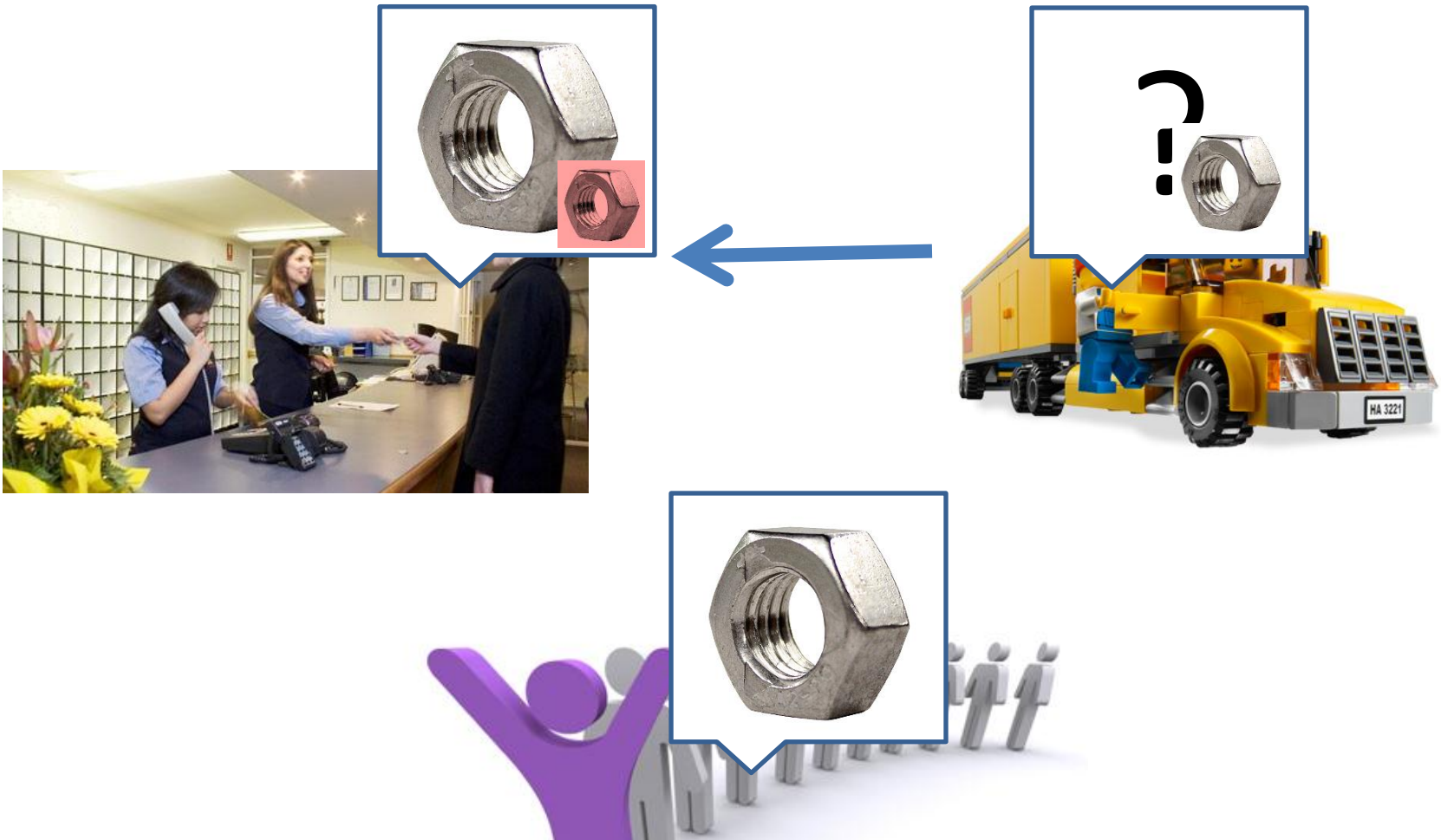
Flow



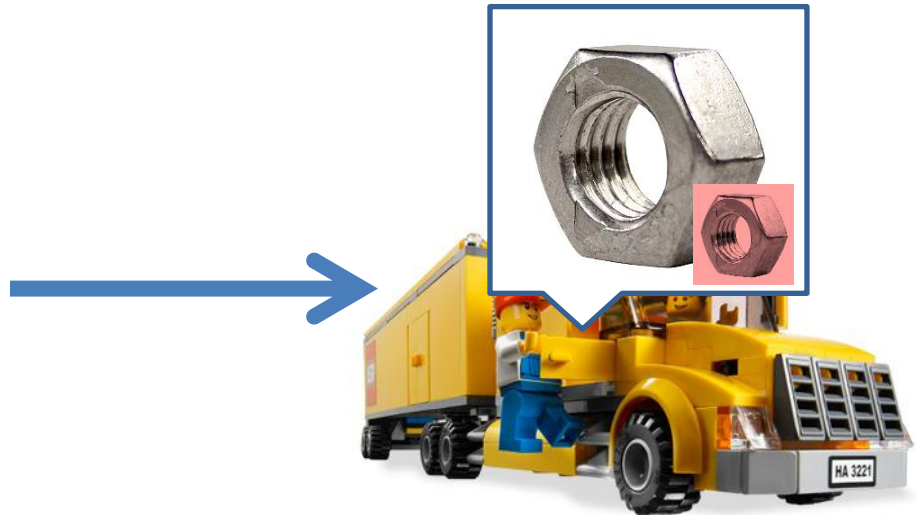
Flow



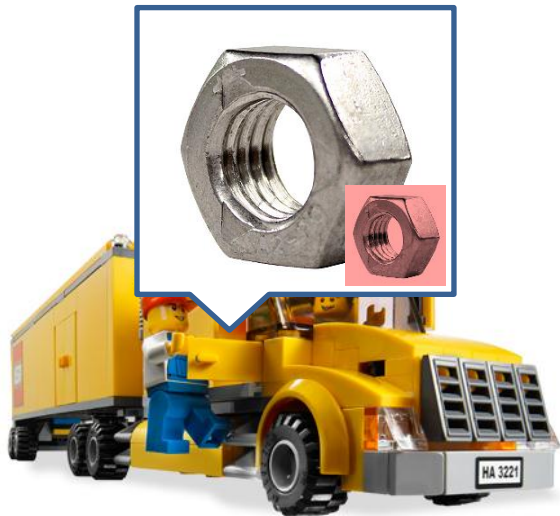
Flow



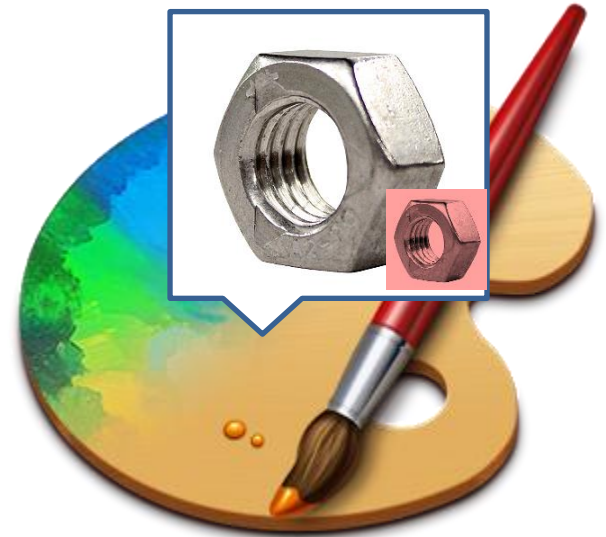
Flow



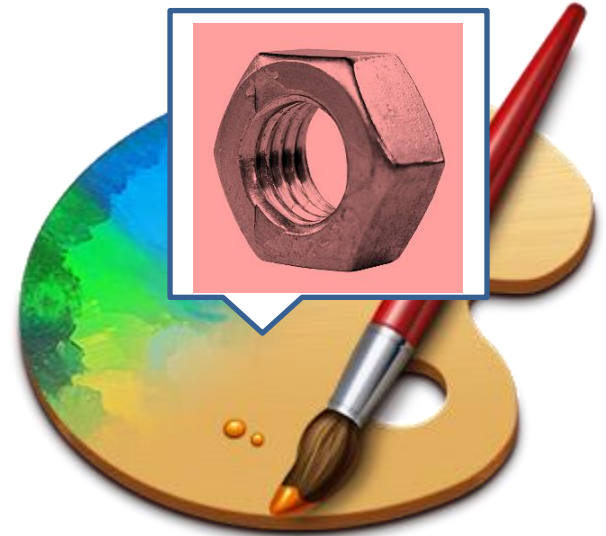
Flow



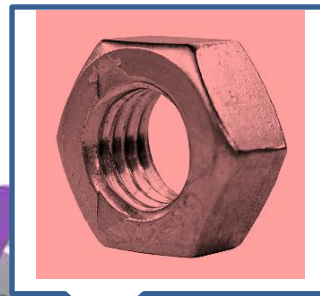
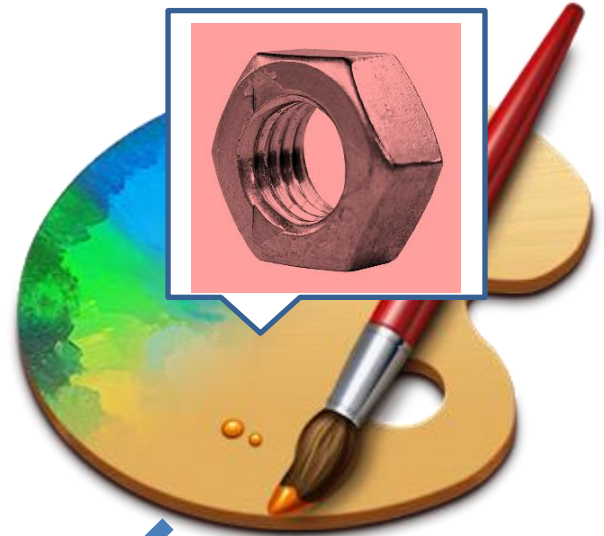
Flow



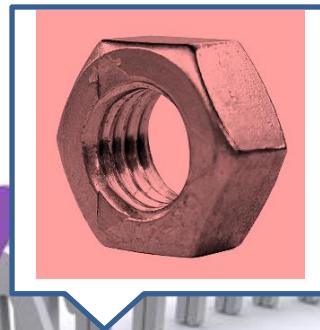
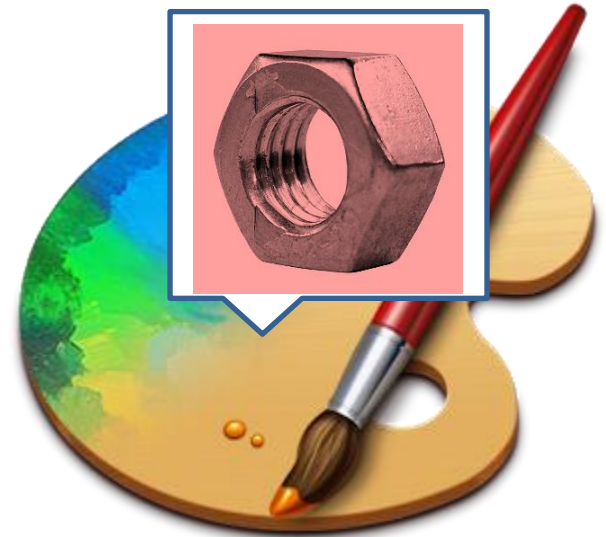
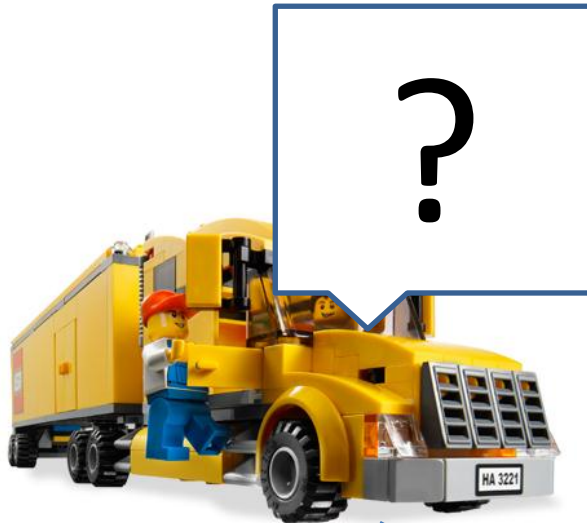
Flow



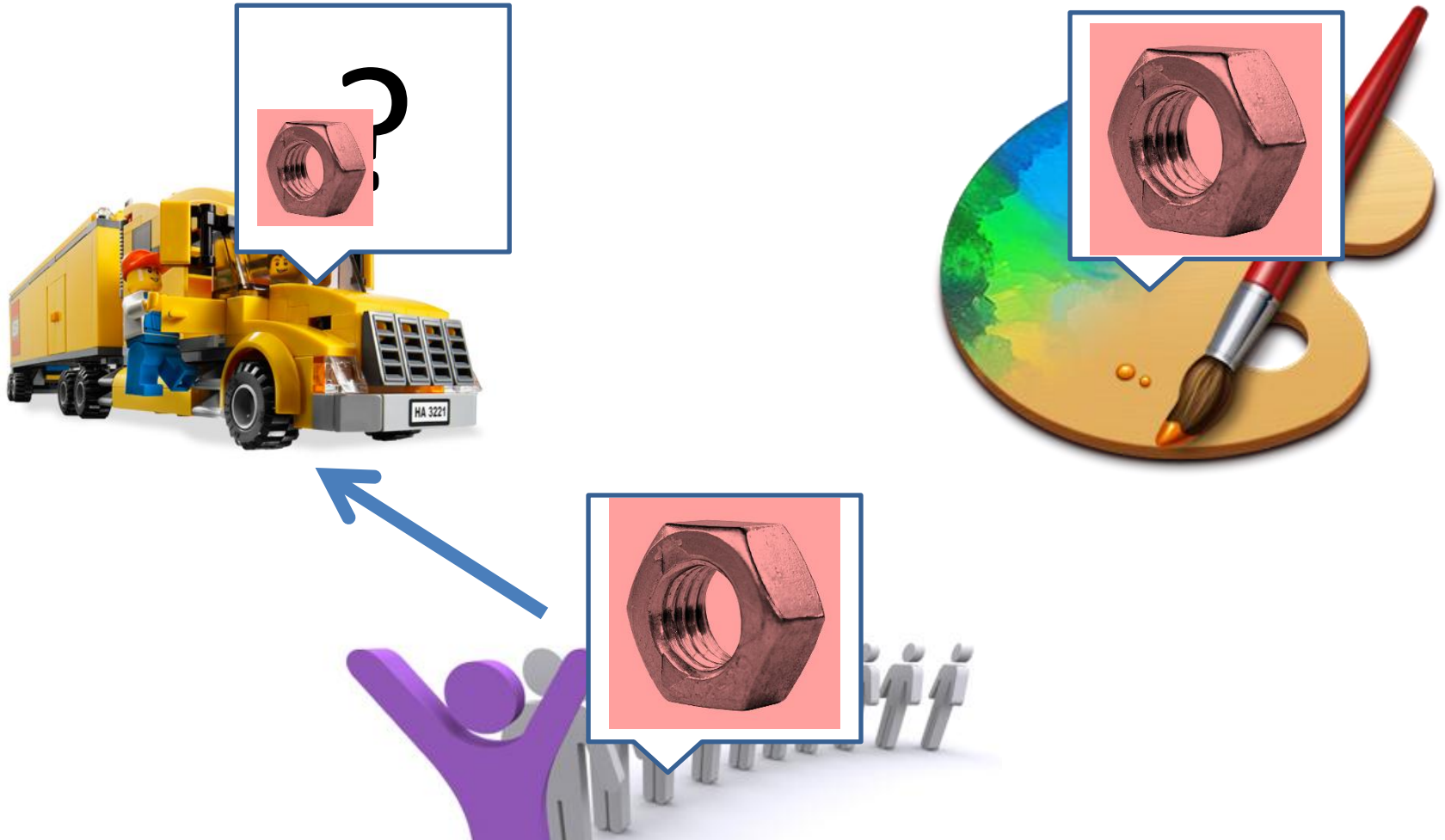
Flow



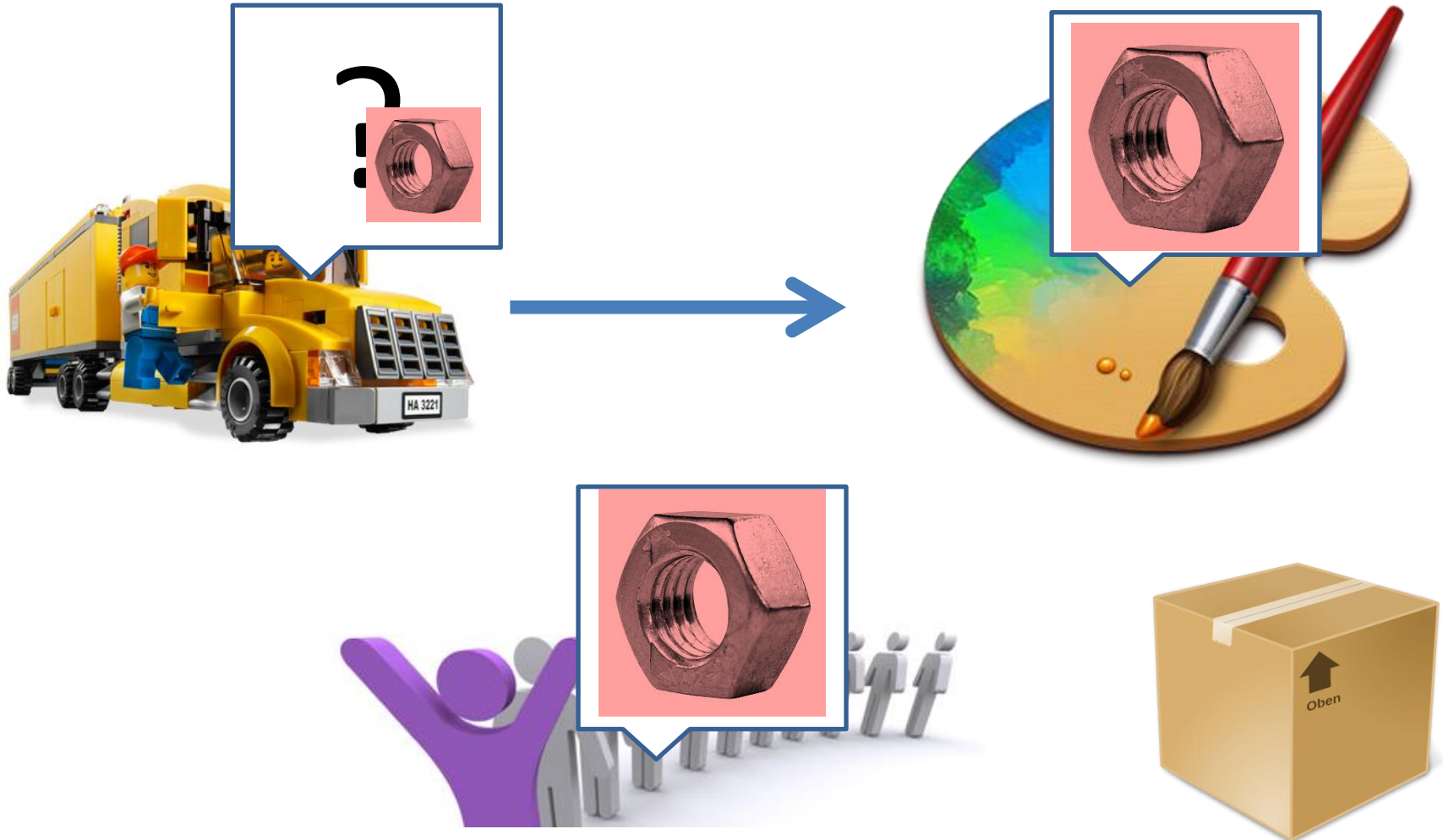
Flow



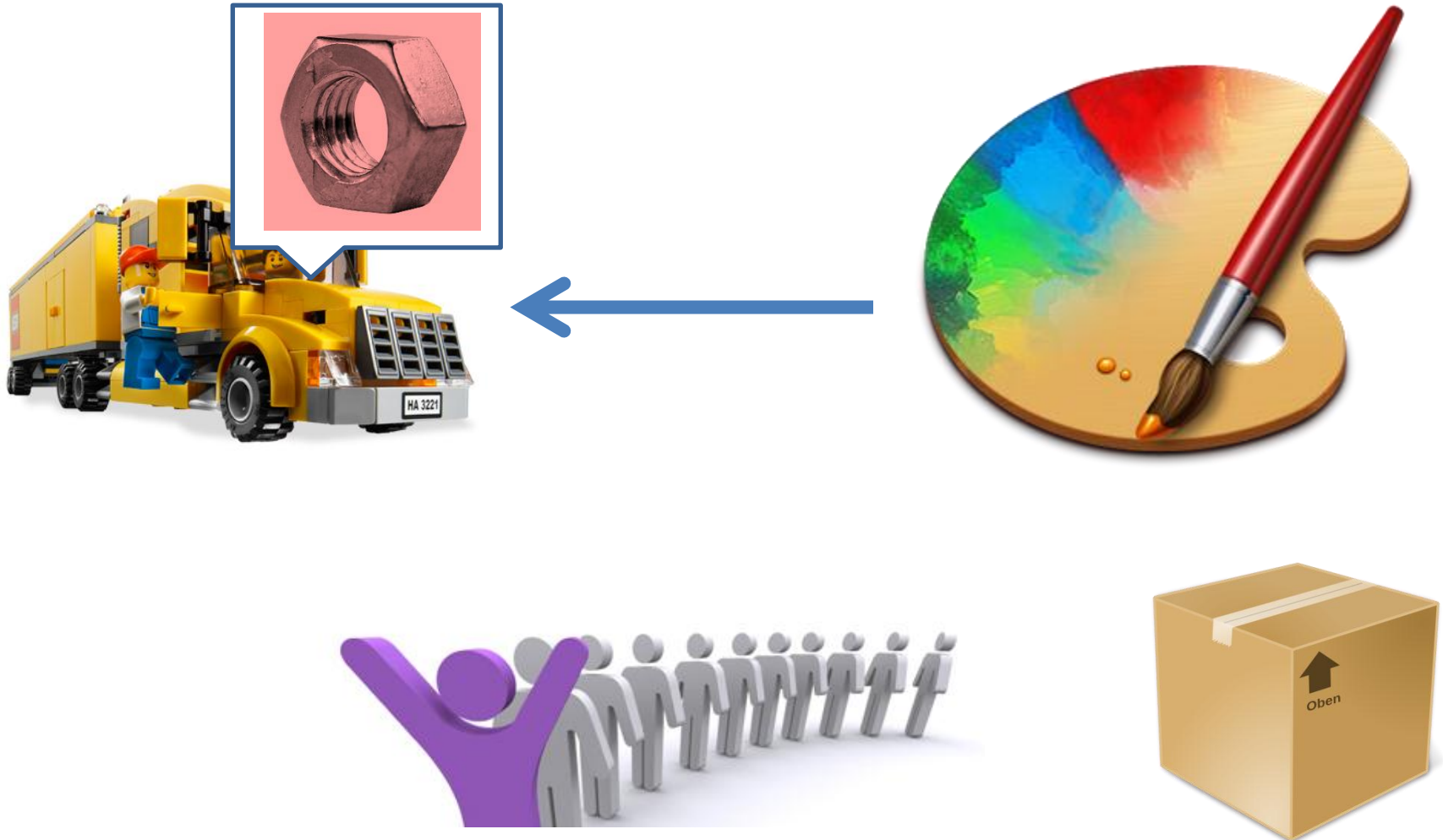
Flow



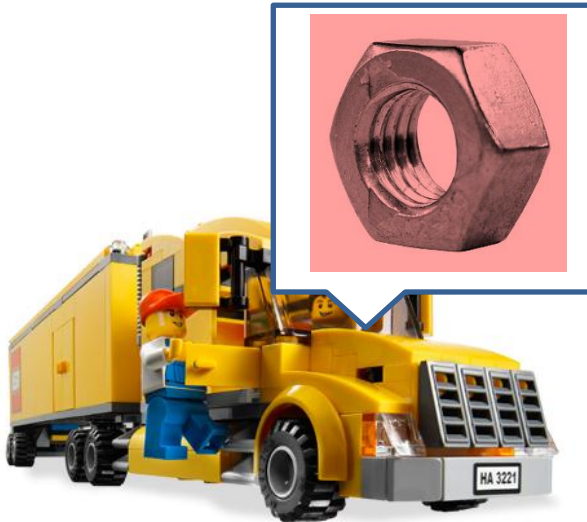
Flow



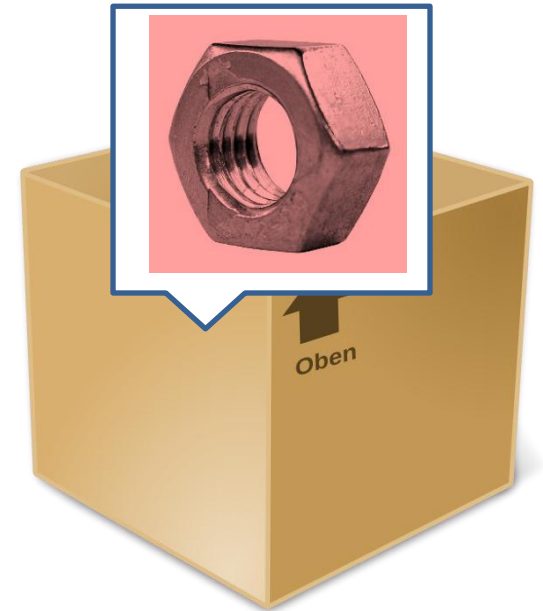
Flow



Flow



Flow



Peculiarities

- Advantages

- Yellow papers based communication
 - Centralized but robust
- Micro contracts
 - Contract look ahead only 1 step
 - Little bandwidth overhead

- Disadvantages

- Deadline based prioritization isn't implemented

Implementation

- JADE issues
 - Minor implementation issues
- Tools used
 - Ticker behaviors
 - RE Initiators
 - Priority Queues
 - Yellow pages
 - Finite State Machines

Lessons Learned

- Scalable architecture
- Can be used ideally in any scenario
 - Computational complexity restricts to relatively high end devices
 - ARM based devices ideal
 - Not suitable for microcontrollers
- Deadlines can be accommodated by changing priority number

