

MAAS-Hub

Scalable homogenous architecture for multi agent systems

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Challenge

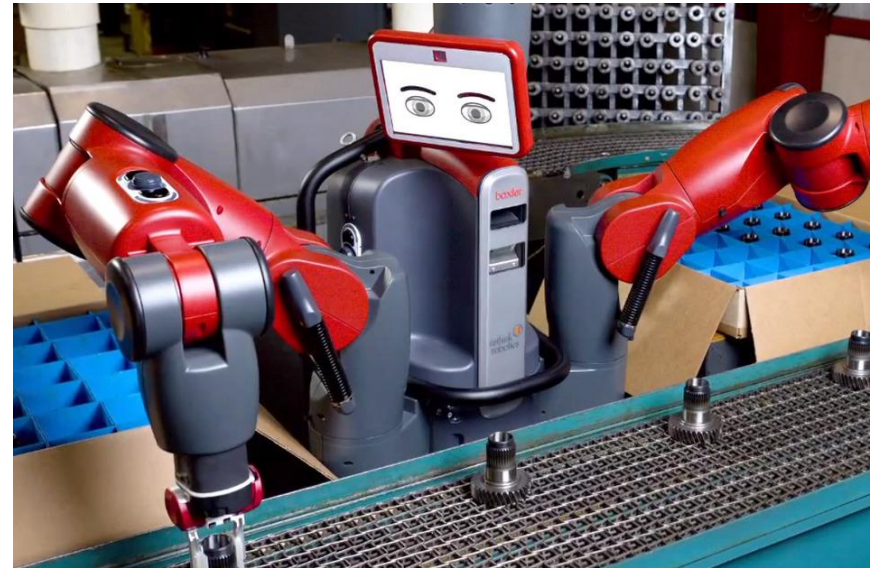
- Customer places order
 - Orders require multiple steps to complete
- Agents have to complete the order
 - Agents have specializations
 - Transporting
 - Can move
 - Painting
 - Can paint
 - Fastening
 - Can fasten two objects together
- Deliver finished order to customer

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

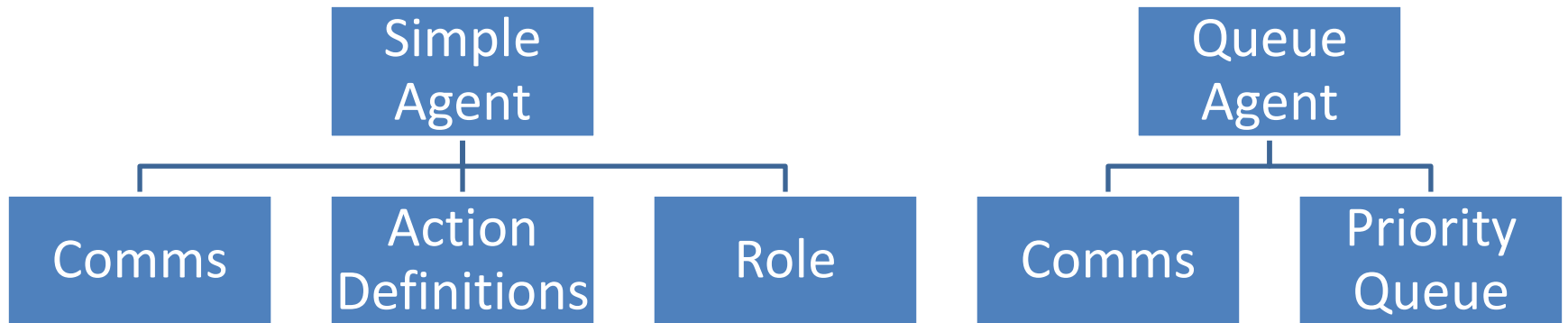
Our Motivations

- Keep agents
 - Homogenous
 - Versatile
 - Indefinitely scalable

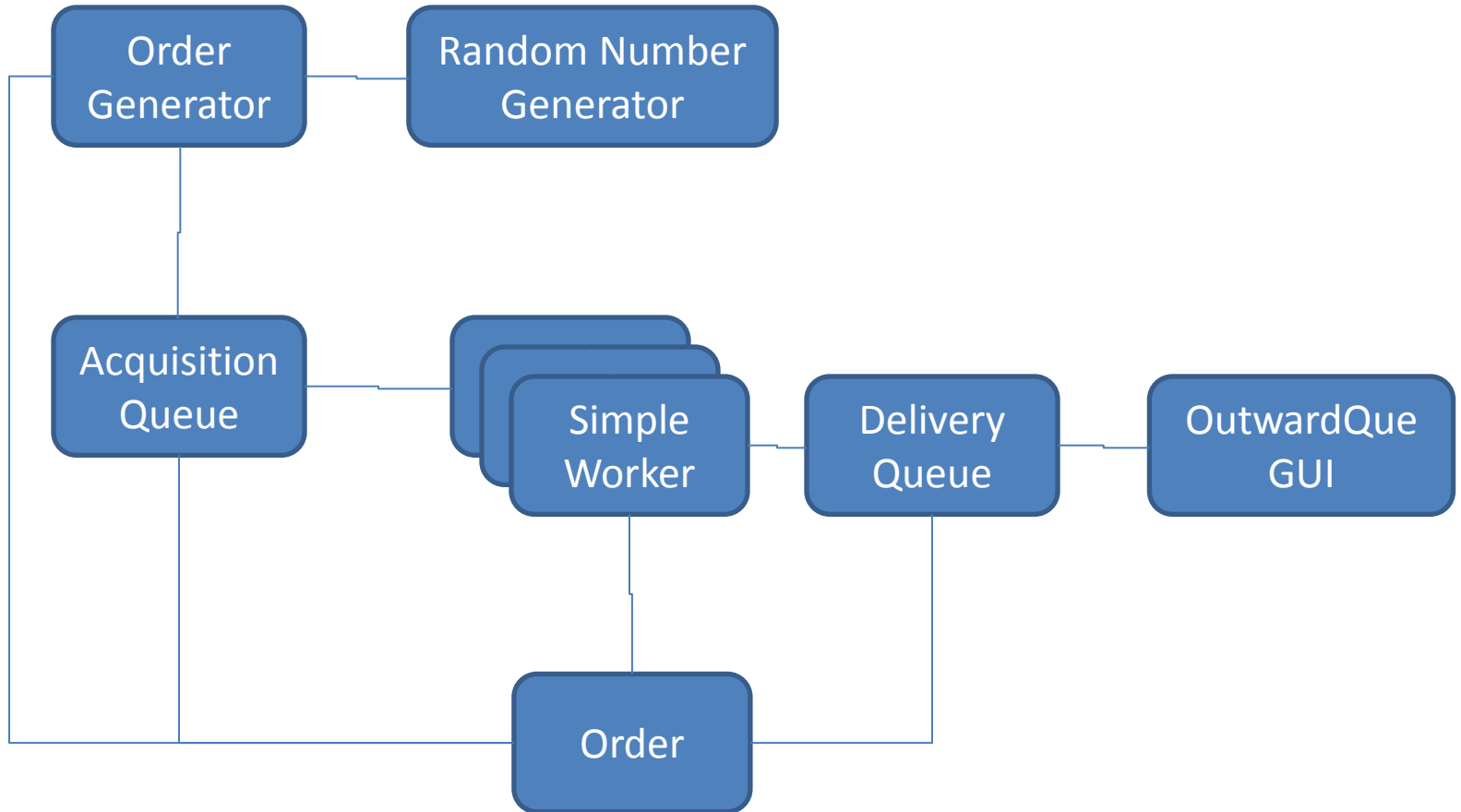


Baxter Robot: A versatile robot worker capable of doing complex tasks

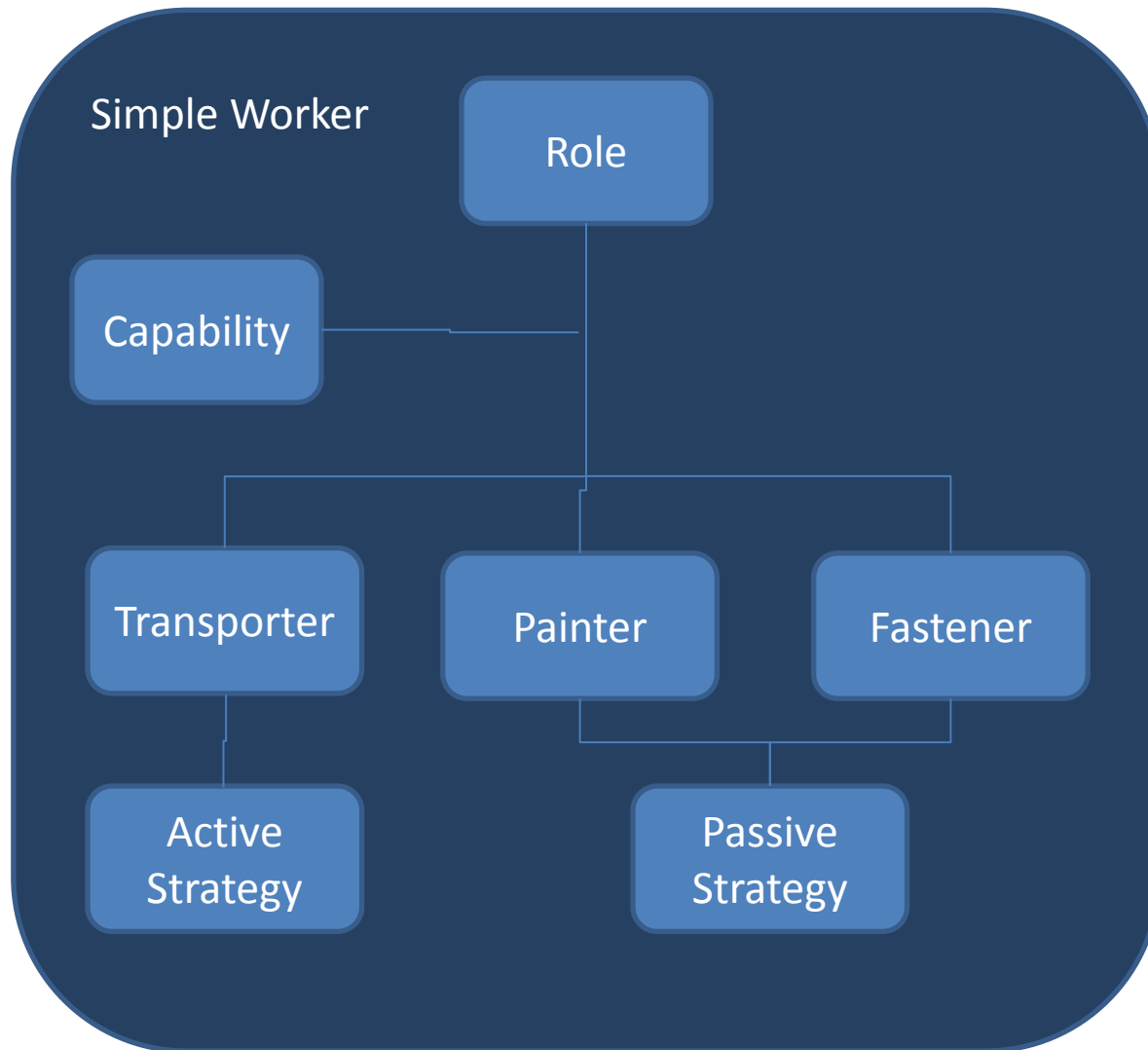
Structure



Class Diagram

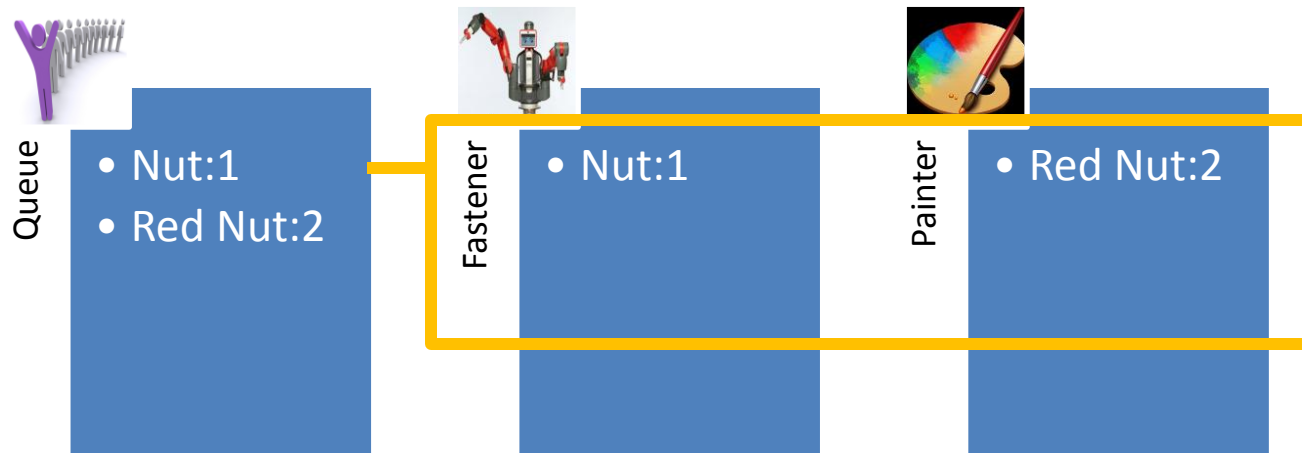


Worker Roles



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



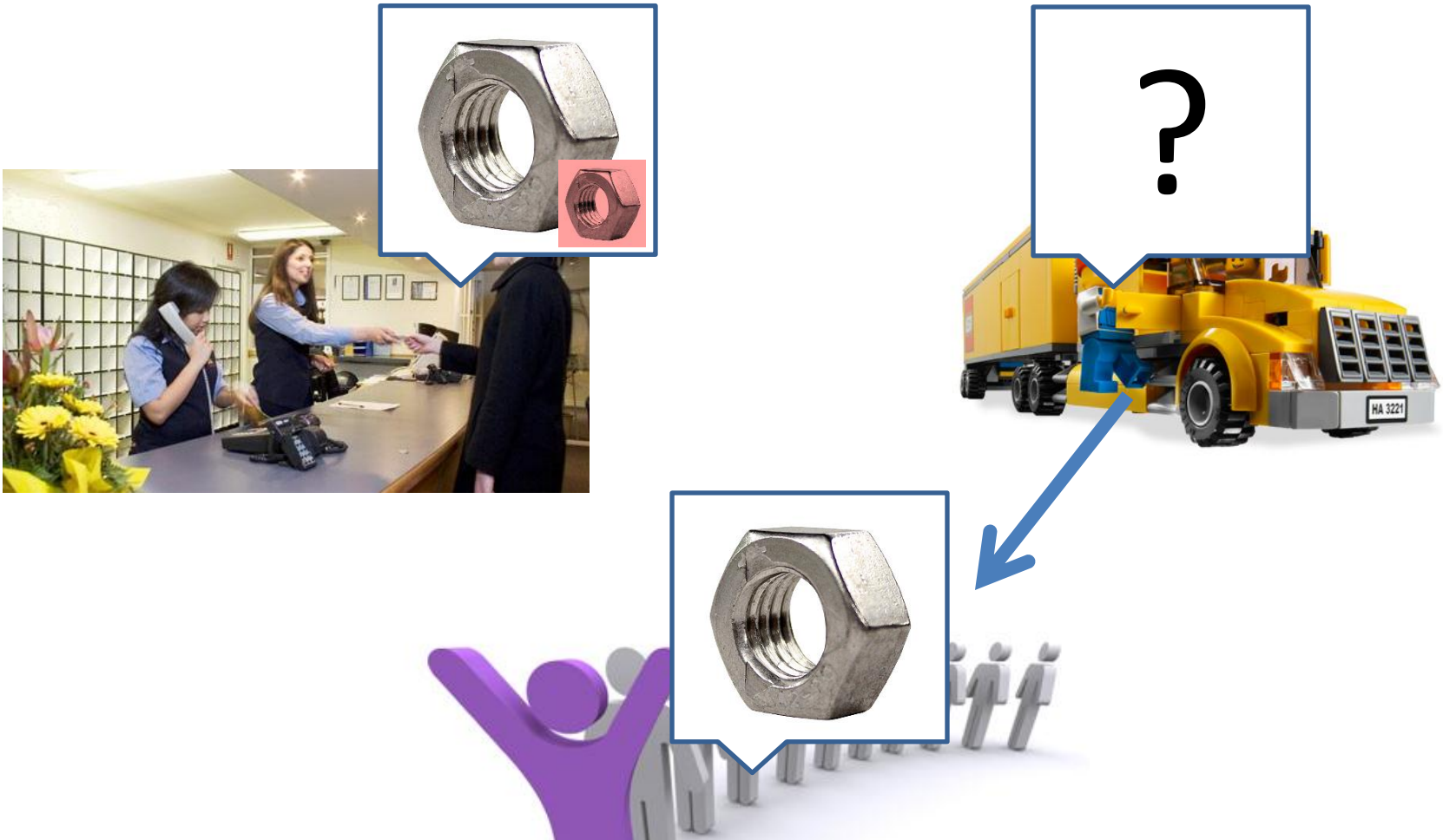
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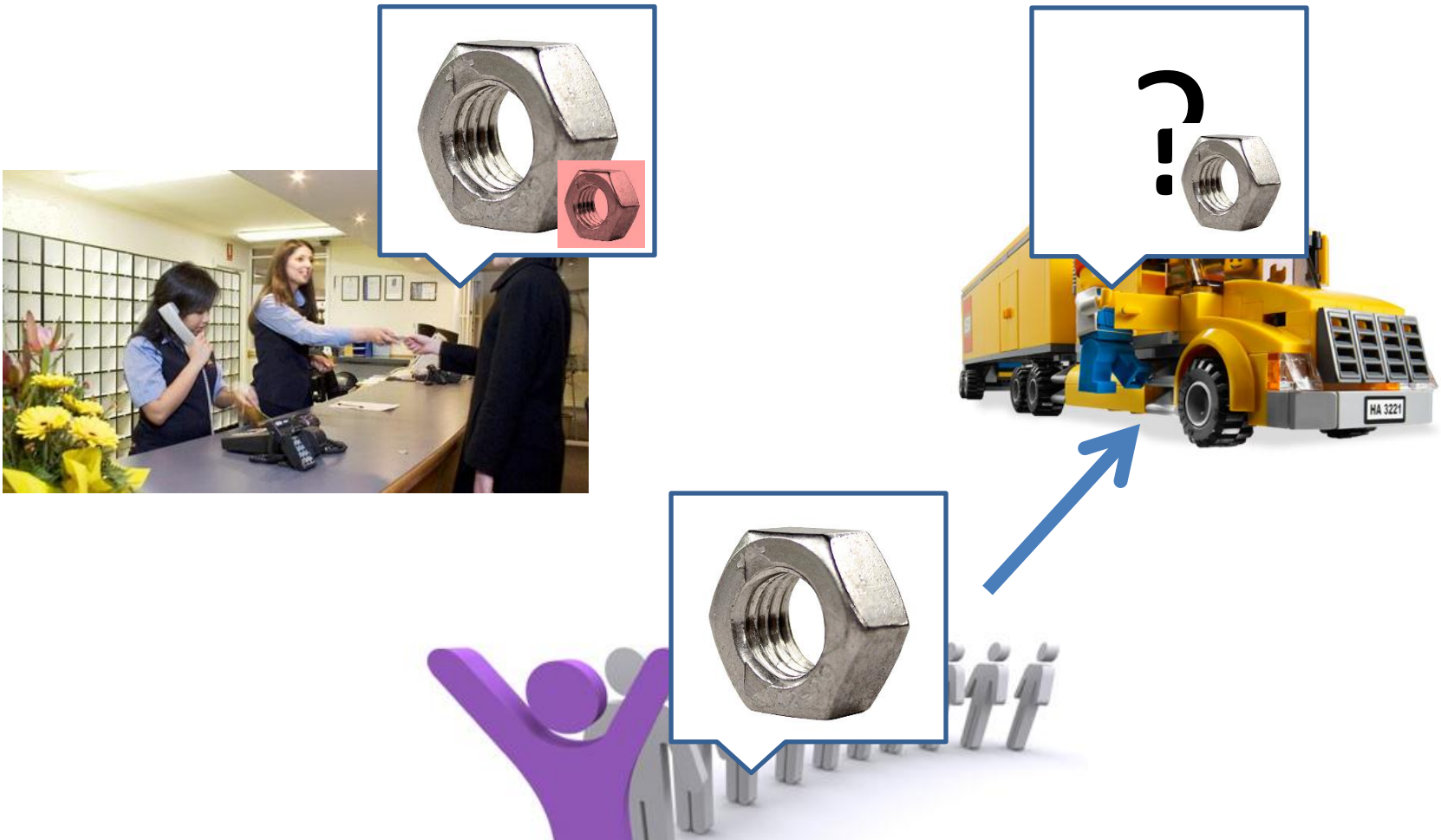
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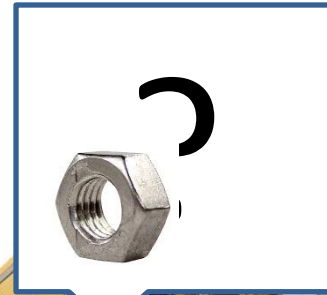
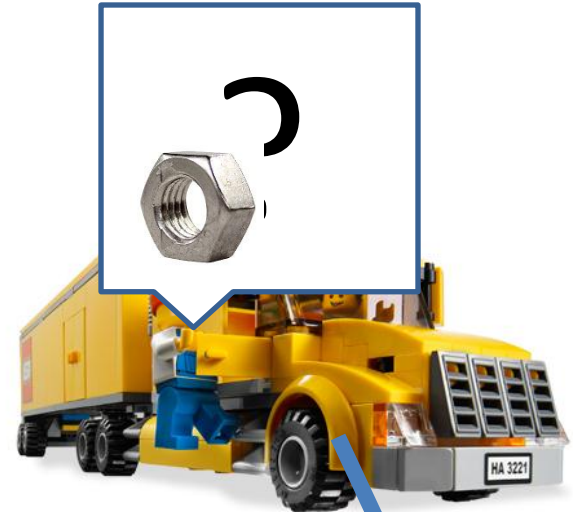
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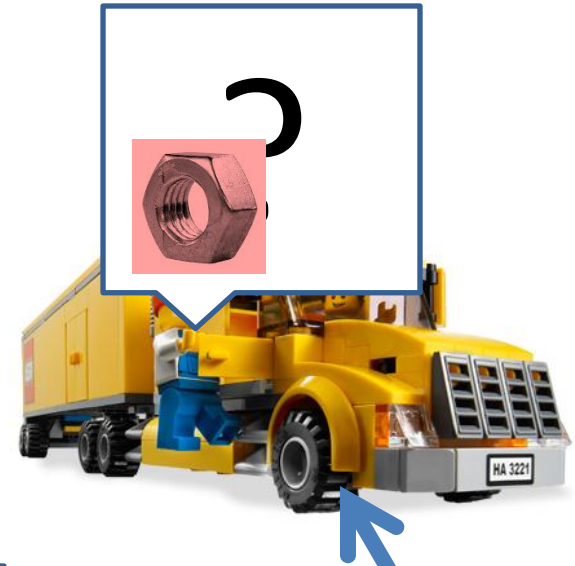
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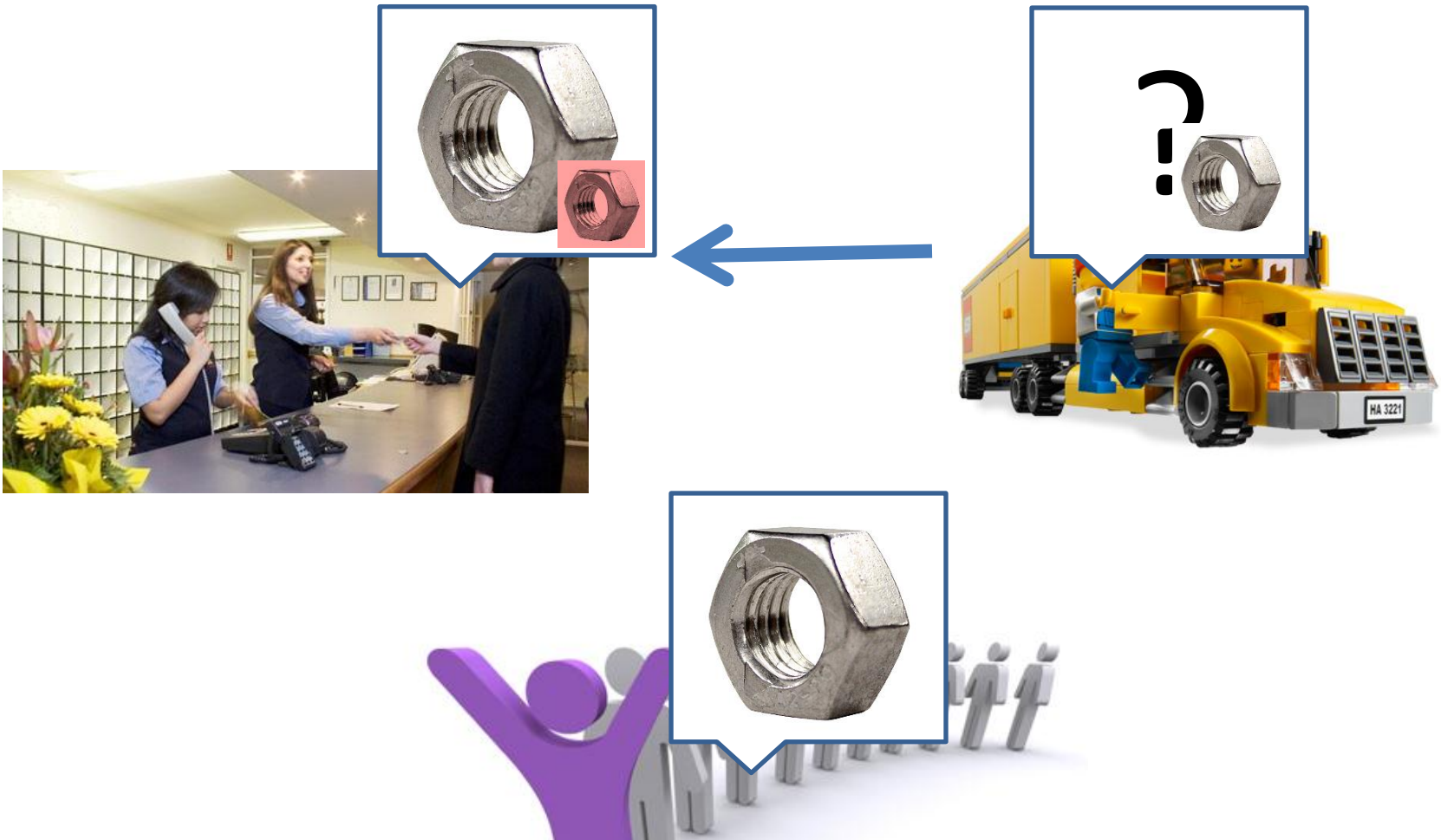
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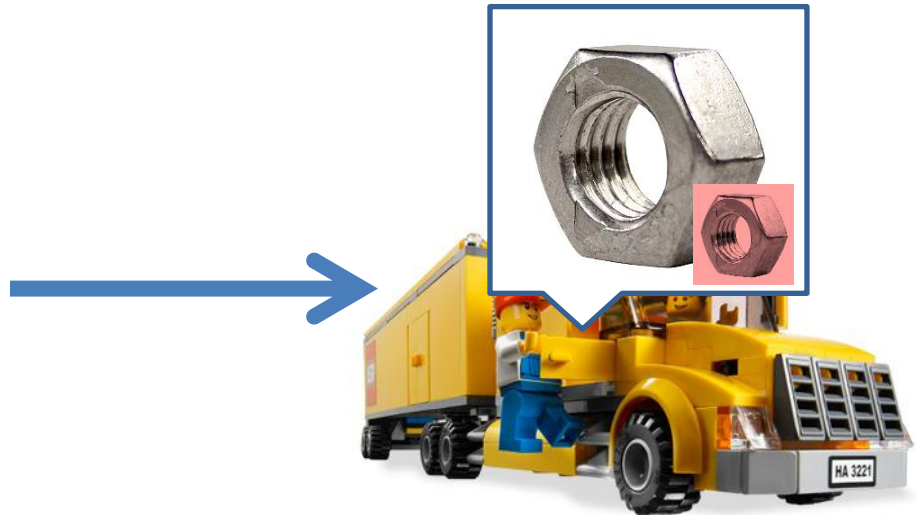
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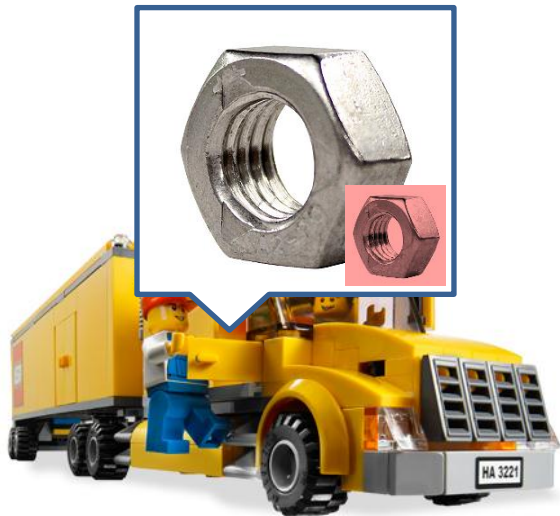
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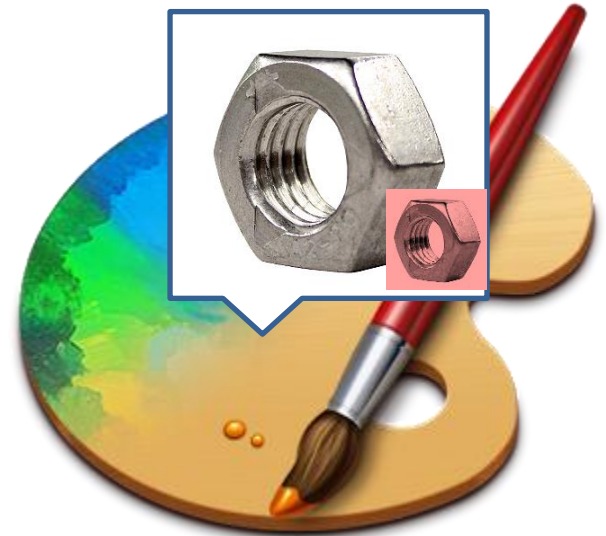
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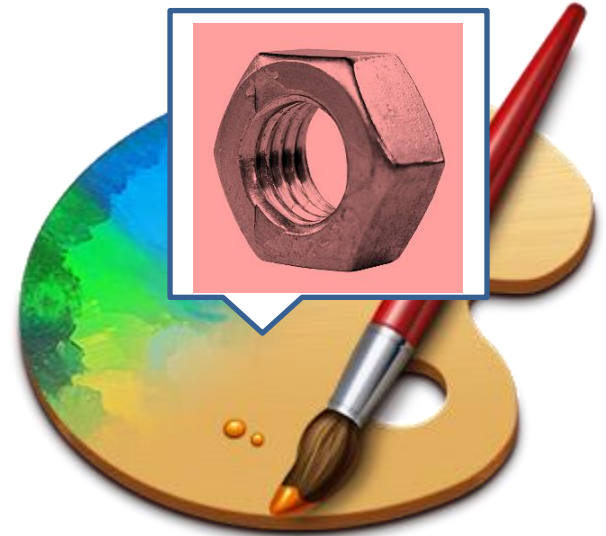
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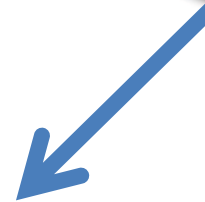
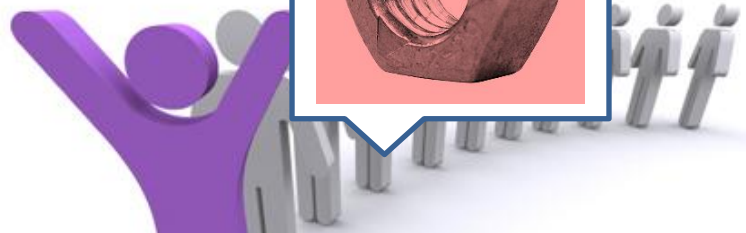
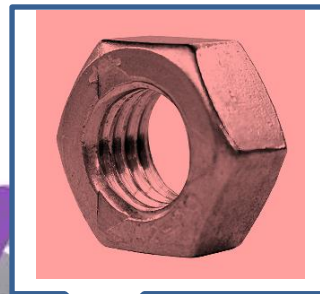
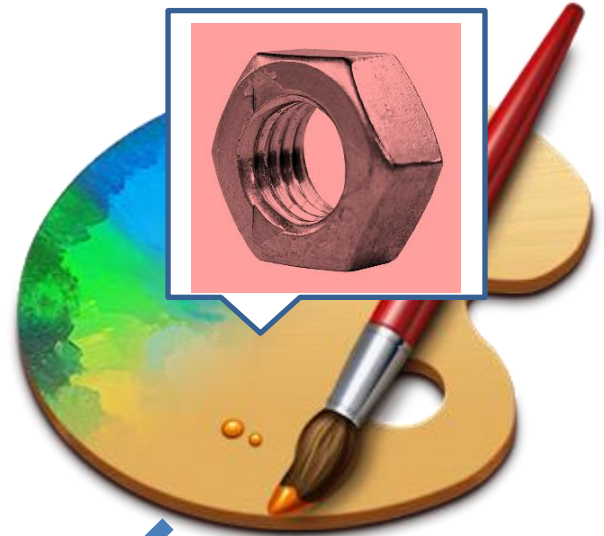
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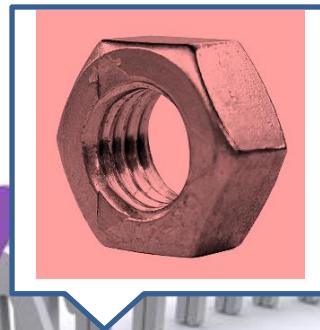
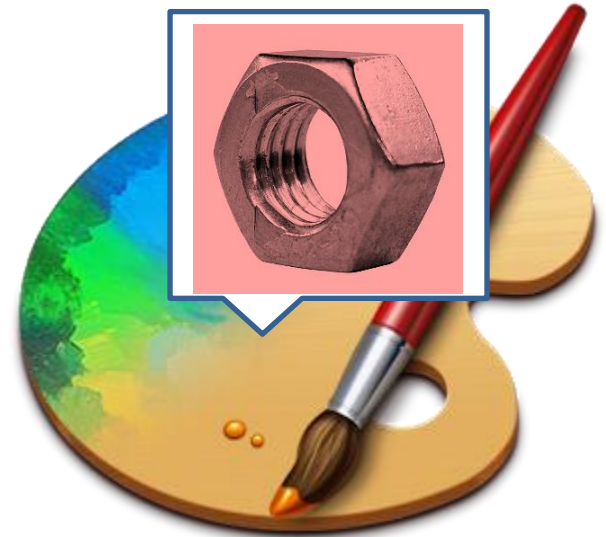
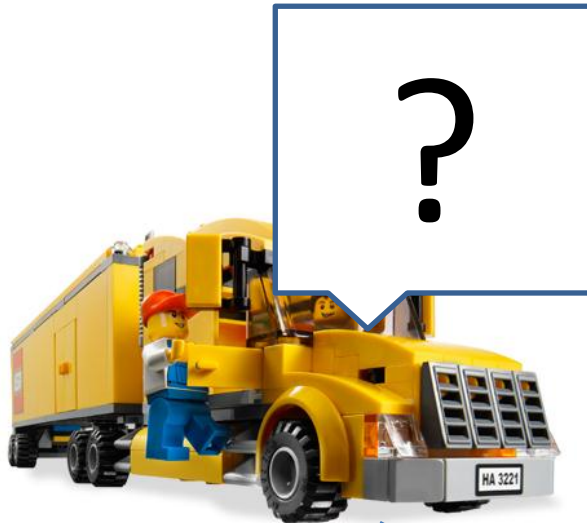
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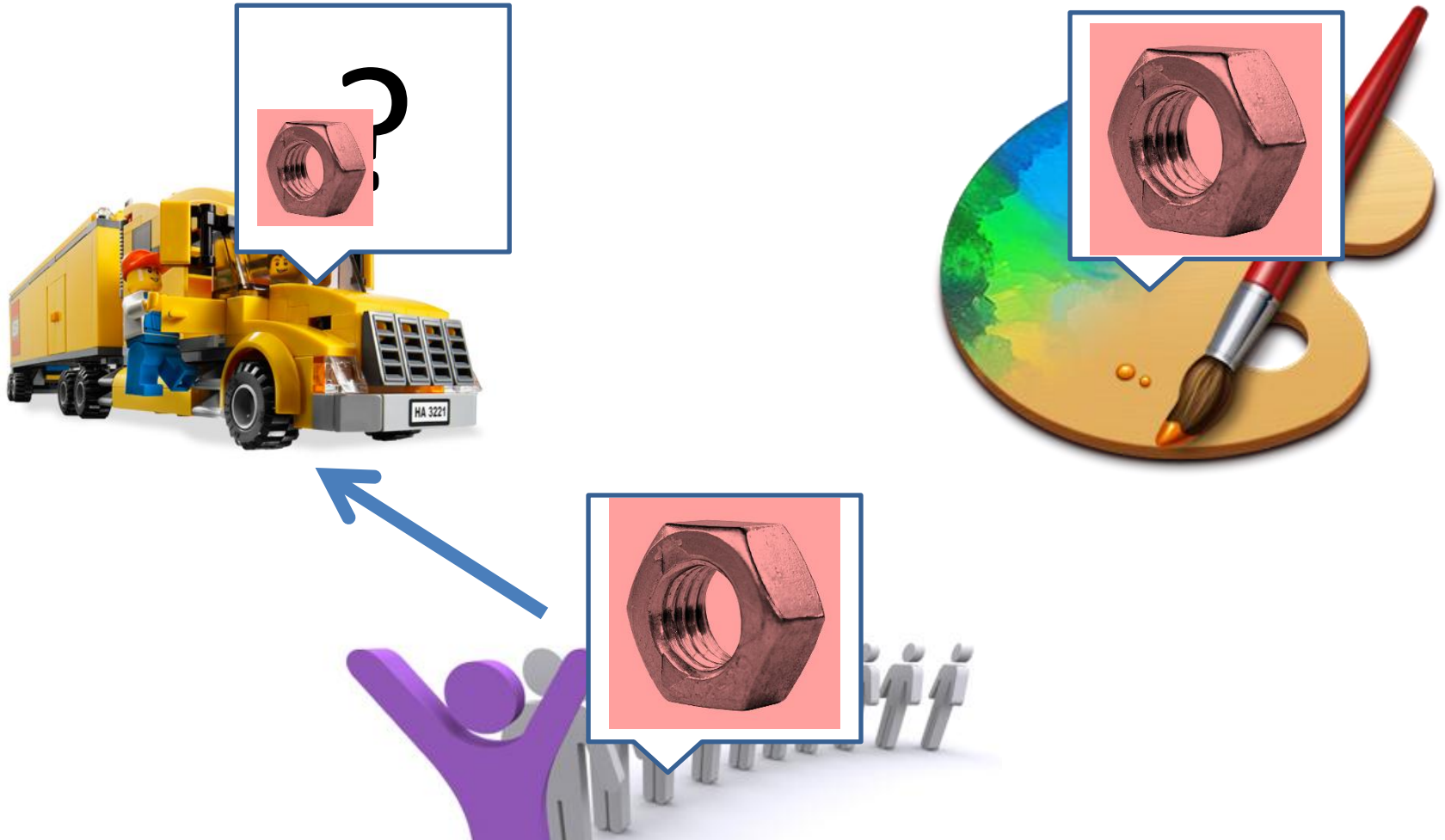
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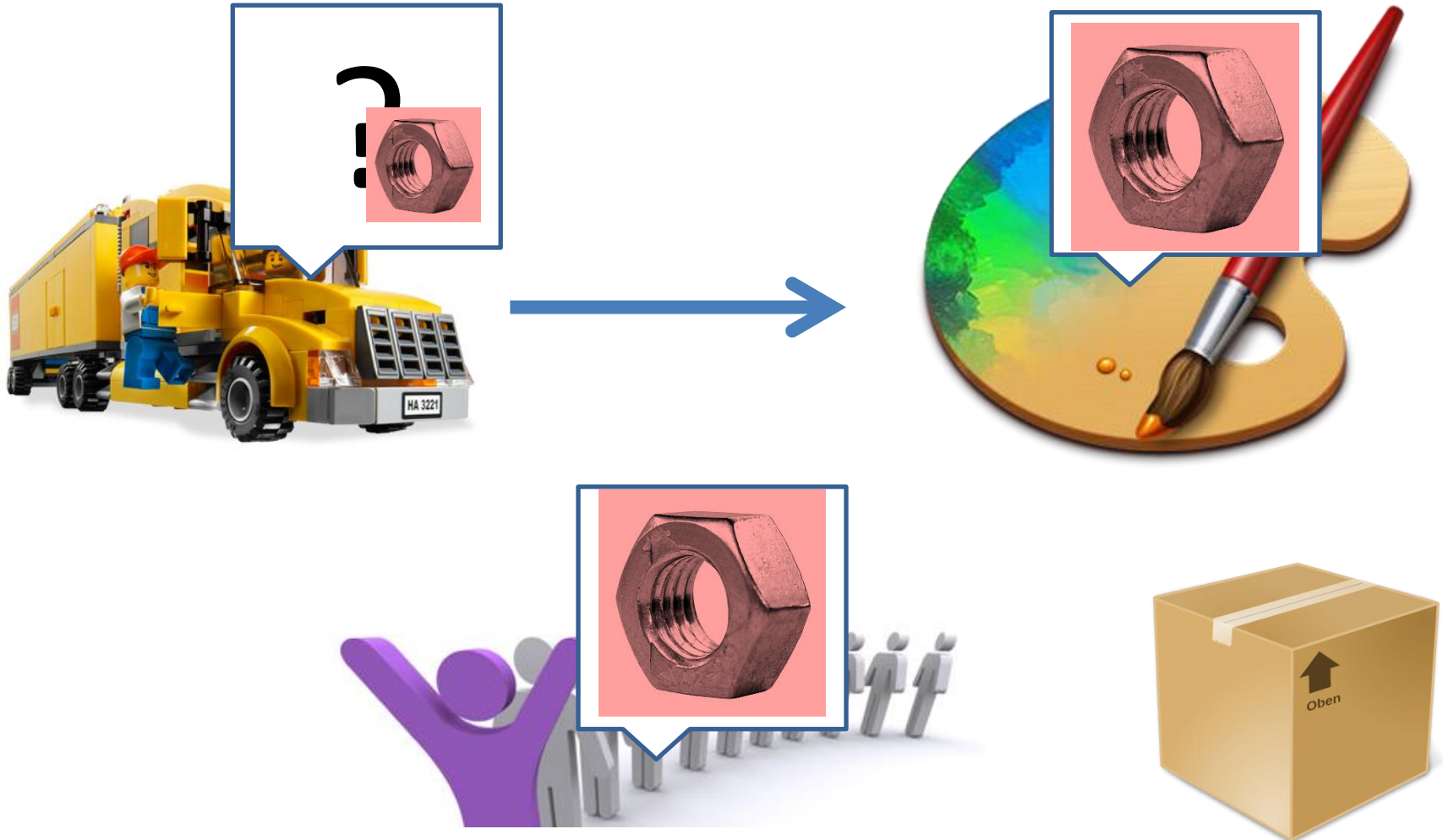
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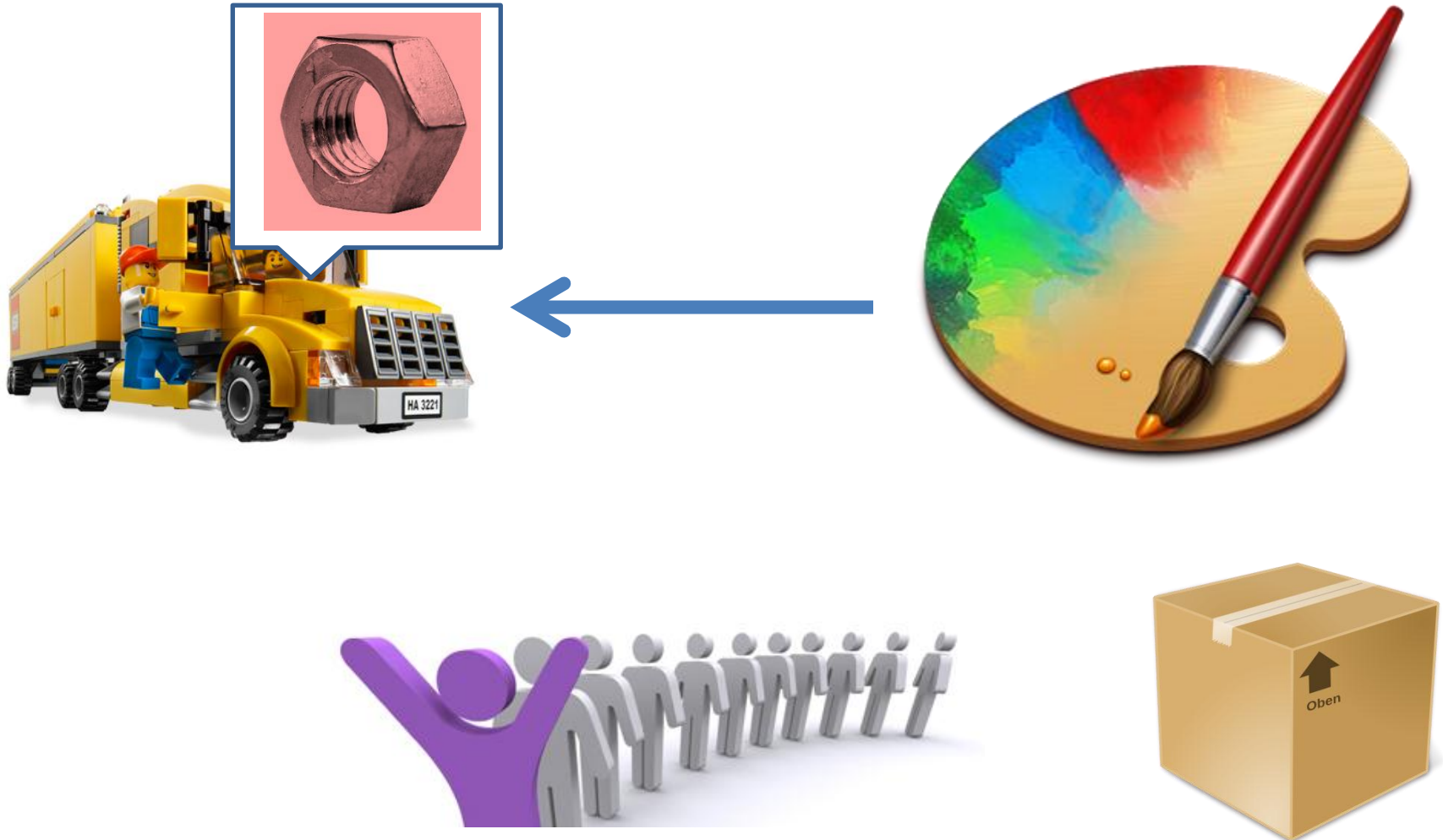
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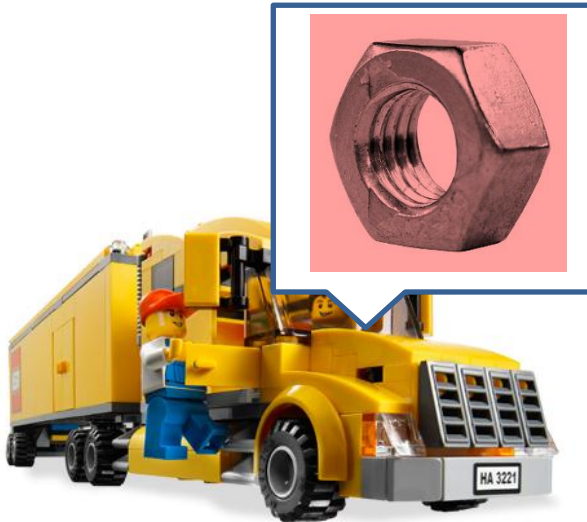
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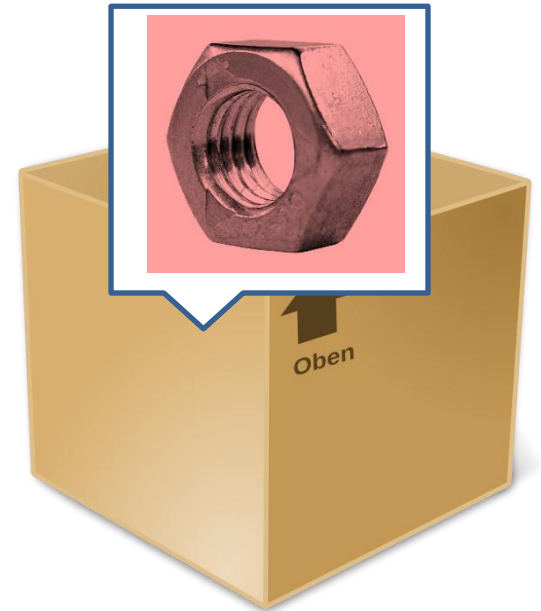
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Flow



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
 - One line solution (change priority number based on time left)

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

