
Pull System Workshop

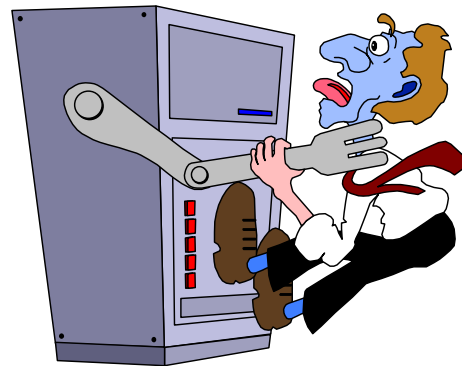
THE GOAL:

Directly link all processes - from the customer back to raw material suppliers - to improve responsiveness, shorten lead time, and reduce costs

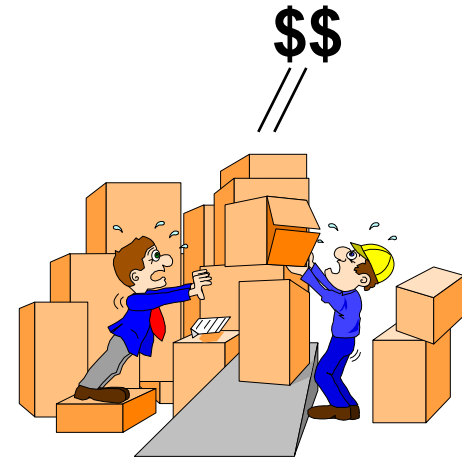
Why Use Pull Systems to Manage Inventory Buffers?



1. Start with invariably inaccurate forecasts

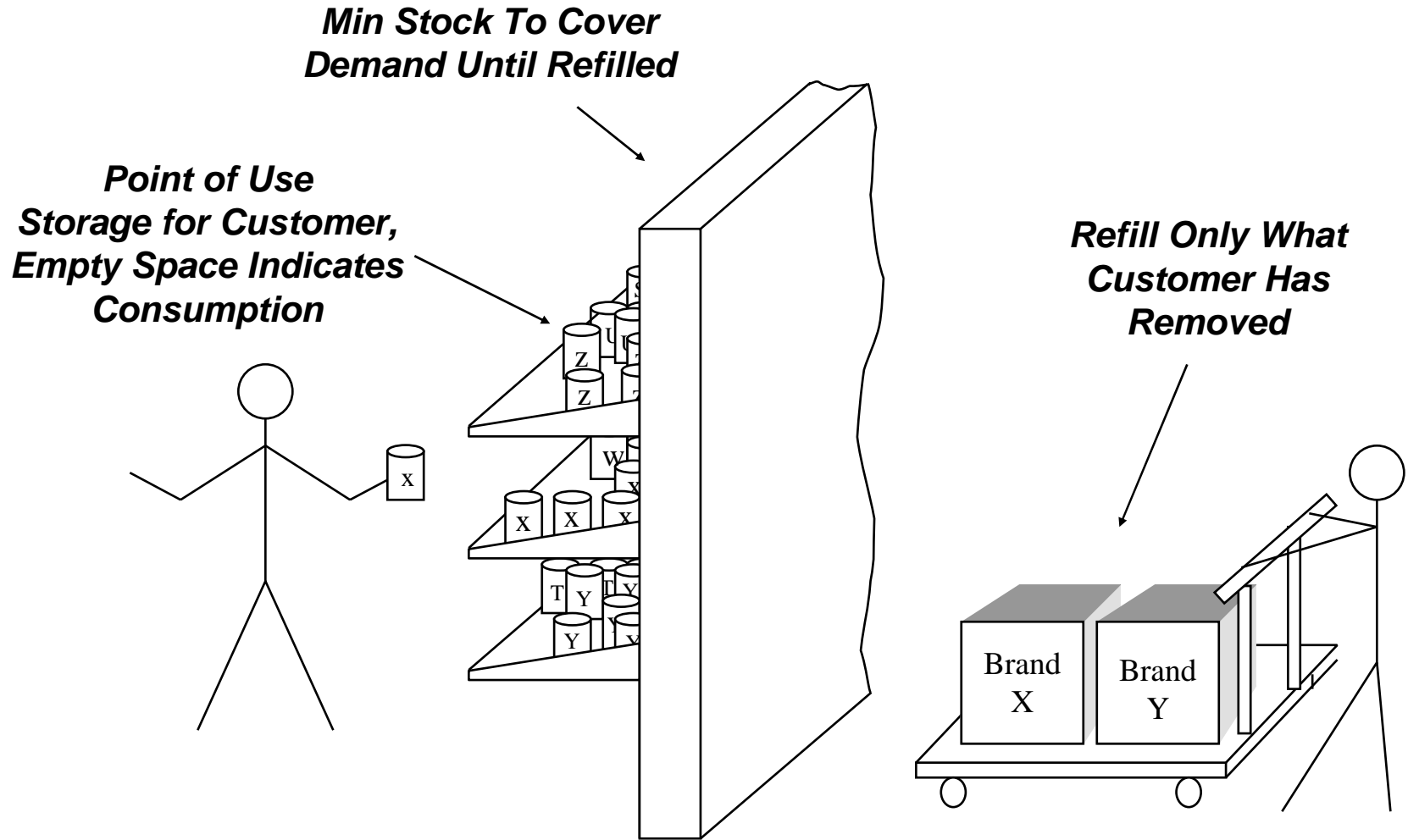


2. Add in the variability of real world operations

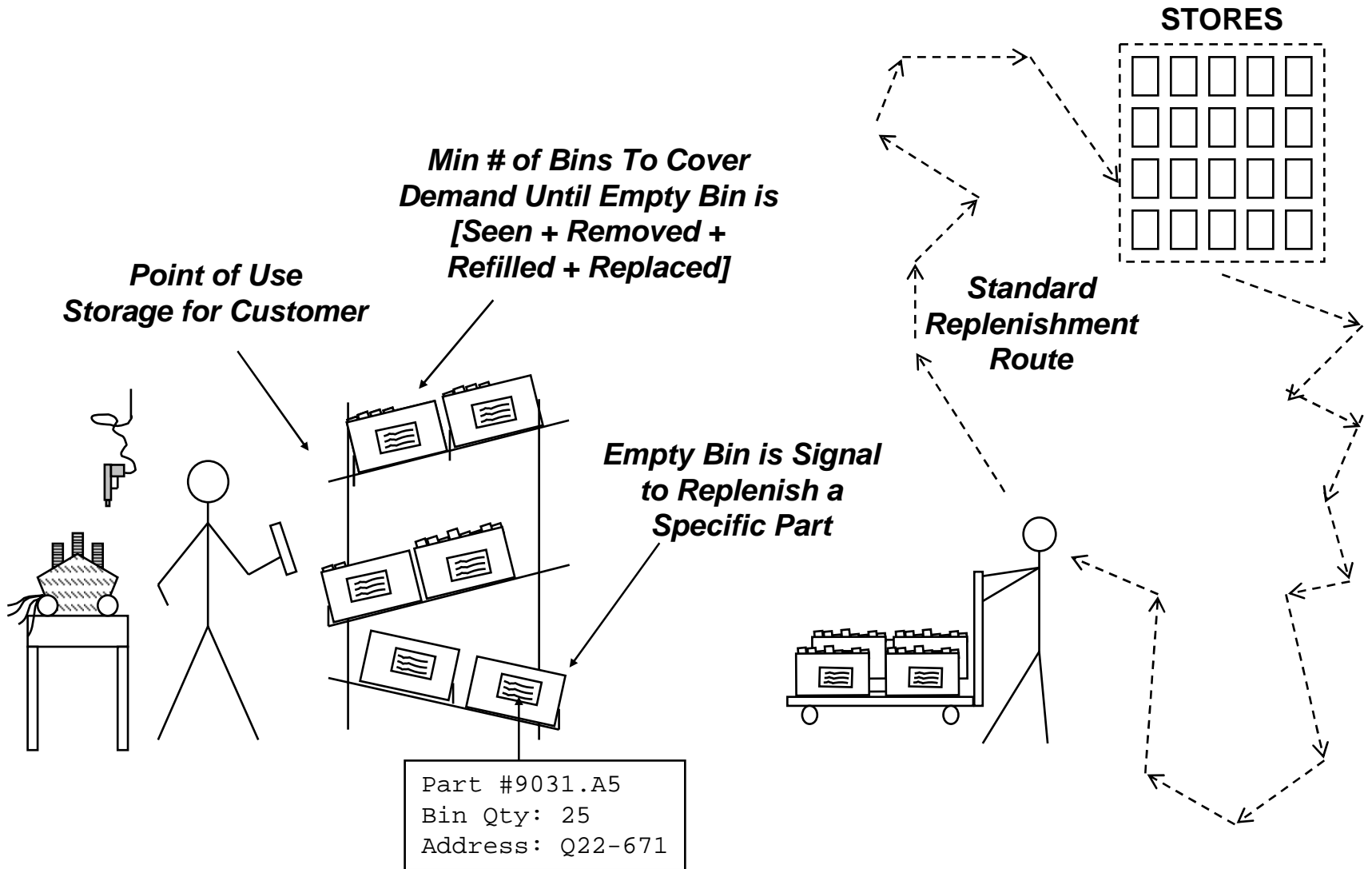


3. And you create large inventories of what you don't need and stock-outs of what you do need

What is a Pull System?



Mfg. Example of a Pull System



Process for Implementing a Pull System

1. Map the Current State



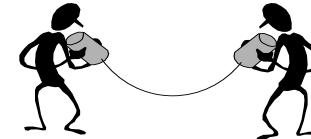
2. Address Barriers to Pull



3. Determine Customer Scheduling Strategy



4. Design a Communication System

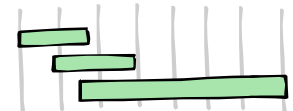
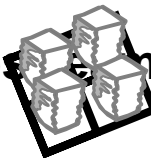


5. Train People to Use the Pull System

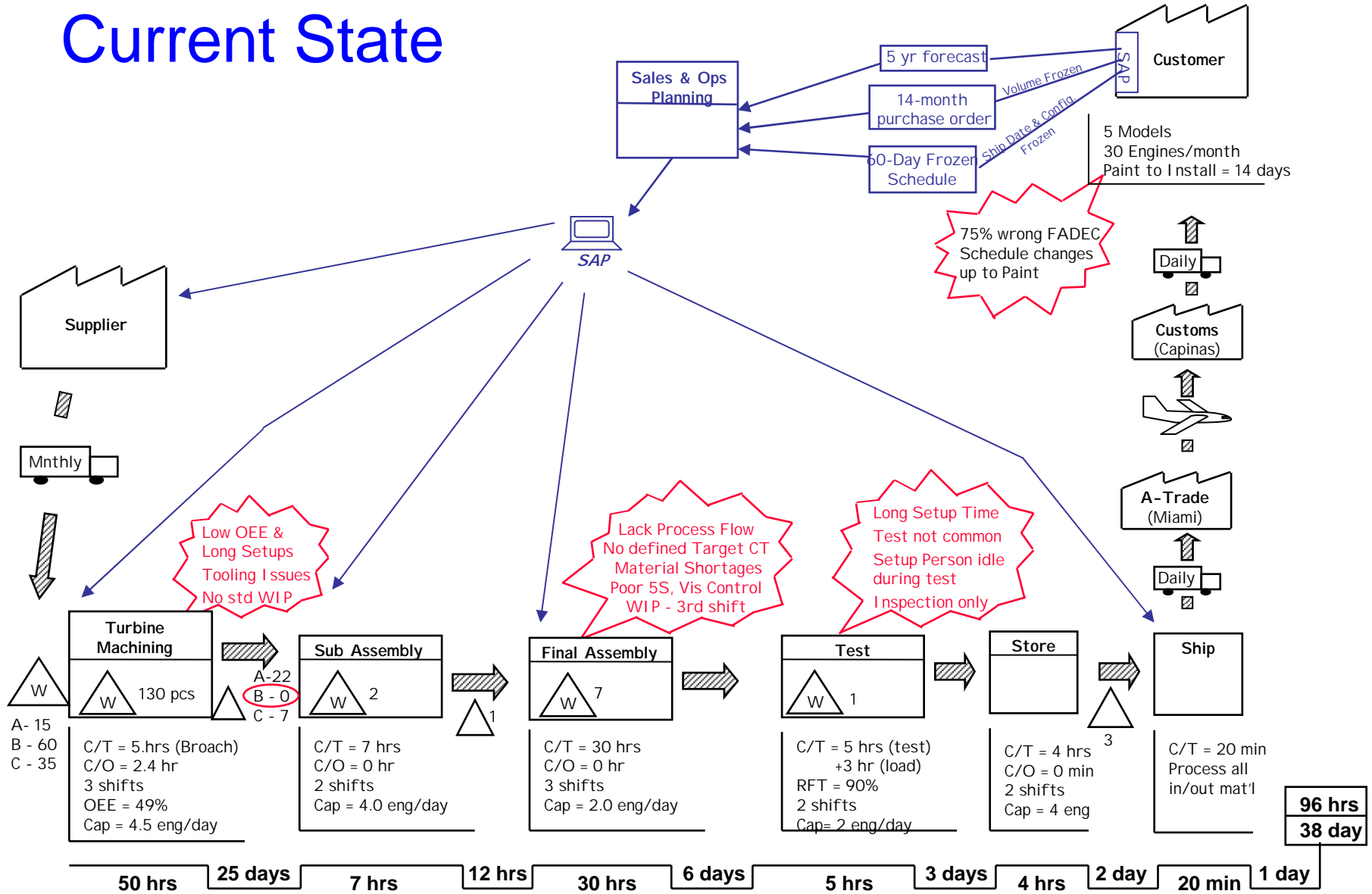
6. Define Inventory Locations



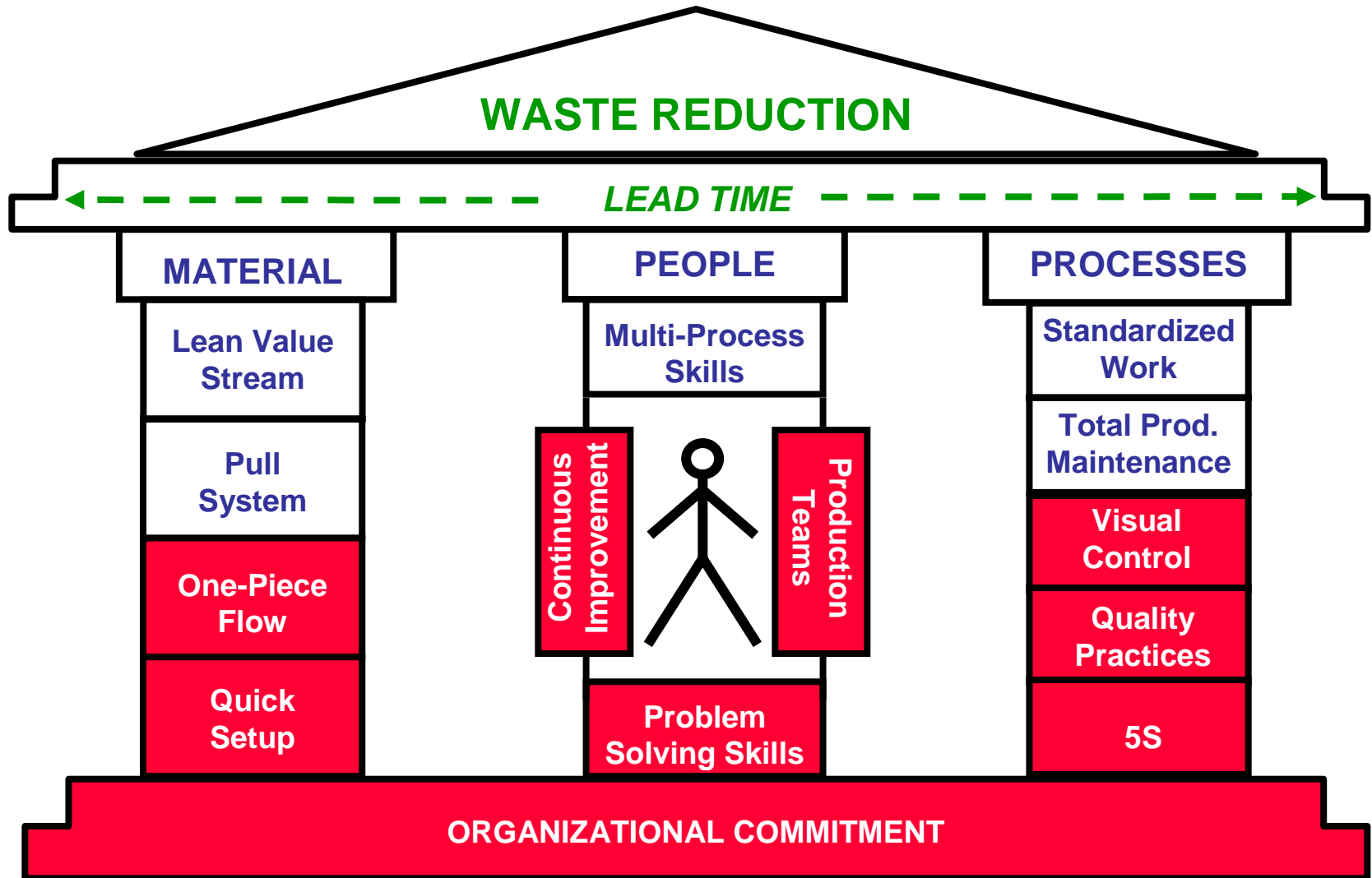
7. Start at Customer and implement upstream



1. Map the Current State

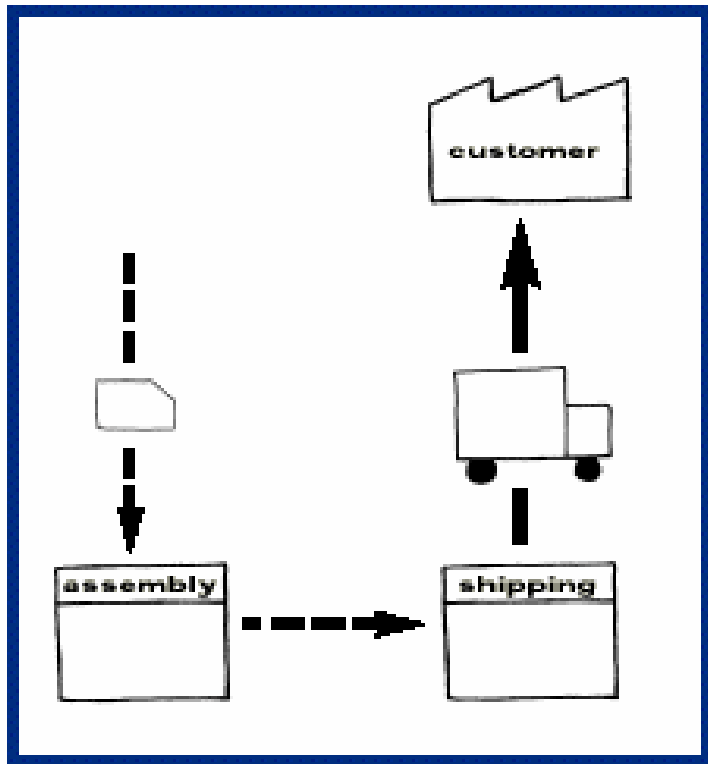


2. Address Barriers

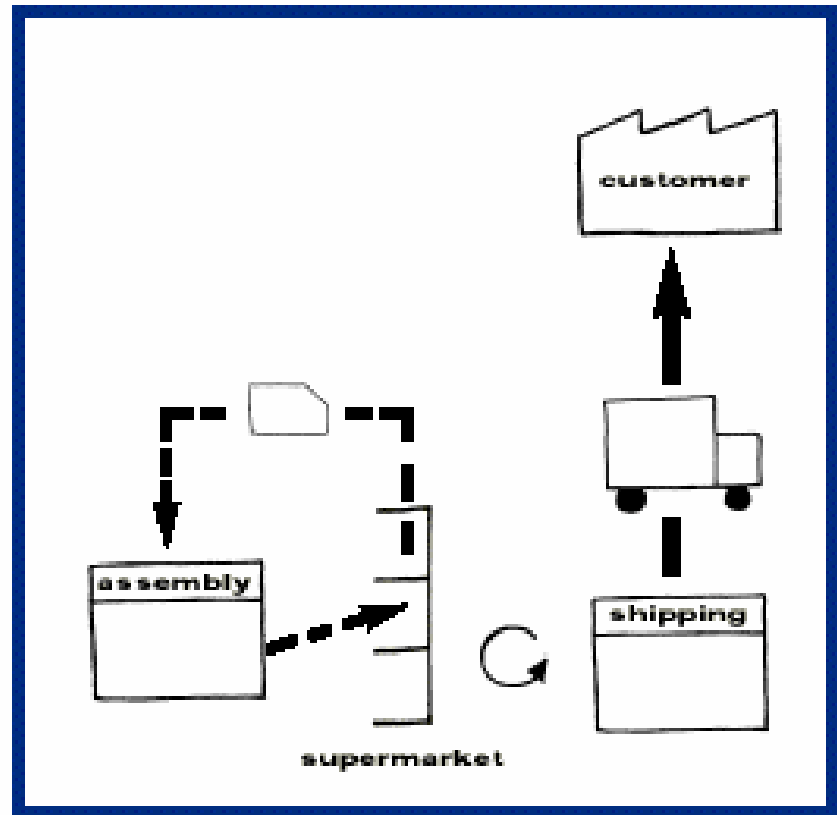


3. Determine Customer Scheduling Strategy

To Shipping



To Supermarket



Communicating Customer Orders to the Plant Floor

- **Send Customer Schedule to Only One Point in your Manufacturing Process**
- **Select point furthest upstream that flows continuously to customer**
- **Avoid including or correct processes that corrupt the customer order sequence**
- **Order-to-Delivery lead time will determine the customer's inventory requirements**
- **Level the schedule to the Production Floor**
- **Consider using a Sequence Pull versus a Conventional Pull System to reduce buffer requirement**

Leveling Production

Determine Demand for Each Product

Model A = 160/month

Model B = 80/month

Model C = 40/month

Level the Daily Volume

Total Volume = $160+80+40 = 280$

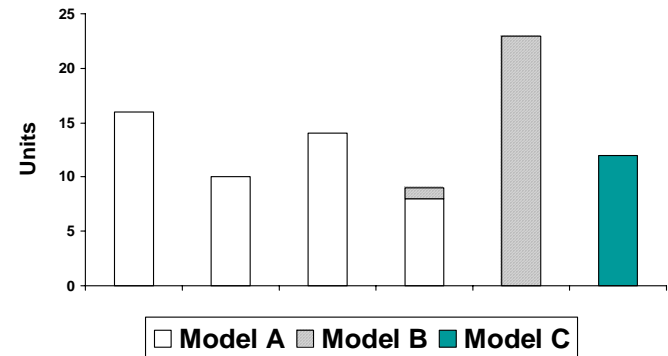
Daily Volume = $280 / 20 \text{ day/month} = 14$

Level the Sequence

Ratio (A:B:C) = $160:80:40 = 4:2:1$

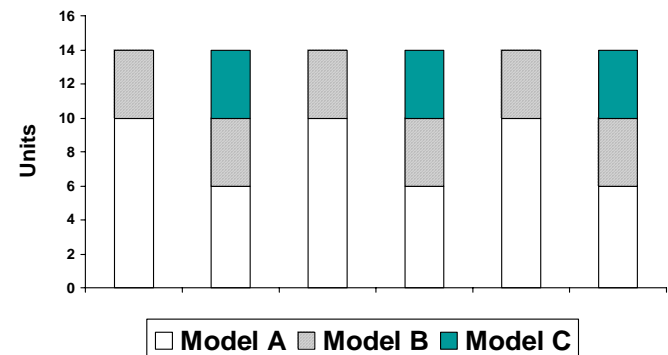
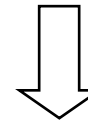
Batch Size = 4 Parts

Sequence = 4A-4A-4B-4A-4A-4B-4C



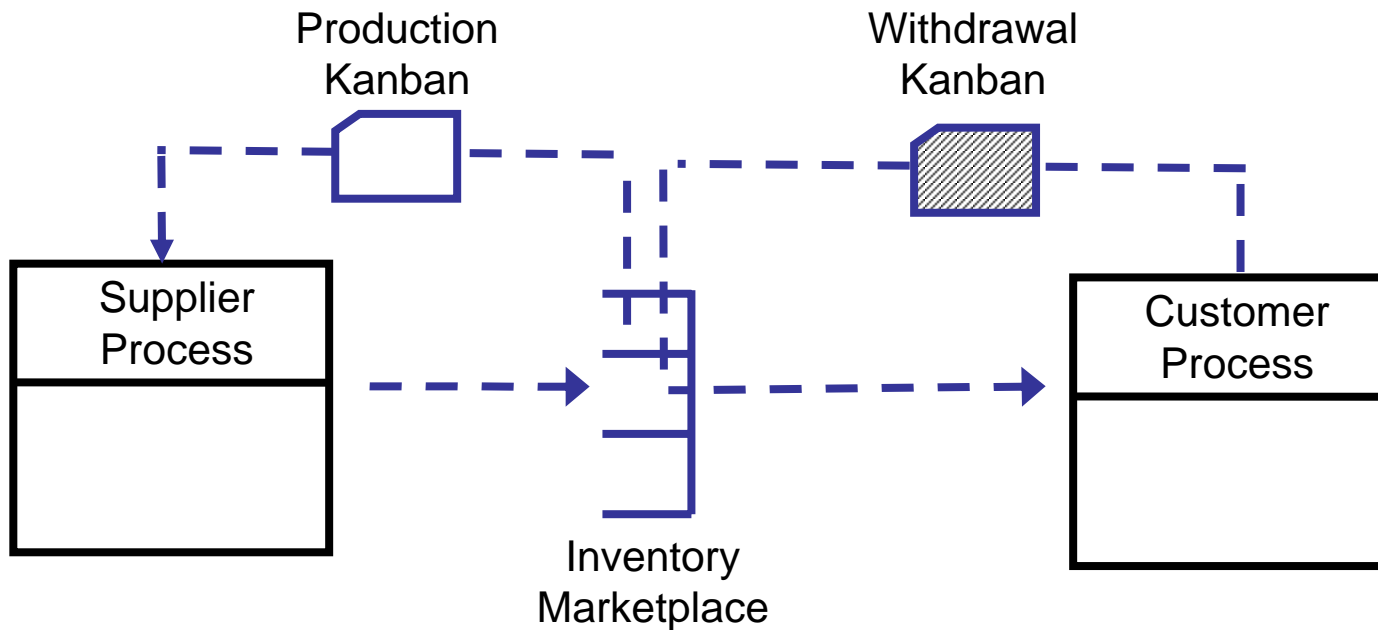
Parts
Month

Parts
Day



4. Design a Communication System

Kanban: Any signal used to directly communicate production or delivery information between those people performing the work




Types of Kanban

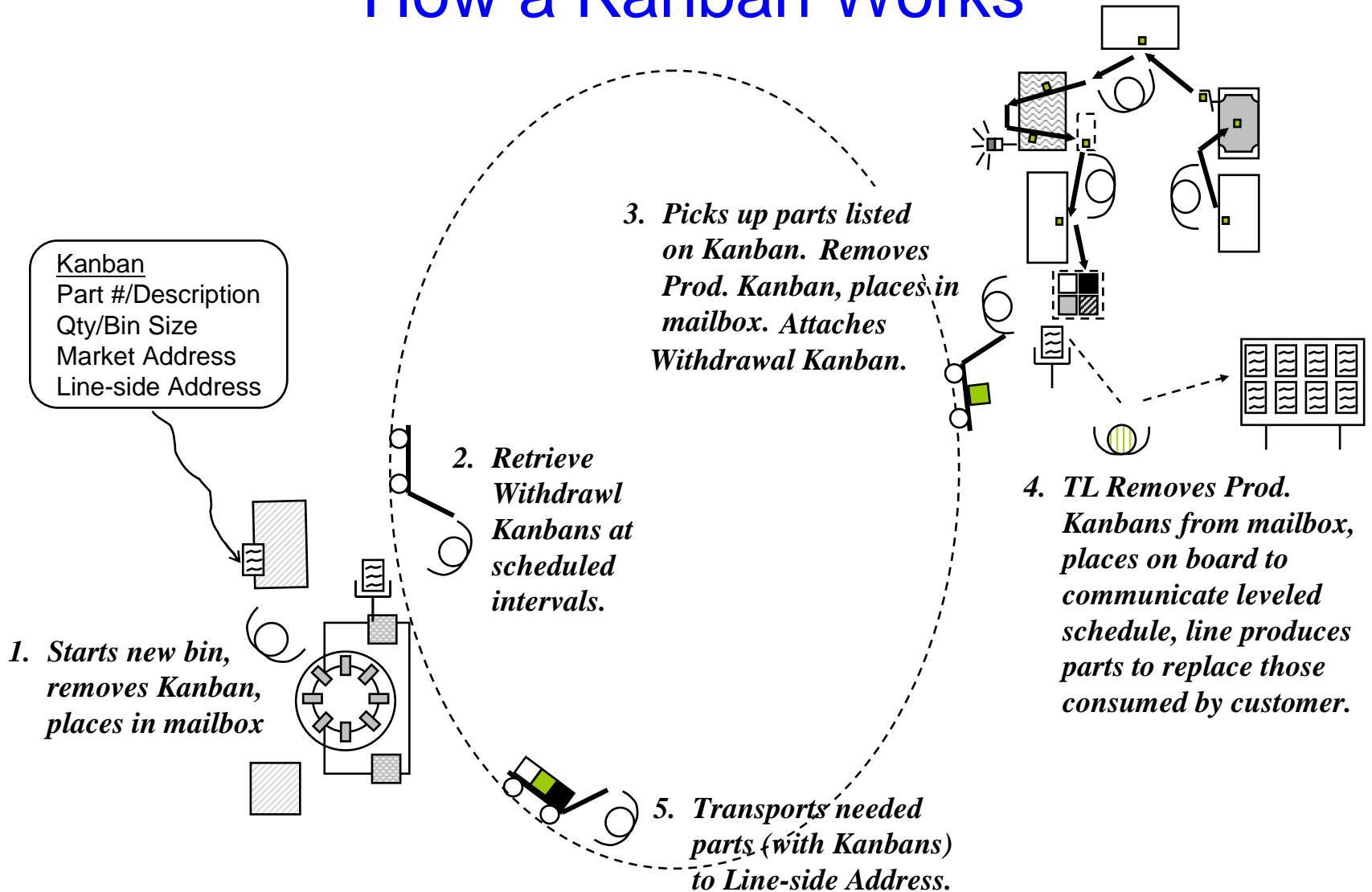
- **Production Kanban**
 - **Signal (or Triangle):** Processes with long setup times
 - **Call:** Where use of a physical card is not practical
 - **Regular:** All other Production Kanbans
- **Withdrawal Kanban**
 - **Stock:** Material is pulled from in-house storage location
 - **Supplier:** Material is ordered from external supplier

Production Kanban

- Contains all information needed to communicate a production order or a delivery order
- One Kanban per bin of parts
- Different forms:
 - Cards
 - Empty Bins
 - Floor Location
 - Call Light
 - Electronic

Market Address or Preceding Process LPT-37-125	Kanban Number 6281	Line-Side Address EBB-289W-5
Pick-up Times 0930 1730	Part Number VW8005673-S56	Route S5
Part Description BOLT – M8x1.25x1.8, HEX FLANGE		
		
Supplier ACME BOLT COMPANY	Quantity 80	Dock Number SOUTH - 3

How a Kanban Works



Kanban Calculations

$$\text{Number of Kanban} = \frac{\text{Daily Output} * \text{Lead Time [Mfg + Kanban + Safety]}}{\text{Parts per Bin}}$$

- **Daily Output = Monthly Output / Workdays per Month**

- **Lead Time =**

Time to Manufacture Part + Time to Process Kanban + Safety Factor

Signal Kanbans

Preceding Process LPT 125B		Subsequent Process TSA 11-4	
Kanban #	DB 02	Part Name	Upper Liner Blank
Material Size	24" x 8" x 8"	Container Capacity	25
Lot Size	50	Number of Containers	2

Advance Notice for Next Production Lot

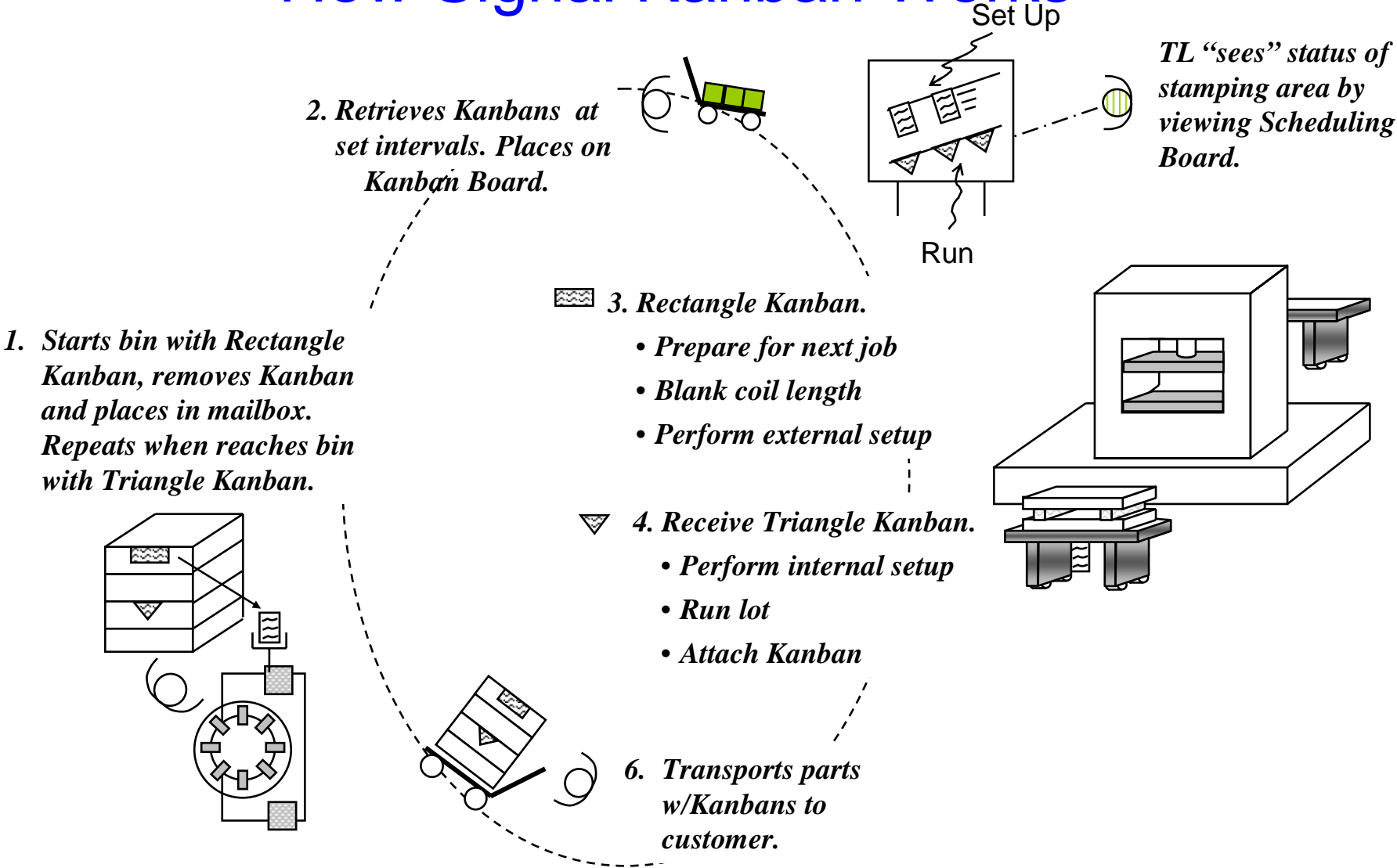
- **Prepare Raw Mat'l**
- **Perform External Set Up**

Lot Size	Part Name	Reorder Point
50	Upper Liner Blank	10
# of Bins	Part #	Bin #
2	E2340098	1
	Storage Location	
	DS 422	
	Pick Up Point	
	PL 11-2	

Signal to Run Next Production Lot

- **Complete Internal Setup**
- **Run Lot to Kanban Requirements**

How Signal Kanban Works



Signal Kanban Calculations

Reorder Point =
(Rectangle)

$$\frac{\text{Daily Output} * \text{Lead Time [Mfg + Prep + Kanban + Safety]}}{\text{Parts per Bin}}$$

Reorder Point =
(Triangle)

$$\frac{\text{Daily Output} * \text{Lead Time [Mfg + Kanban + Safety]}}{\text{Parts per Bin}}$$

- Prep is the critical-path time needed to prepare for the production run to include external setup and cutting of raw material

5. Train People to Use the Pull System

1. **Never send defective products downstream.**
2. **Downstream process draws from upstream processes only what is required by the Kanban.**
3. **Upstream process produces items in exact quantity and sequence indicated by the Kanban.**
4. **Never produce or convey parts without a Kanban.**
5. **Attach Kanban to the actual container of parts.**
6. **Use Kanban to fine tune the production system.**

6. Define Inventory Locations

Before



After



If you had only 30 seconds to find the unit...

...which storage system would you choose?

7. Start at the Customer and Implement Upstream

- **Initial buffers may be large to account for long lead times or unstable processes**
- **Reduce buffer sizes over time as implement improvements upstream and gain confidence in the system**
- **Avoid using your ERP system to communicate customer pull signal to the plant floor**
 - Streamline the communication/scheduling process connecting your customer to your plant floor
 - Use ERP for capacity planning and long-lead suppliers
- **Implement Material-Information Loops starting at shipping dock and working upstream**

Future State Map

