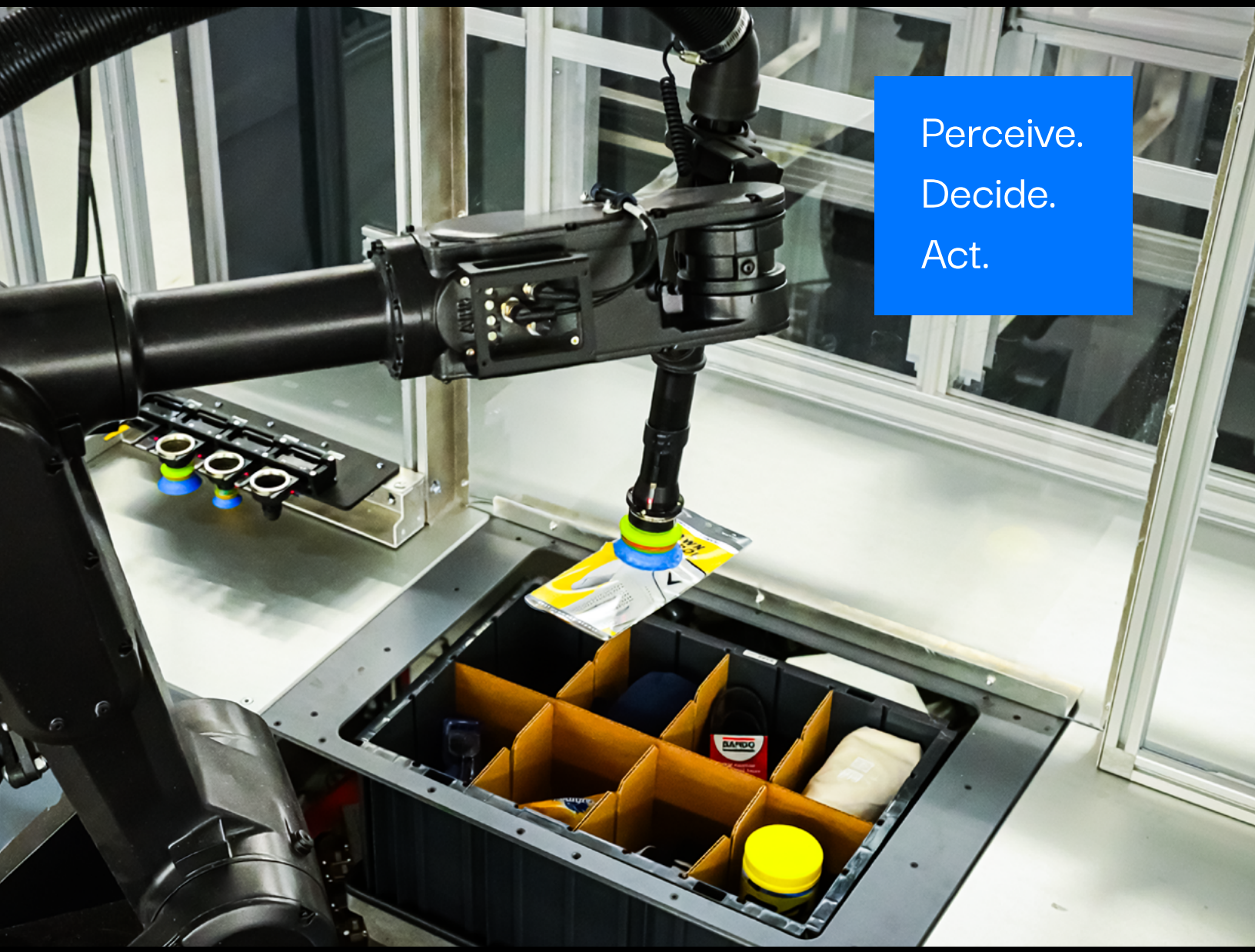
Physical AI Explained

What it is. How it works. Why it matters.

An introduction for supply chain leaders.



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AI that helps machines act in the physical world.

Physical AI is artificial intelligence used to perceive, make decisions, and guide actions in the physical world. In a warehouse, it can help a robotic system locate an item, assess how to grasp it, and respond when its surroundings change.

INFORMATION

DIGITAL AI

Produces content, predictions, or recommendations.

FOR EXAMPLE

Analyze an order and recommend a fulfillment plan.

INFORMATION + ACTION

PHYSICAL AI

Guides actions that complete a physical task.

FOR EXAMPLE

Identify an item, grasp it, and place it in the right container.

Physical AI describes a capability, not a robot shape. It can be used in robot arms, mobile robots, autonomous vehicles, and other physical systems. This guide focuses on its use in warehouse robotics.

From sensor data to physical action.

A robotic system uses information about its surroundings and its assigned task to determine what to do next. The following steps describe a simplified cycle; they can overlap and repeat during the task. AI can support each of these steps. Planning software and conventional controls also contribute to the cycle.

01 Sense
Capture the current scene through cameras and sensors.

02 Interpret
Locate objects and estimate relevant properties, such as position, shape, or orientation.

03 Plan
Choose an action and motion path that fit the task, assigned destination, and equipment limits.

04 Act
Control the robot through completion of the physical task.

05 Verify
Check the outcome, such as whether an item was picked or placed successfully, and determine the next step.

Feedback informs the next action.

Perception identifies package positions before the robot selects its next action.

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Every item creates a different challenge.

An object can bend, slip, reflect light, or hide behind another object. Moving one item can shift others. A robotic system has to account for these conditions as it completes the task. In an AI-enabled picking system, a learned model can help locate an item and assess possible grasp points. Planning software and controls then use that information to guide handling and placement.

SHAPE AND SURFACE

Soft bags, rigid cartons, and irregular items behave differently when a robot makes contact.

ITEM PRESENTATION

Overlapping items and shifted packages change what the robot can see and reach.

PLACEMENT & FLOW

A successful grasp is one step. The item still has to reach the correct destination.

Responding to variation can also mean recognizing a limit. Depending on its design, a system may retry, choose another action, or request help when it cannot complete a task.

What learned models add.

Conventional automation uses programmed rules, algorithms, and controls to perform tasks. It can use sensors and machine vision to respond to changes. Physical AI can add models trained on examples to help interpret conditions that are difficult to address through explicit rules alone.

DEFINED SEQUENCE

PREDEFINED AUTOMATION

Engineers define instructions and methods for locating objects, choosing actions, and controlling movement. These methods can be effective when the relevant variation is well understood.

FOR EXAMPLE

A carton arrives at a fixed location. The robot repeats a taught pick.

LEARNED ADAPTATION

AI-ENABLED ADAPTATION

Training produces a model that uses patterns learned from data to interpret inputs or help select actions. Its capability depends on the training, task, and conditions.

FOR EXAMPLE

A carton arrives rotated in a mixed tote. The system locates it and selects a workable grasp.

Both approaches can use sensors and feedback. Production systems often combine learned models with conventional controls.

How robots learn physical skills.

Machine learning uses data to train a model: software that applies learned patterns to new inputs. Depending on the application, training can use sensor recordings, human demonstrations, simulated environments, or a combination of these.

COLLECT DATA

Capture examples – observations, actions, and outcomes – across varied tasks and conditions relevant to the intended task.

TRAIN OR ADAPT

Train a model or adapt an existing one using those examples. Reinforcement learning is often used to reward successful actions in simulation.

VALIDATE

Test the model and the complete system on representative tasks, including difficult cases. Simulation can support testing, but performance should also be validated under real operating conditions.

DEPLOY & MONITOR

Run approved models on live sensor inputs. Review outcomes and validate future updates.

Reacting and retraining are different. Responding to a new scene uses the deployed model. Improving that model is a separate training and validation process.

AI is one part of a complete system.

An AI model interprets inputs or helps choose actions. Useful physical work also requires sensors, engineered motion, suitable hardware, and people who manage the operation.

01
SENSORS & PERCEPTION

Cameras and other sensors provide observations. Perception turns them into information the system can use.

02
PLANNING & CONTROL

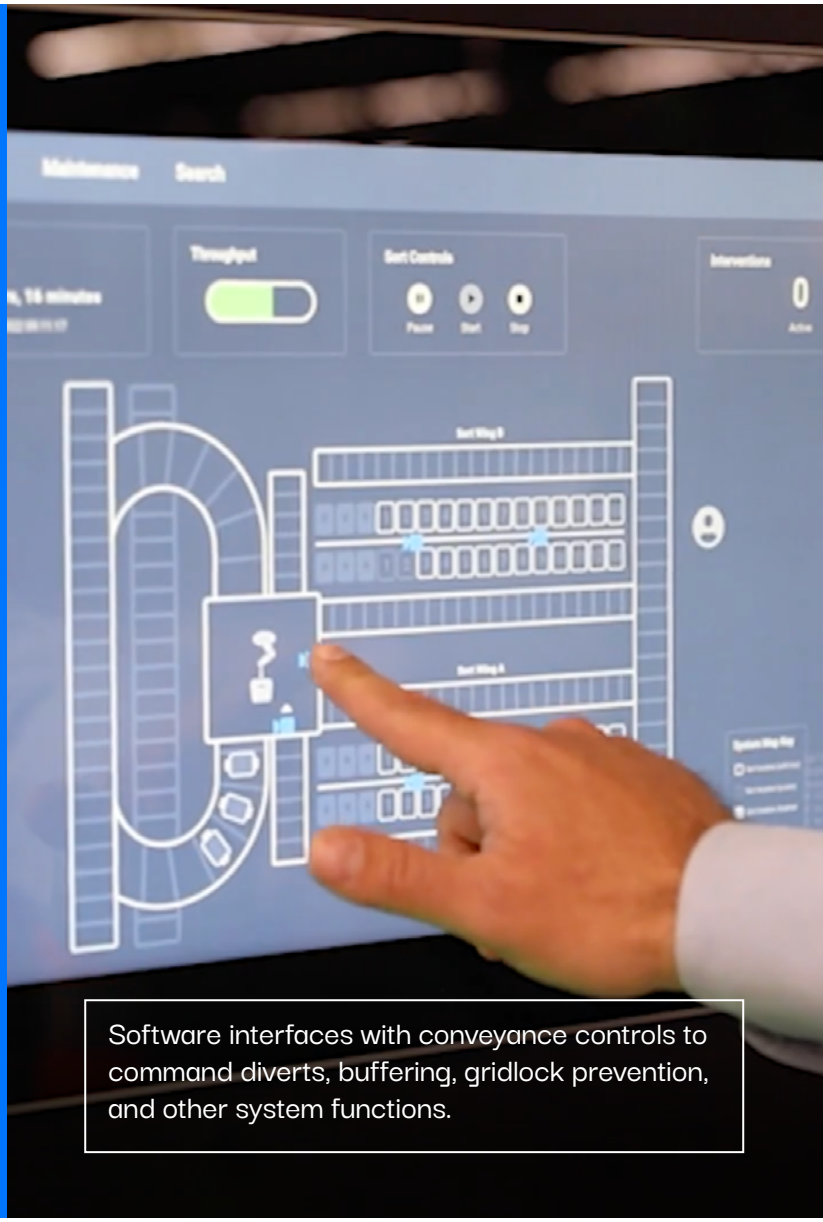
Software selects an action and translates it into coordinated movements within the robot's limits.

03
HARDWARE & SAFEGUARDS

Grippers, motors, and safety controls determine how the robot can move, handle items, and interact with its surroundings.

04
PEOPLE & PROCESSES

Teams set tasks, monitor results, resolve exceptions, and maintain the system.

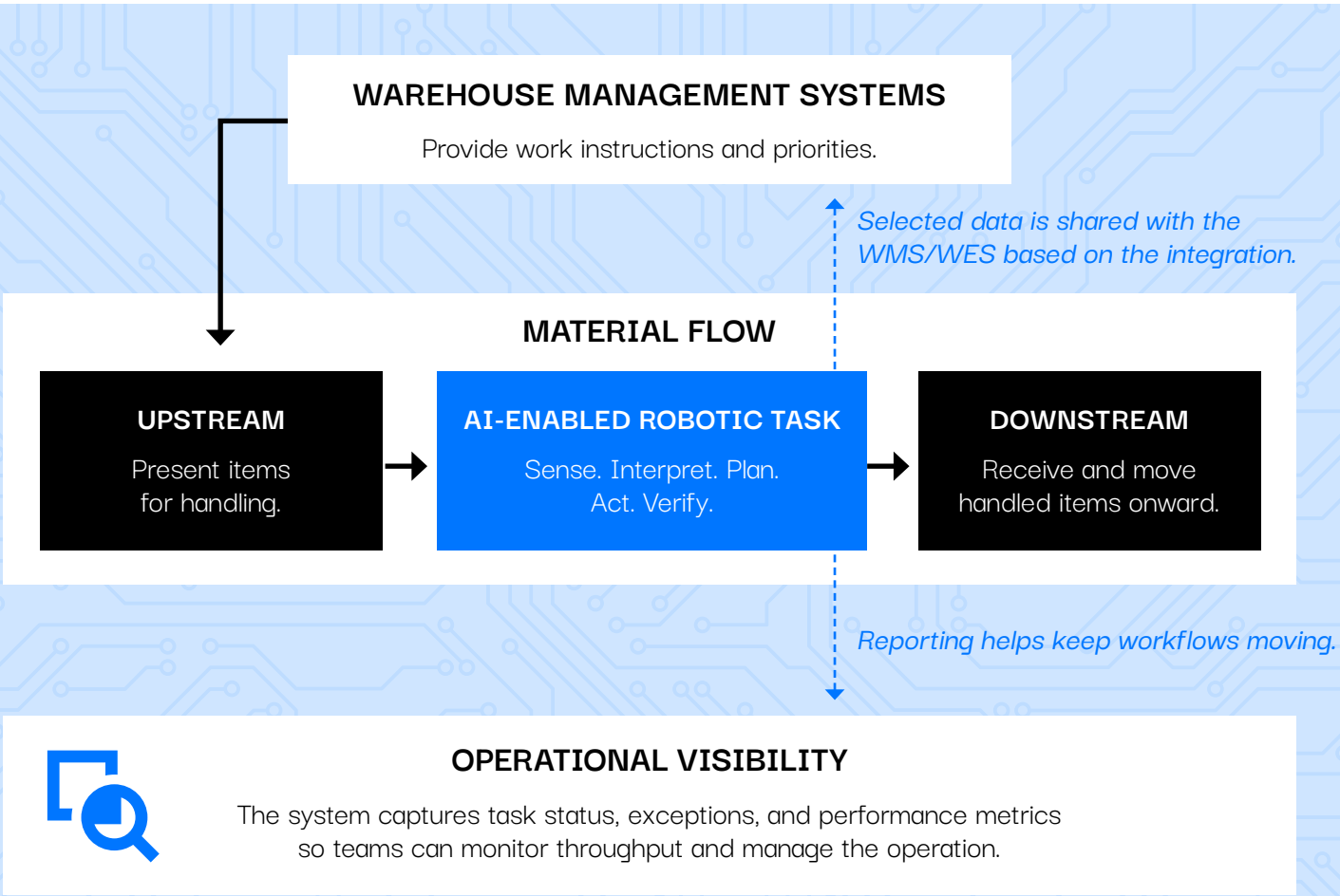


Software interfaces with conveyance controls to command diverts, buffering, gridlock prevention, and other system functions.

The model, hardware, controls, and operating process work together to complete the task reliably.

Intelligence has to connect.

- A successful robotic task depends on what arrives before it and what happens after it.



Illustrative architecture; connections depend on the application.

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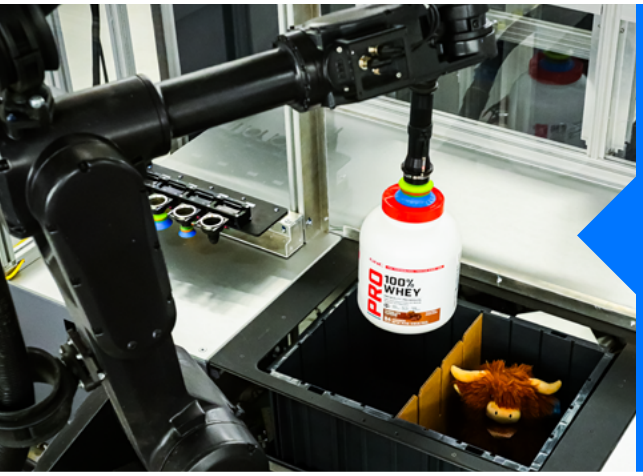
Physical AI in warehouse work.

Physical AI connects intelligence to specific tasks. In warehouses, these tasks include picking individual items, unloading packages, and moving merchandise to the right destination.

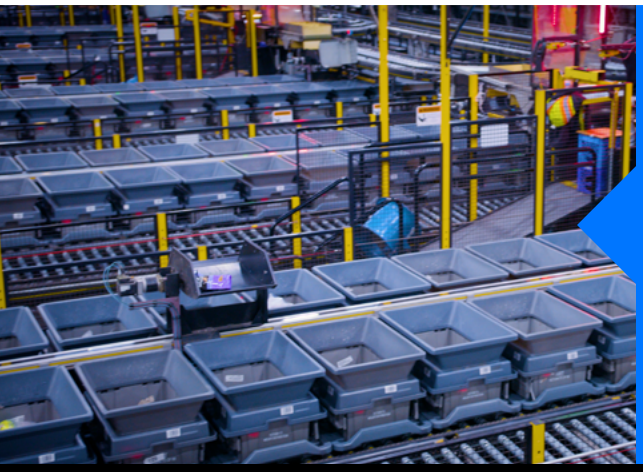


PICKING

Perception locates an item. The robot selects a grasp, moves the item, and places it at the required destination.

TRAILER UNLOADING

The system interprets the changing package arrangement and coordinates handling as freight is removed.

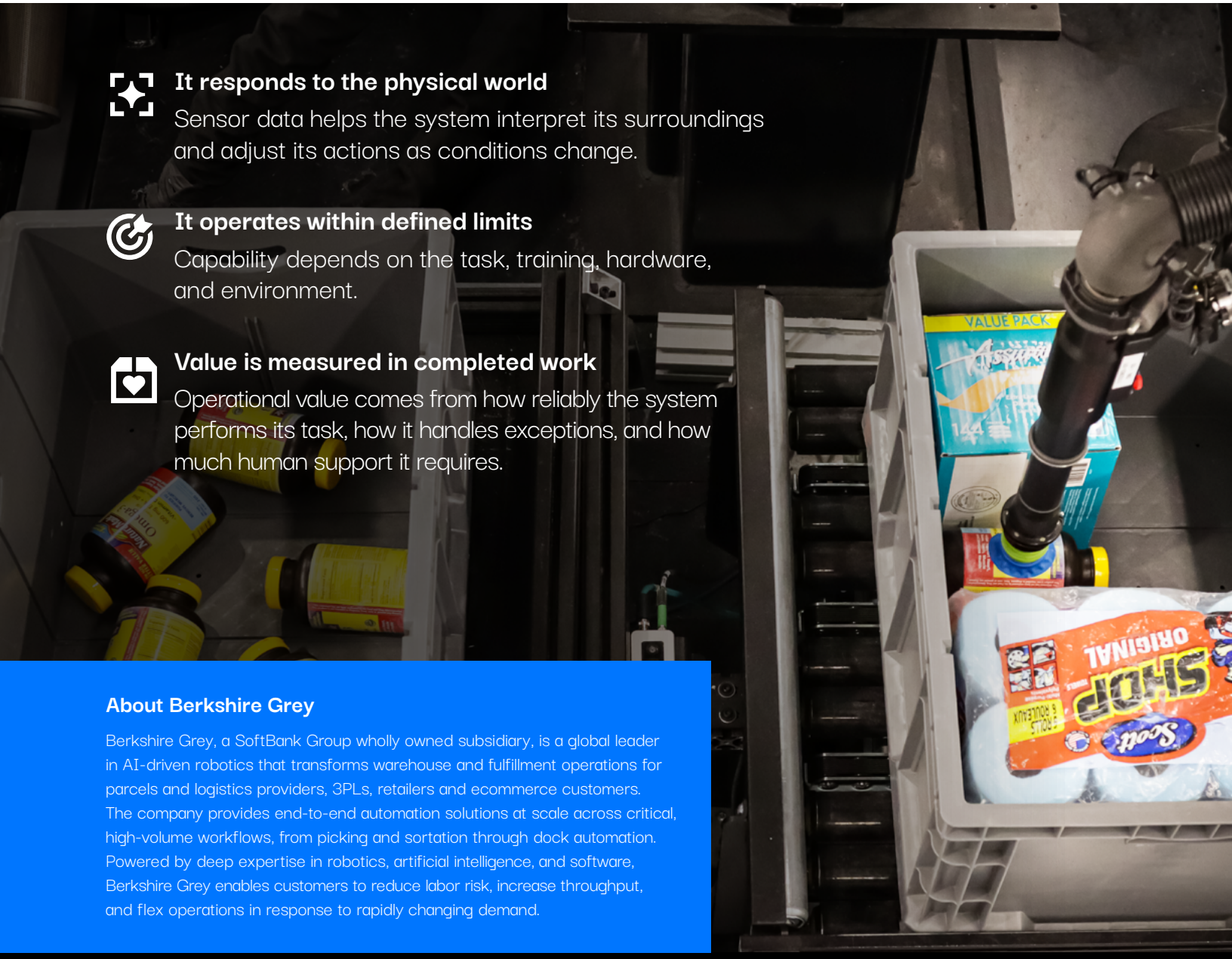


SORTATION

Software directs robotic shuttles to move merchandise to the correct destinations as work arrives.

Understanding Physical AI

Physical AI connects perception, decisions, and movement so machines can perform useful work in changing environments.



It responds to the physical world

Sensor data helps the system interpret its surroundings and adjust its actions as conditions change.

It operates within defined limits

Capability depends on the task, training, hardware, and environment.

Value is measured in completed work

Operational value comes from how reliably the system performs its task, how it handles exceptions, and how much human support it requires.

About Berkshire Grey

Berkshire Grey, a SoftBank Group wholly owned subsidiary, is a global leader in AI-driven robotics that transforms warehouse and fulfillment operations for parcels and logistics providers, 3PLs, retailers and ecommerce customers. The company provides end-to-end automation solutions at scale across critical, high-volume workflows, from picking and sortation through dock automation. Powered by deep expertise in robotics, artificial intelligence, and software, Berkshire Grey enables customers to reduce labor risk, increase throughput, and flex operations in response to rapidly changing demand.

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