



Leveraging ROS-Industrial to Deliver Customer Value

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Mobile Robotics Manager

3/7/18

Bastian Solutions



- Established in 1952
- 629 Employees
 - 305 Engineers
- 300+ Suppliers
- 5000+ Customers



Bastian

SOLUTIONS



Bastian
SOFTWARE SOLUTIONS



Bastian
CONSULTING



Bastian
CONTROLS



Bastian
ROBOTICS



Bastian
MOBILE ROBOTICS



Bastian
AUTOMATION
ENGINEERING



Bastian
ZIPLINE CONVEYOR



Bastian
INTERNET OF THINGS

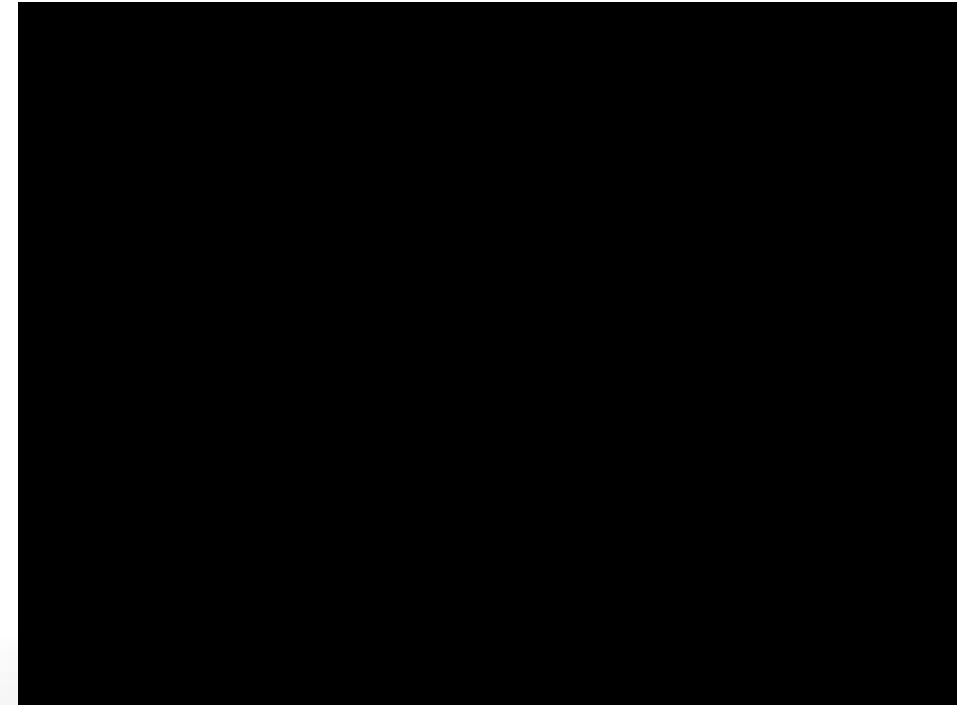


Bastian
COMPOSITE PALLET GROUP

Bastian
SOLUTIONS

Background

- The Challenges

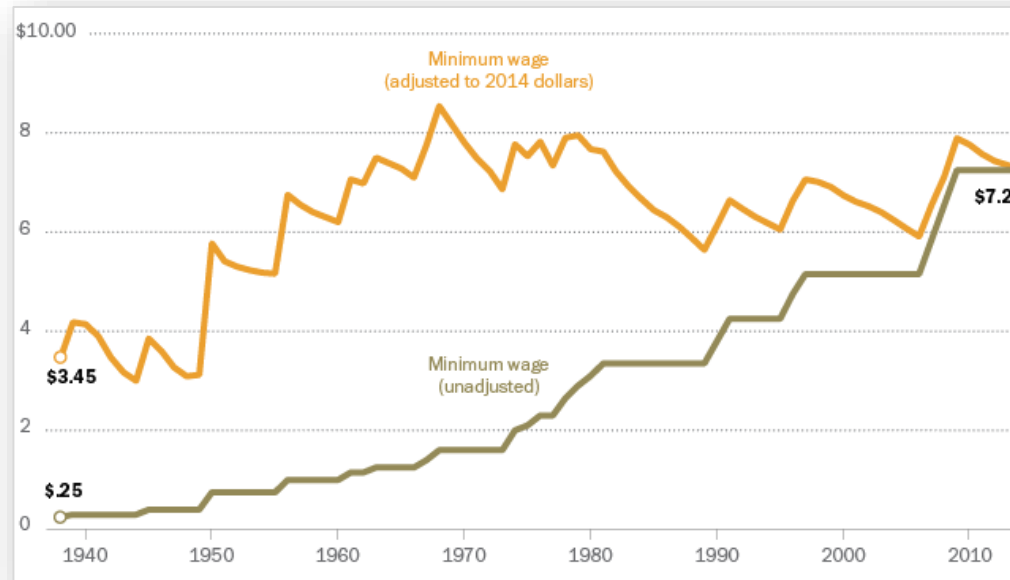


Background



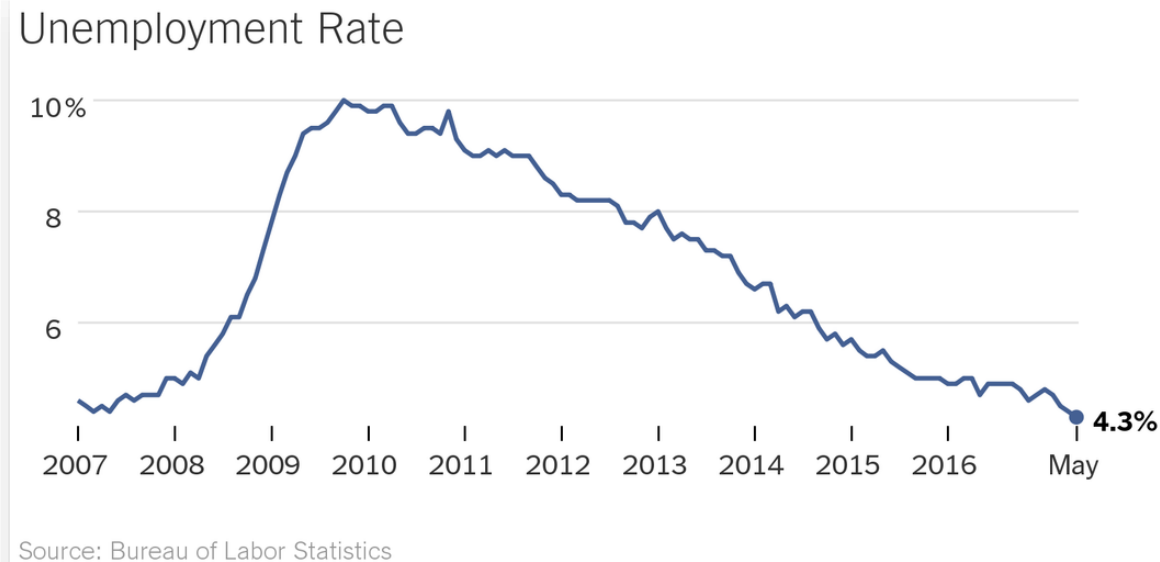
Enabling Trends

- Labor Costs: Minimum Wage



Enabling Trends

- Labor Costs: Unemployment Rates



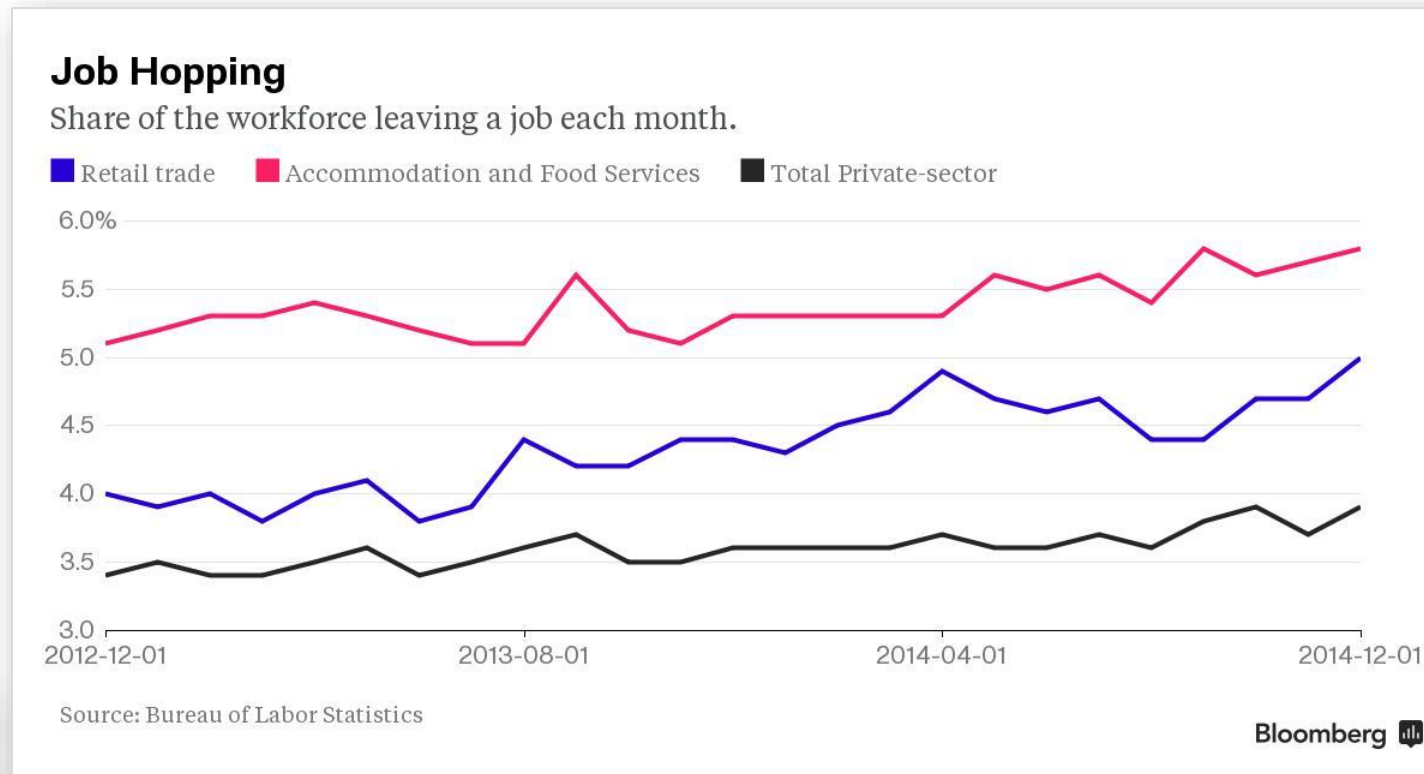
Enabling Trends

- Labor Costs: Seasonal Demands Difficulties



Enabling Trends

- Labor Costs: Employee Turnover



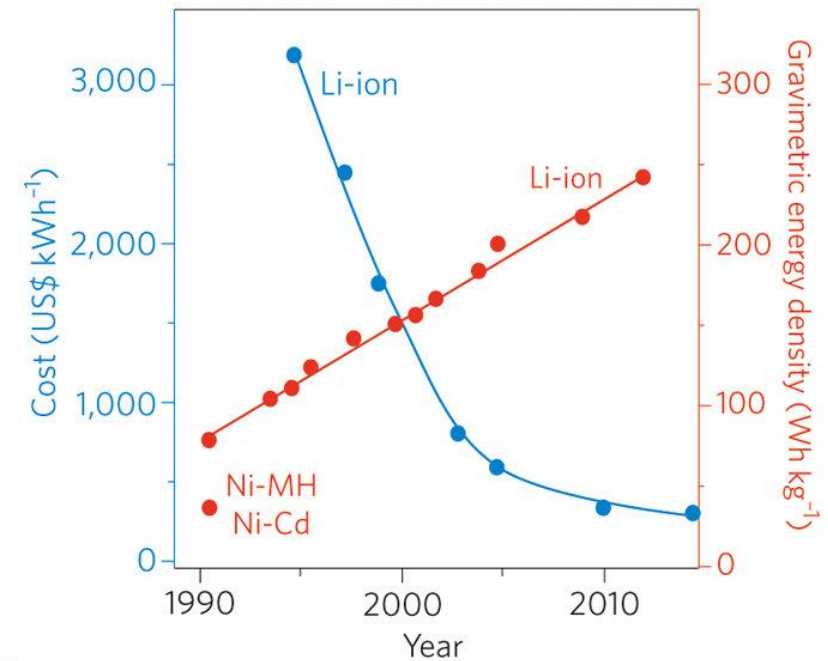
Enabling Trends

- eCommerce
 - Order complexity
 - High SKU numbers
 - Larger warehouses
 - Returns
- Next day, same day, next hour
- +flyers etc
- Connection to last mile transportation (expensive)



Enabling Technologies

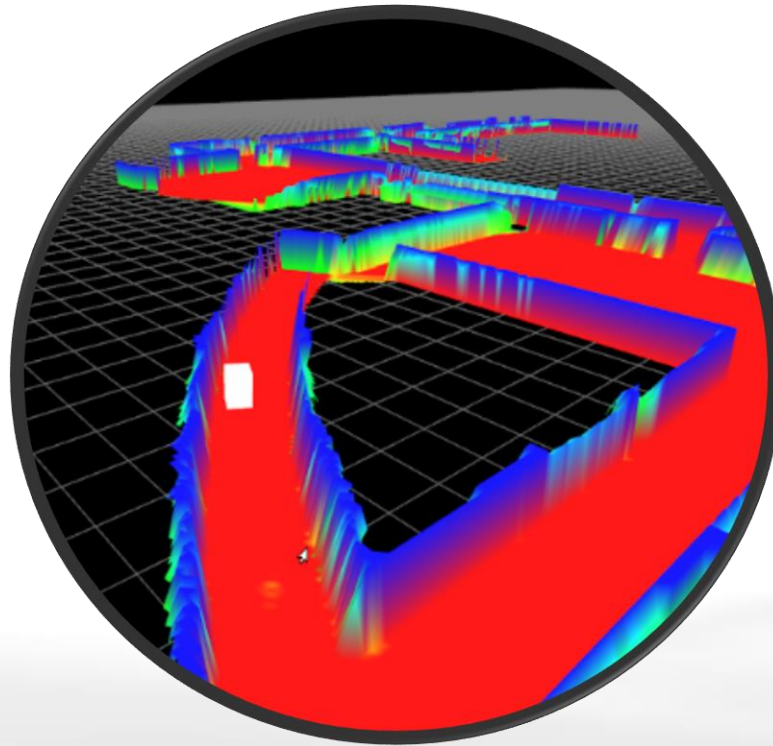
- Energy Sources



Crabtree, G., Kócs, E., & Trahey, L. (2015). The energy-storage frontier: Lithium-ion batteries and beyond. *MRS Bulletin*, 40(12), 1067-1078. doi:10.1557/mrs.2015.259

Enabling Technologies

- Sensors & Navigation Systems



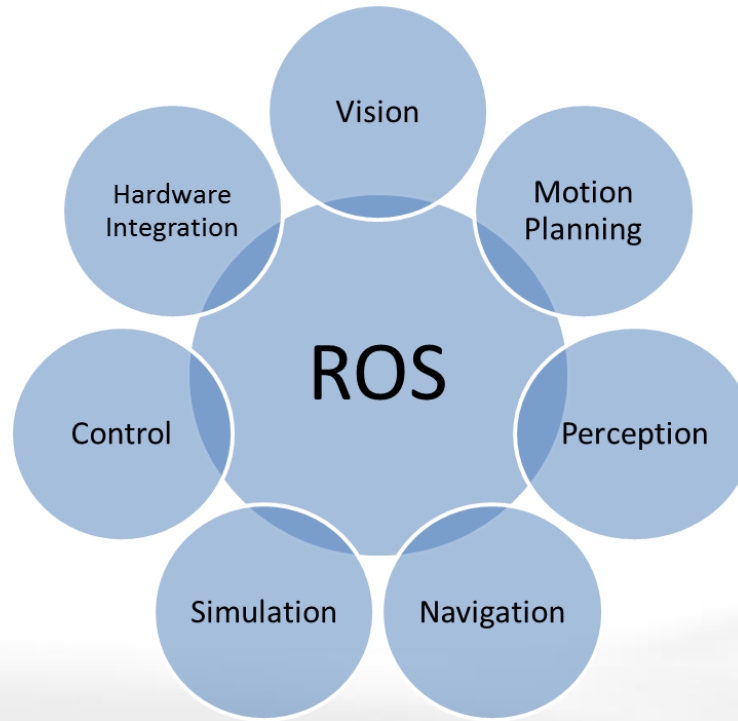
Enabling Technologies

- End-of-Arm Tooling



Enabling Technologies

- ROS



Advantages of Mobile Robots

- Higher throughput rates
- Minimize employee turnover
- Greater reliability (no downtime)
- More efficient
- Labor optimization
- Scalable and modular solution for shifting market demands
- Greater cube density
- Short payback period (1-2 years)
- Energy Saving

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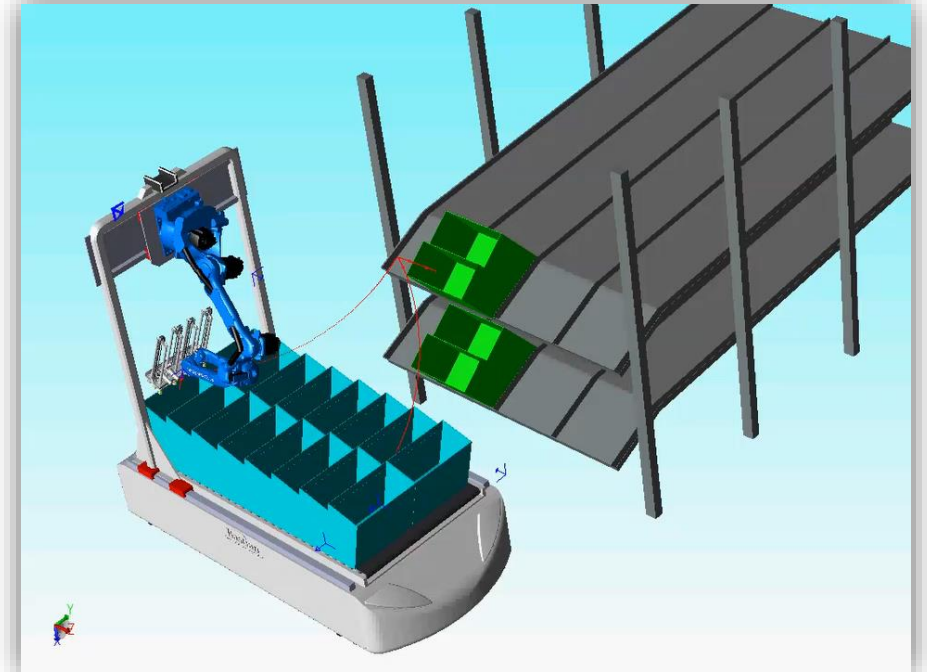
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Batch Picking Mobile Robot



Patent #62215948



Batch Picking Mobile Robot

- 1** 6-axis Robot
Payload: 12+ kg
Custom End of Arm Tool

- 2** ROS Industrial
Open Source

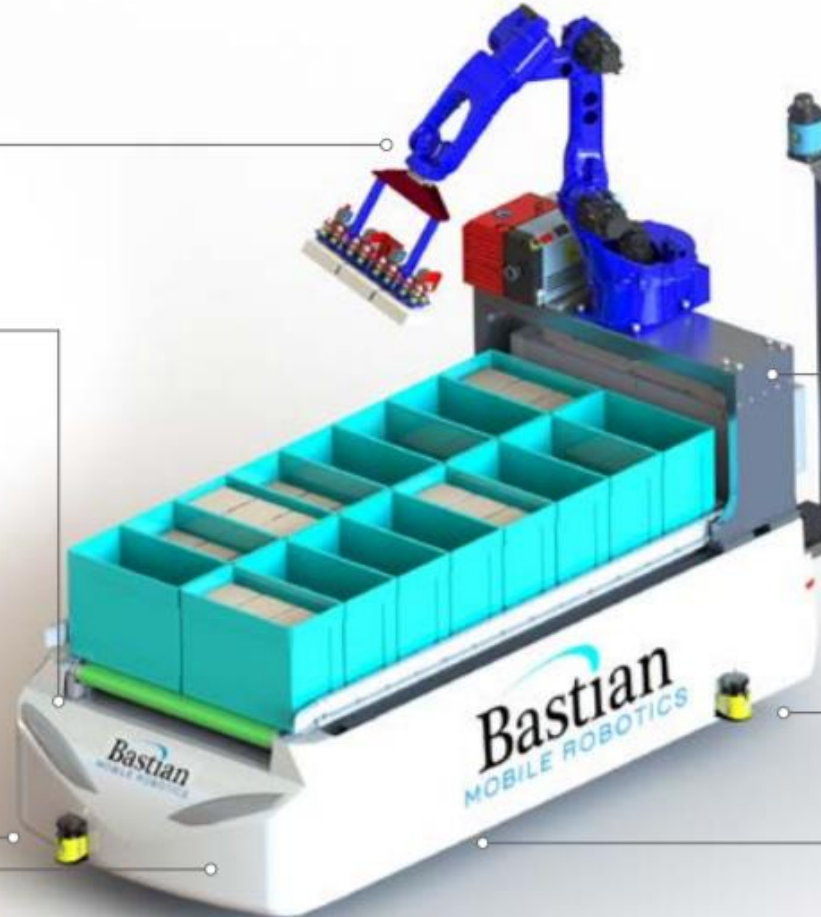
- 3** Opportunity Charging
Wireless Charging
Ultracapacitors

- 4** Singular Controller
Seamless & Dynamic Motion
Controls up to 62 Axes

- 7** Navigation
Obstacle Avoidance
Fleet Management
Conforms to Safety Standards

- 6** Gantry
Batch Picking
Multiple Orders
Highest Throughput Rates

- 5** Omnidirectional Wheels
Speed: 230 ft/min
Payload: 1,000+ lb
9 ft x 4 ft



Mobile Robot-Fleet Management



Euler- SwRI



Mobile Robot-ProMat April 2017

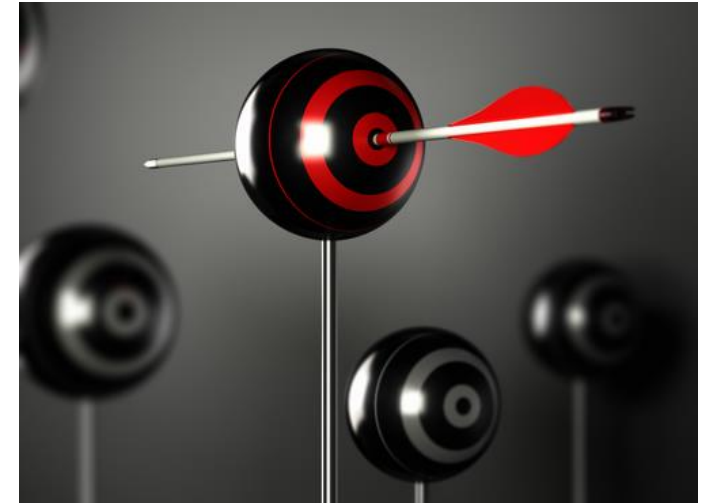


Batch Picking Mobile Robot: Features

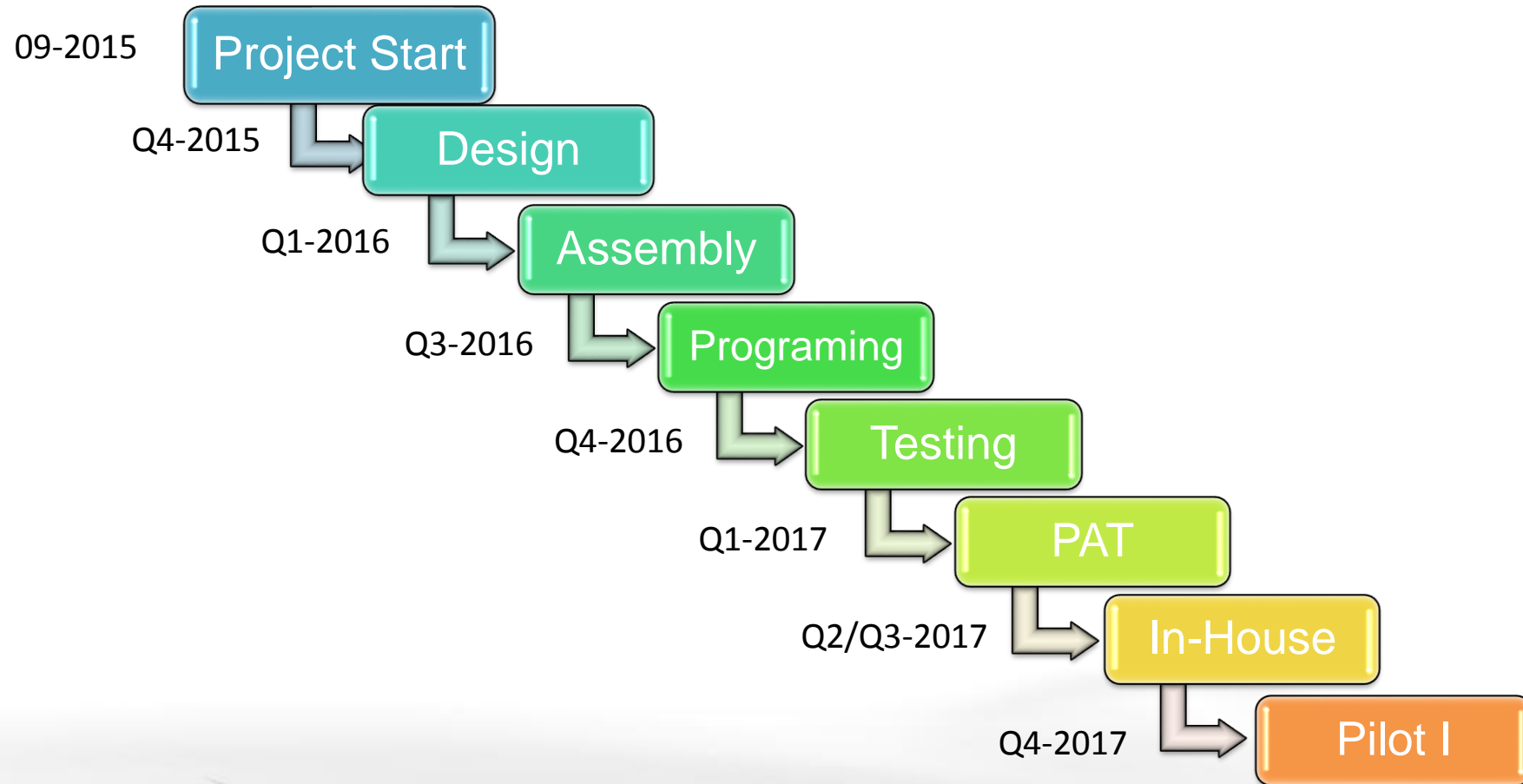
- **System throughput rates example with 7 Robots:**

1200 Orders/hour = 115k Lines/hour

- **Vehicle top speed:** 230 fpm
- **Positioning precision:** +/- 6 mm (+/- 10 mm at full speed)
- **Capacitor life:** 1 Million cycles (10 years)
- **One charge** = 60 minutes of power
- **Meets AGV Safety Standards ANSI B56.5**



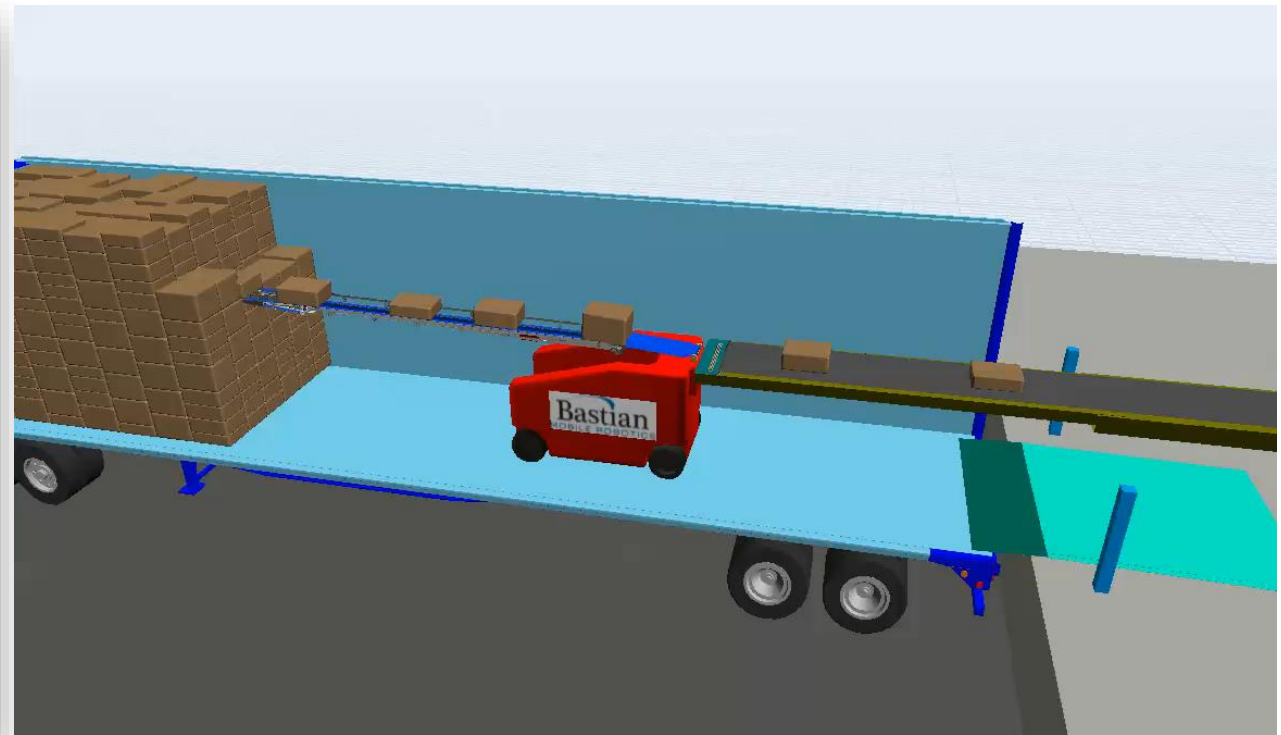
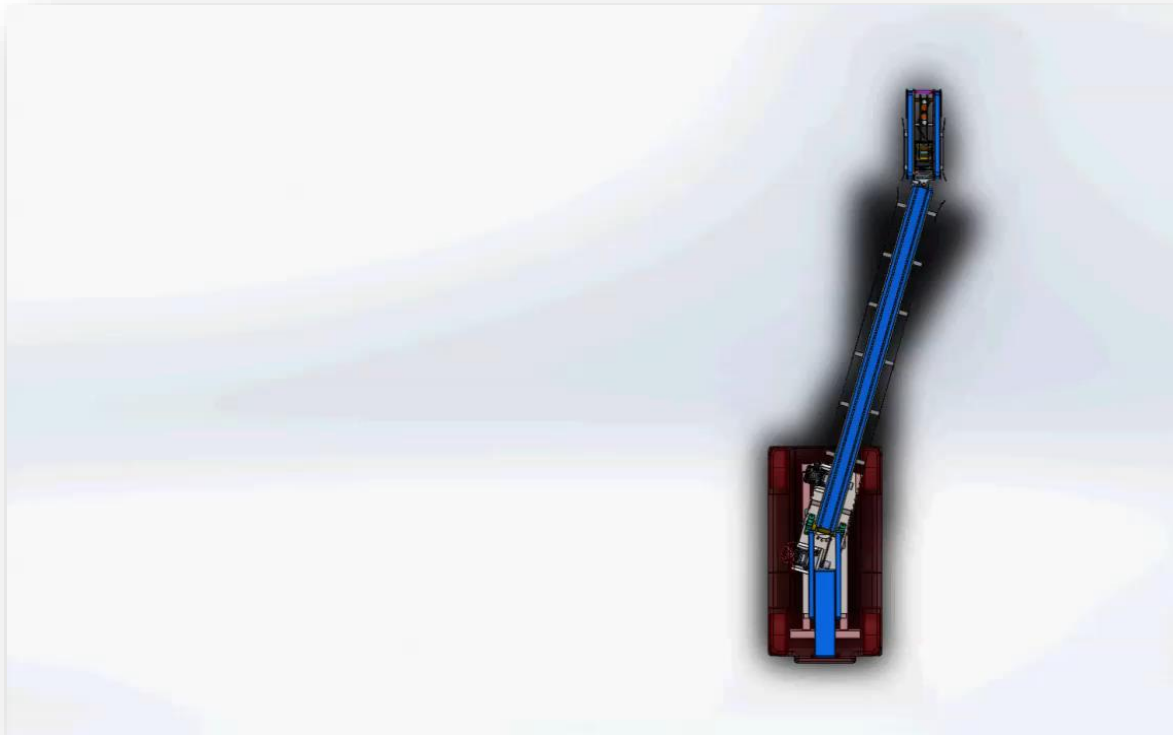
Mobile Robots



Truck Loader/Unloader



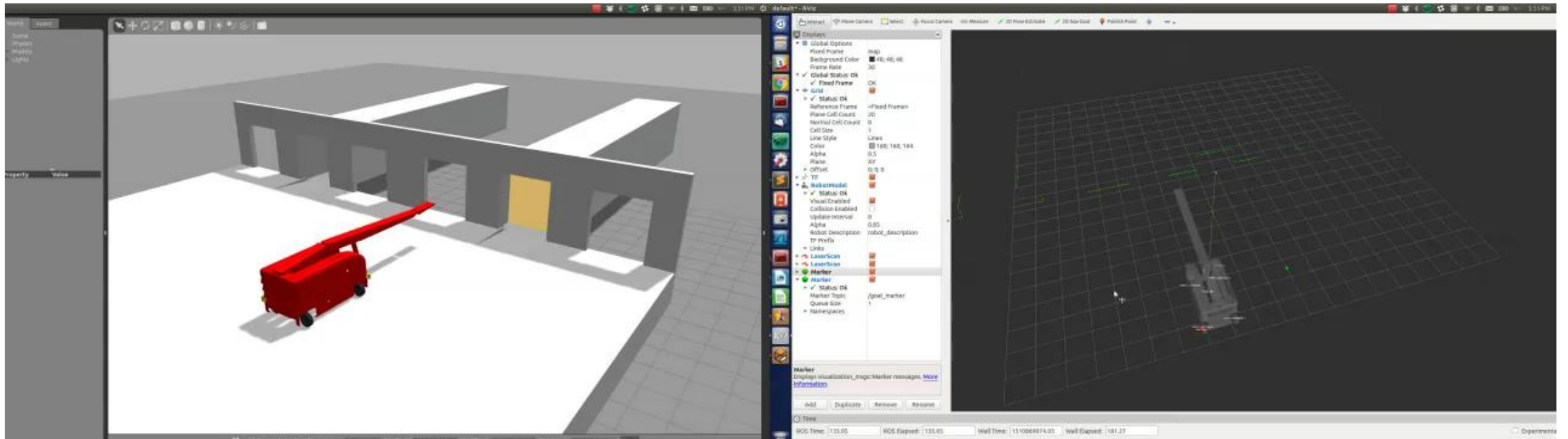
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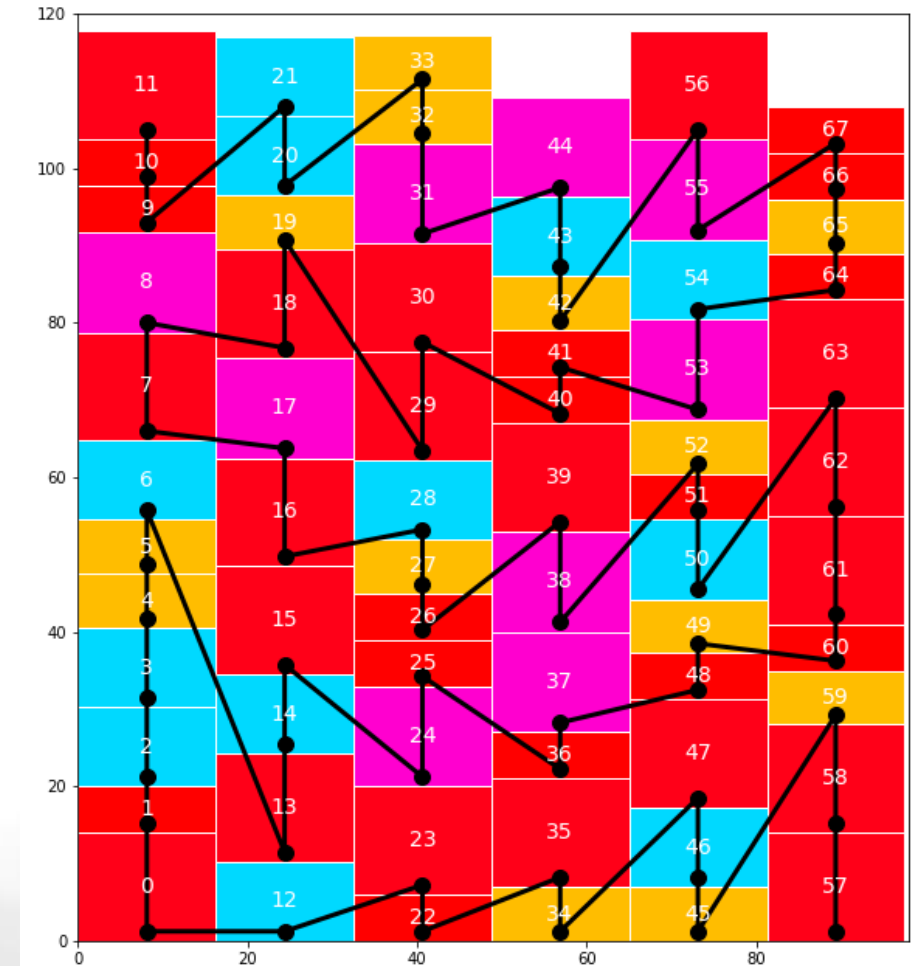
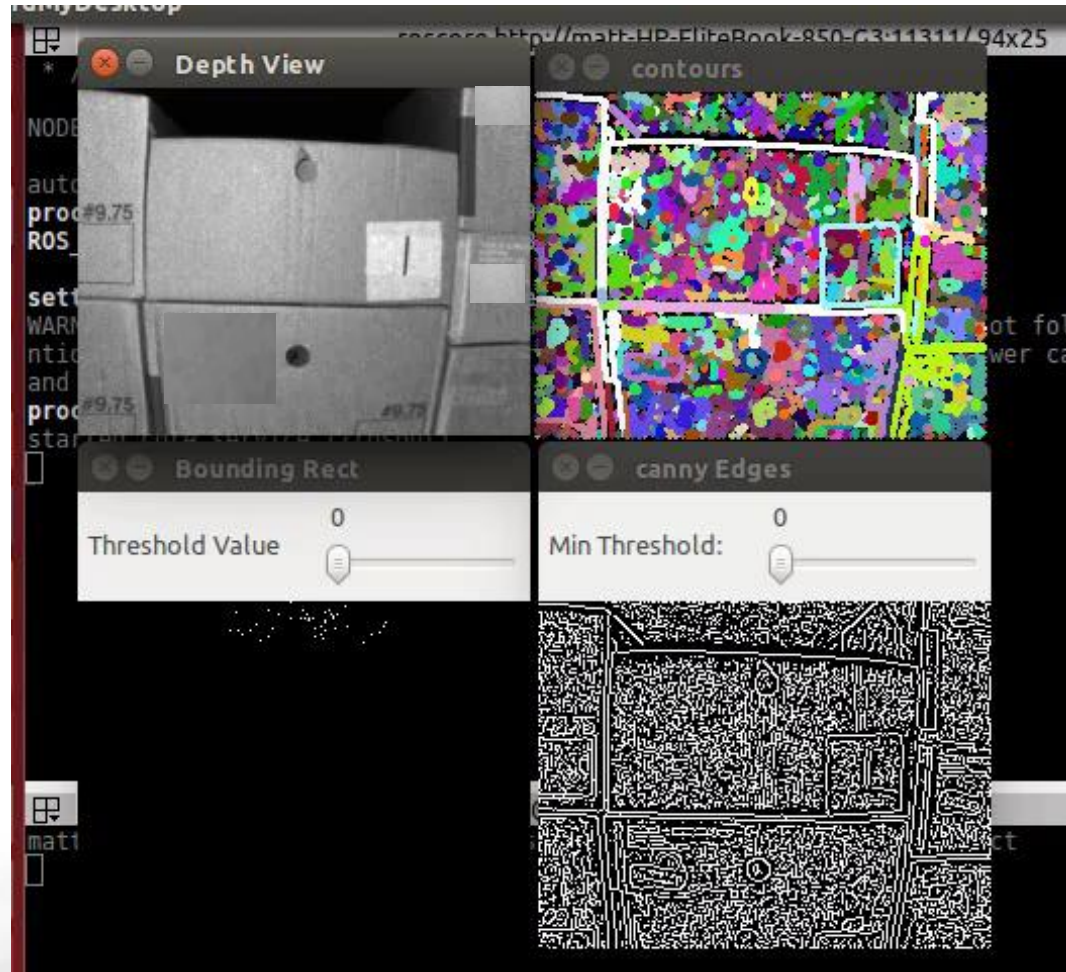
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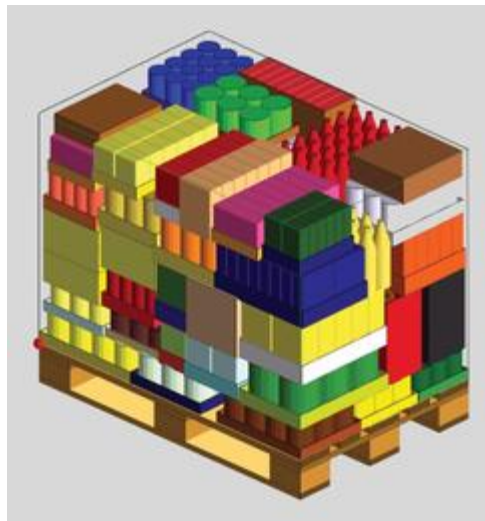
Navigation



Vision

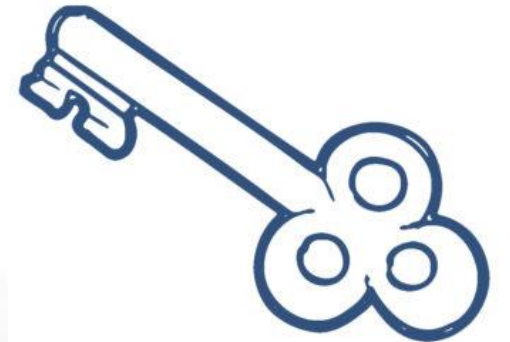


R&D Projects

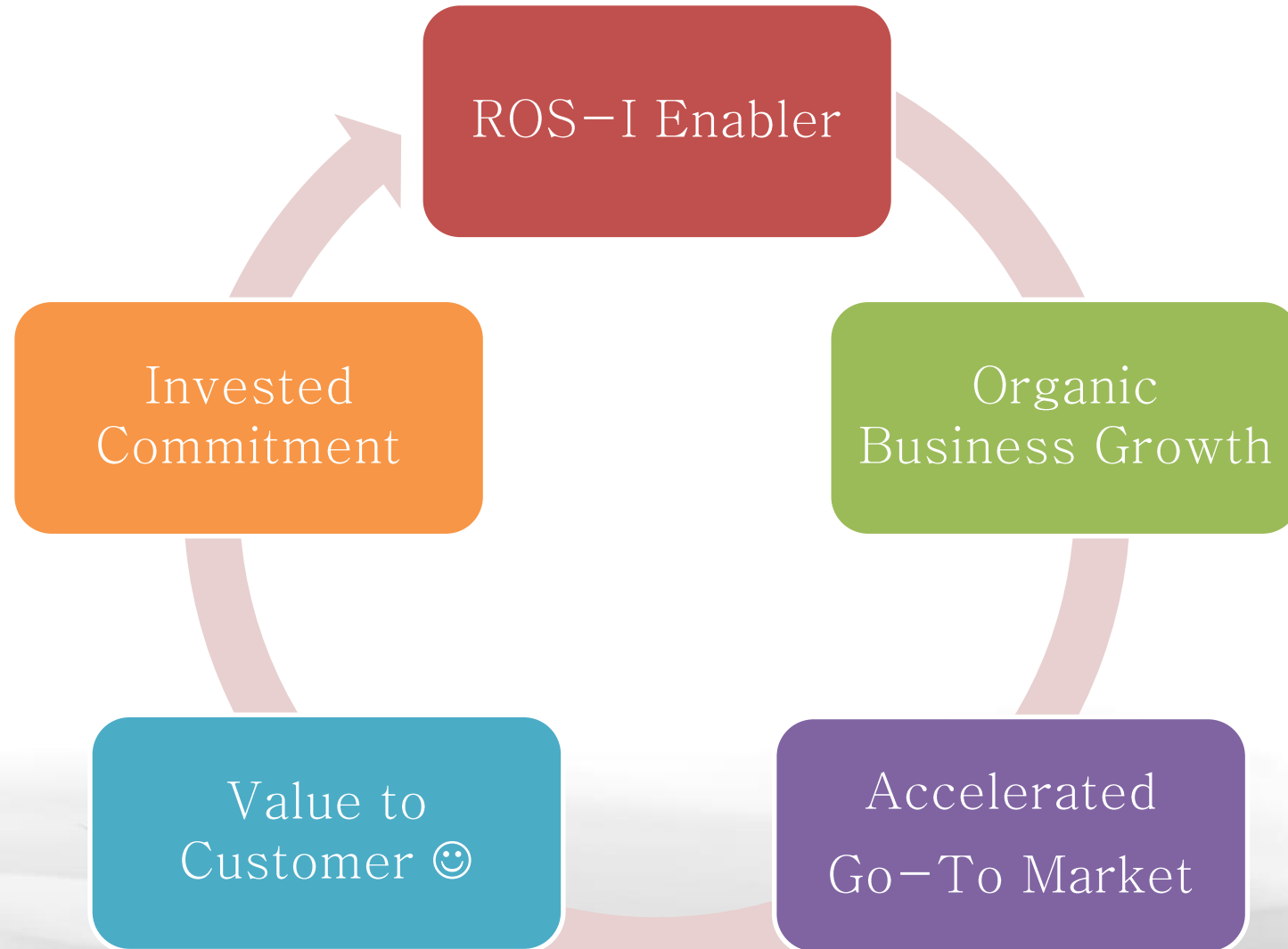


Summary

- ROS-I has been Key enabler for our advanced robotic divisions at Bastian Solutions
- Move It, Descartes, Simple Message Protocol, Perception, Euler, TF, and industrial robot client. + Other tools and libraries available in ROS: Gazebo, RViz, sensor fusion, Ethernet IP, etc.
- Training and Fast Ramp-up
- Hiring talents
- Modularity with various robotic systems
- Accelerated Timeline



Conclusion



Thank you

Questions?