LATTEBOT

Mobile Manipulation for Smart Farming

Casali Cristian and Flotta Aldo

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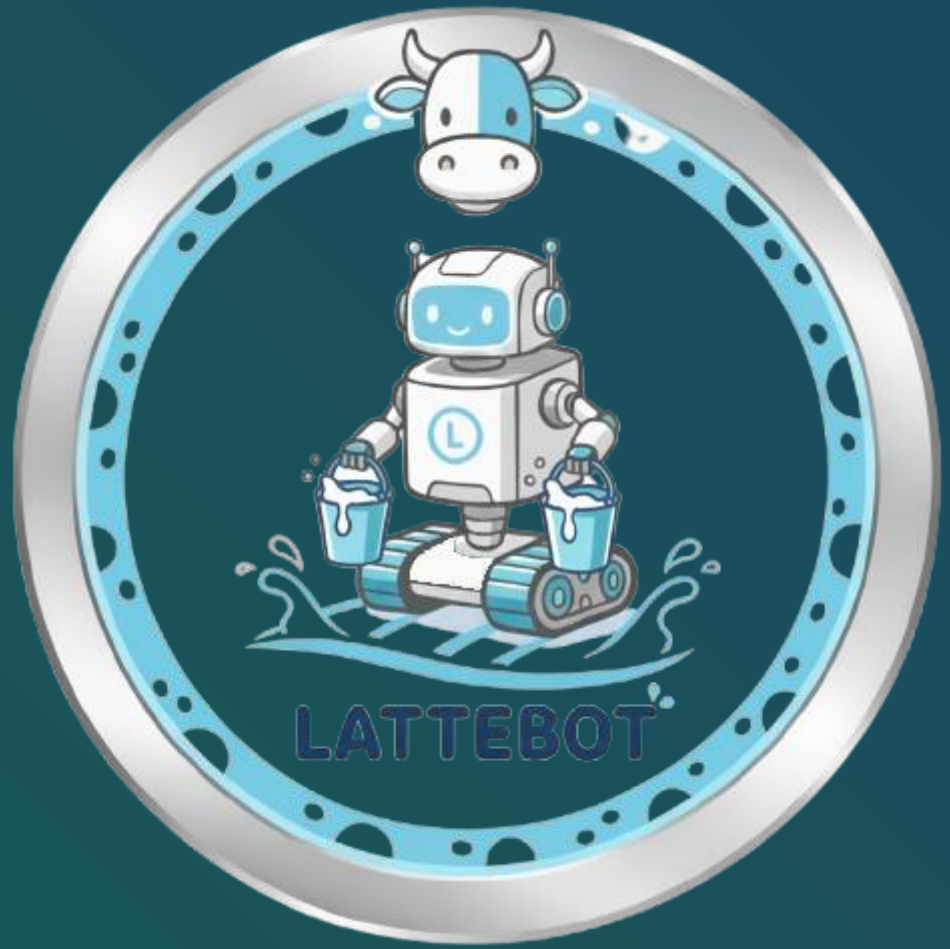

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What Does It Do?

Application Goal

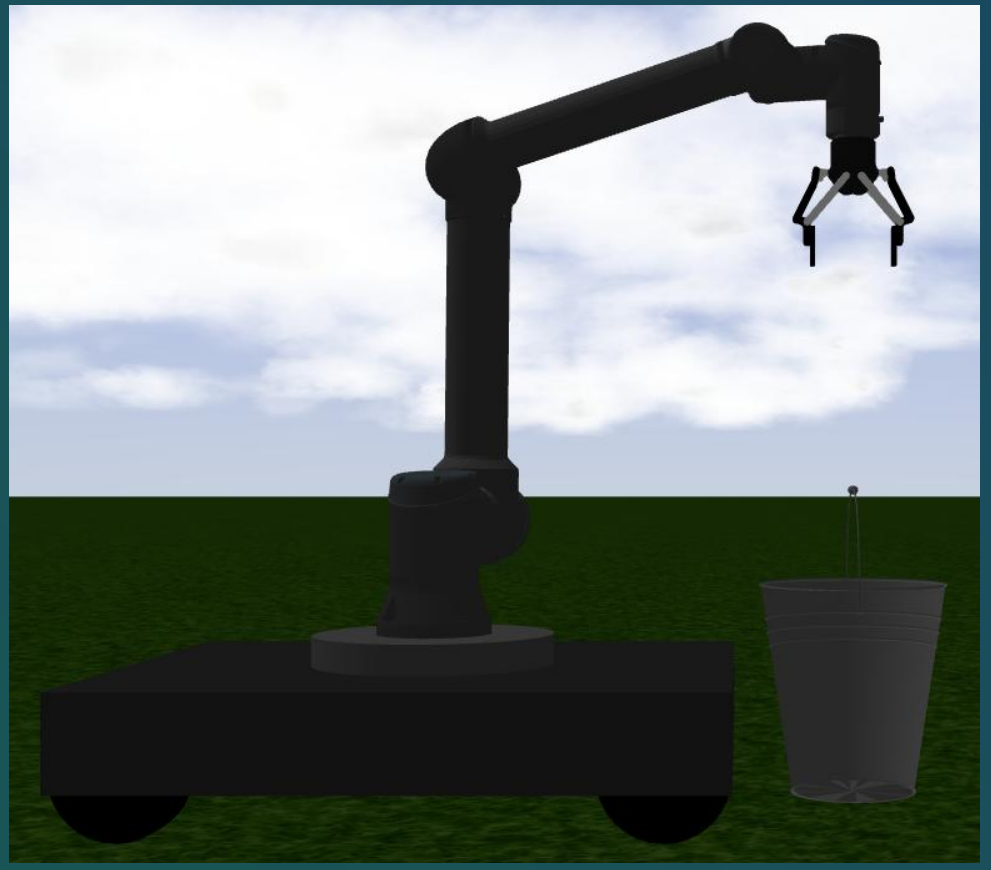
Operates in a **stall environment**, moving milk buckets to different cows based on their needs

Simulation

Simulates a **UR10e** manipulator with **Robotiq 2F-140** gripper on a 10-meter linear **platform**

Operator Control

Specify **cow number** and required **milk quantity**



Main Features

Robot manipulator

UR10e arm + Robotiq gripper + mobile platform

10m Platform

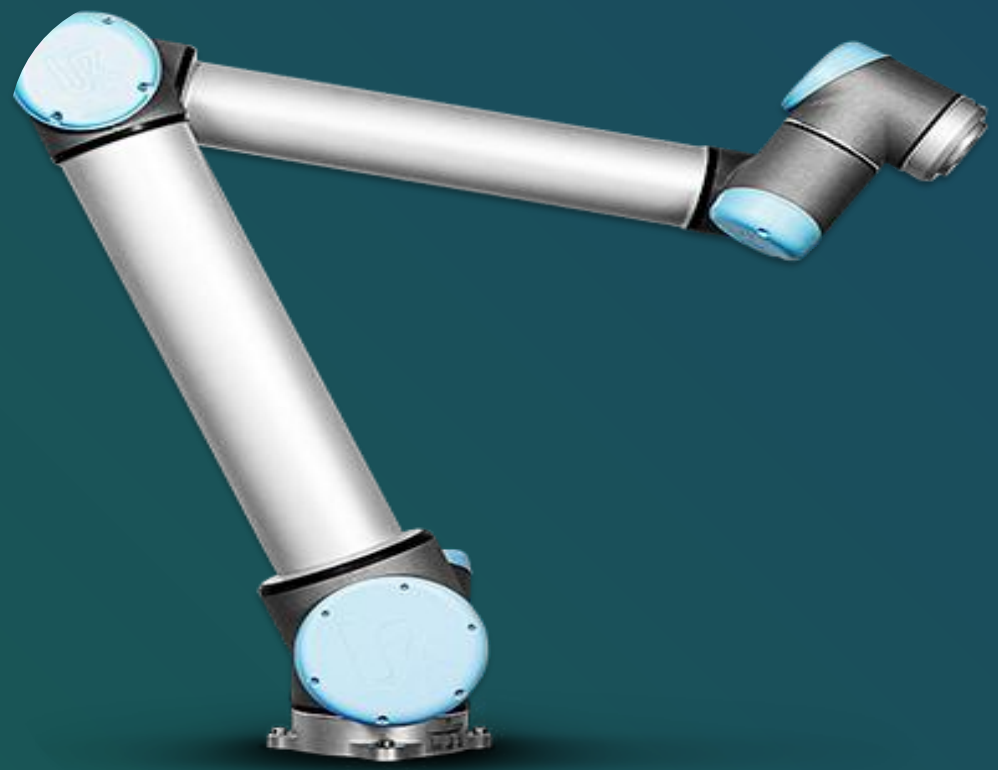
Prismatic joint on X-axis allows linear travel along stall

Arduino

Microcontroller-Based system for bucket weight detection

MQTT

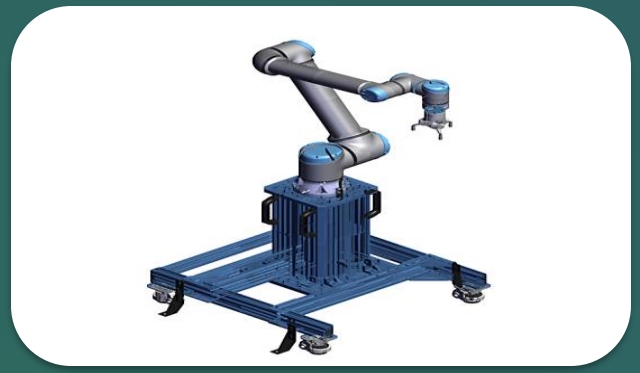
Communication between different type of nodes



Hardware

UR10e Manipulator & Platform

Universal Robots



- **6-DOF** robotic arm
- 1300mm reach
- 12.5kg payload
- **10-meter** linear platform

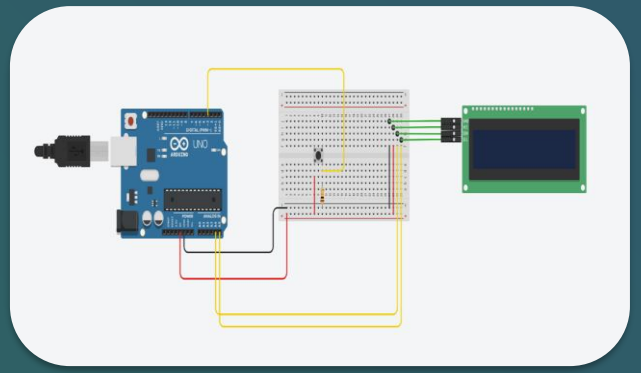
Robotiq 2F-140

Adaptive Gripper

- **2-finger** parallel gripper
- Single actuated joint
- Mimic joint plugin

Arduino

With Weight Sensor



- Button – placeholder for a weight sensor
- LCD display to show current weight

Software Stack

Robot

ROS

Manages **communication**, services, and topics between nodes

For **motion planning**, inverse kinematics, and collision avoidance

MoveIt

GAZEBO

For **3D physics simulation** and environment

Arduino

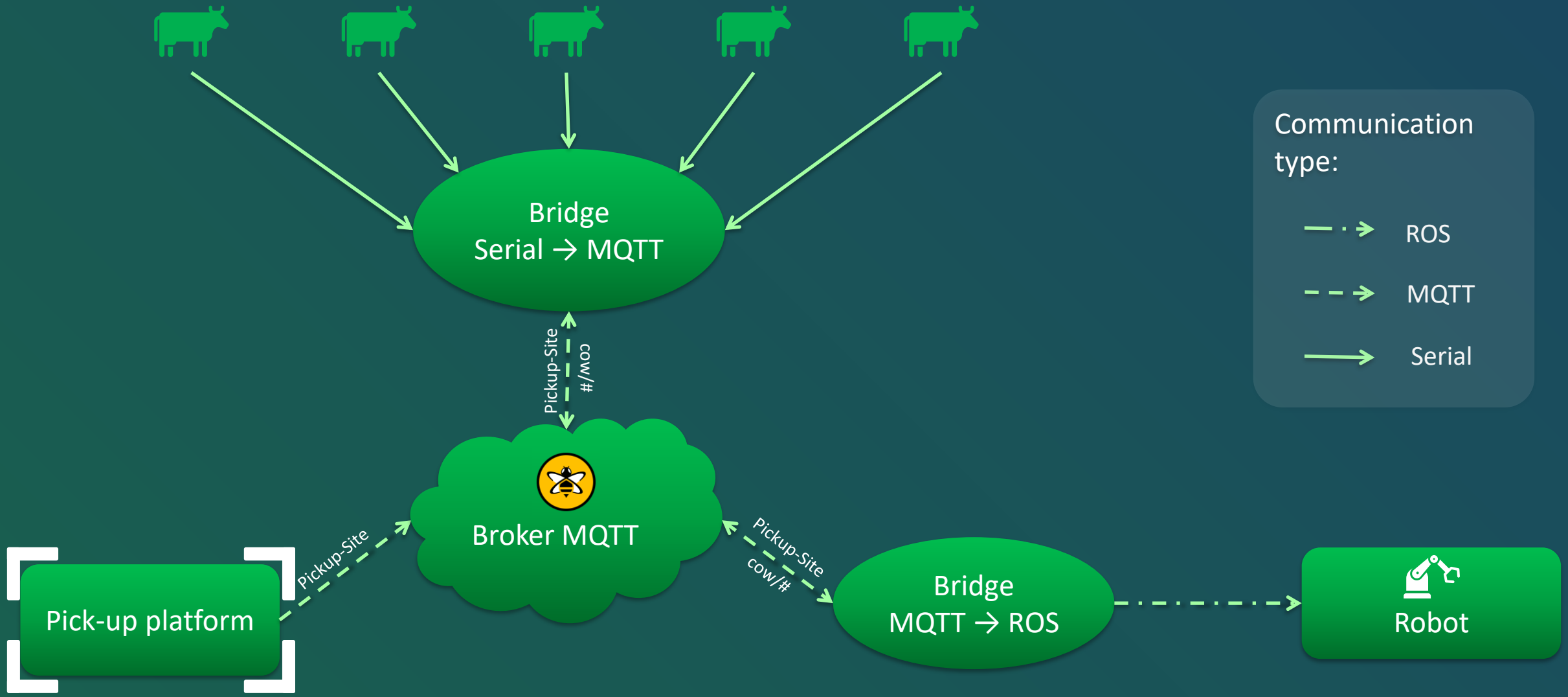
Arduino IDE

Microcontroller management

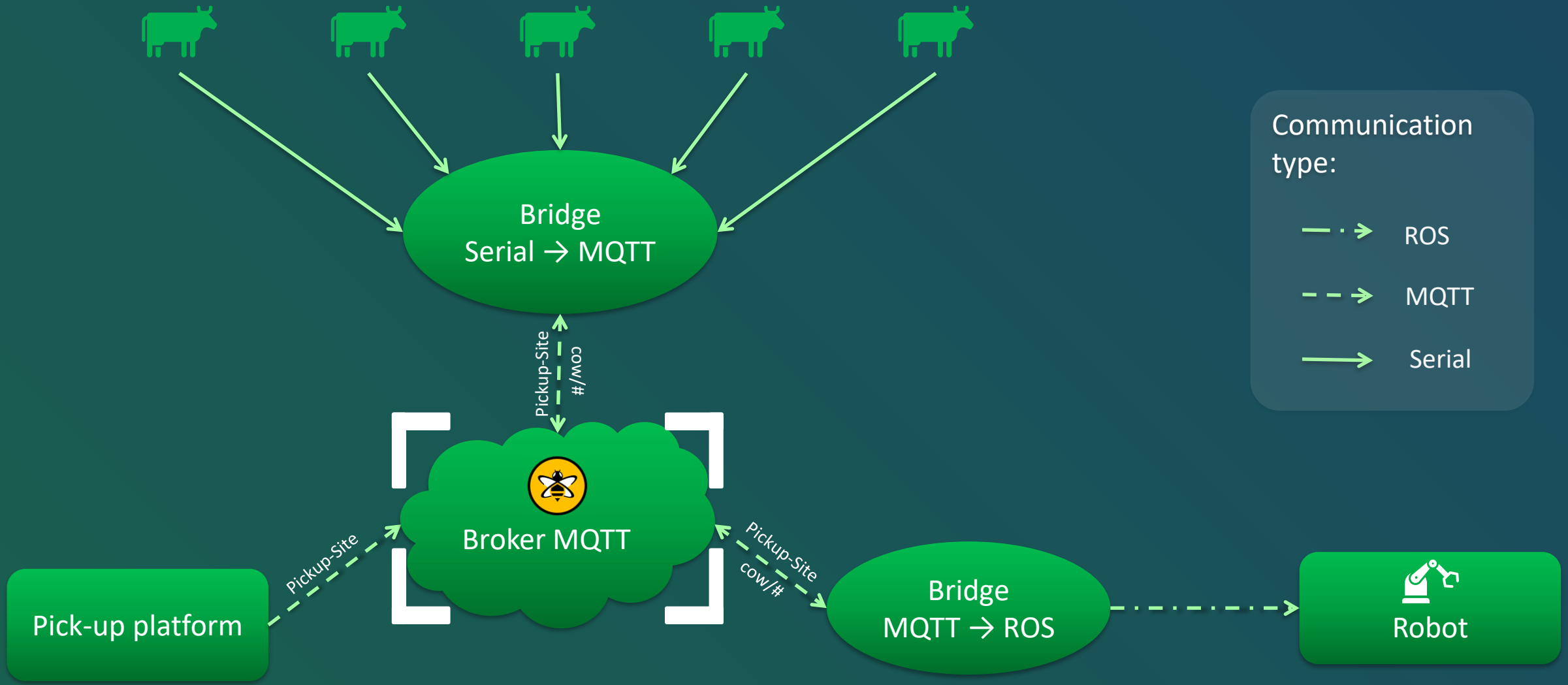
Broker for **MQTT** communication

HIVEMQ

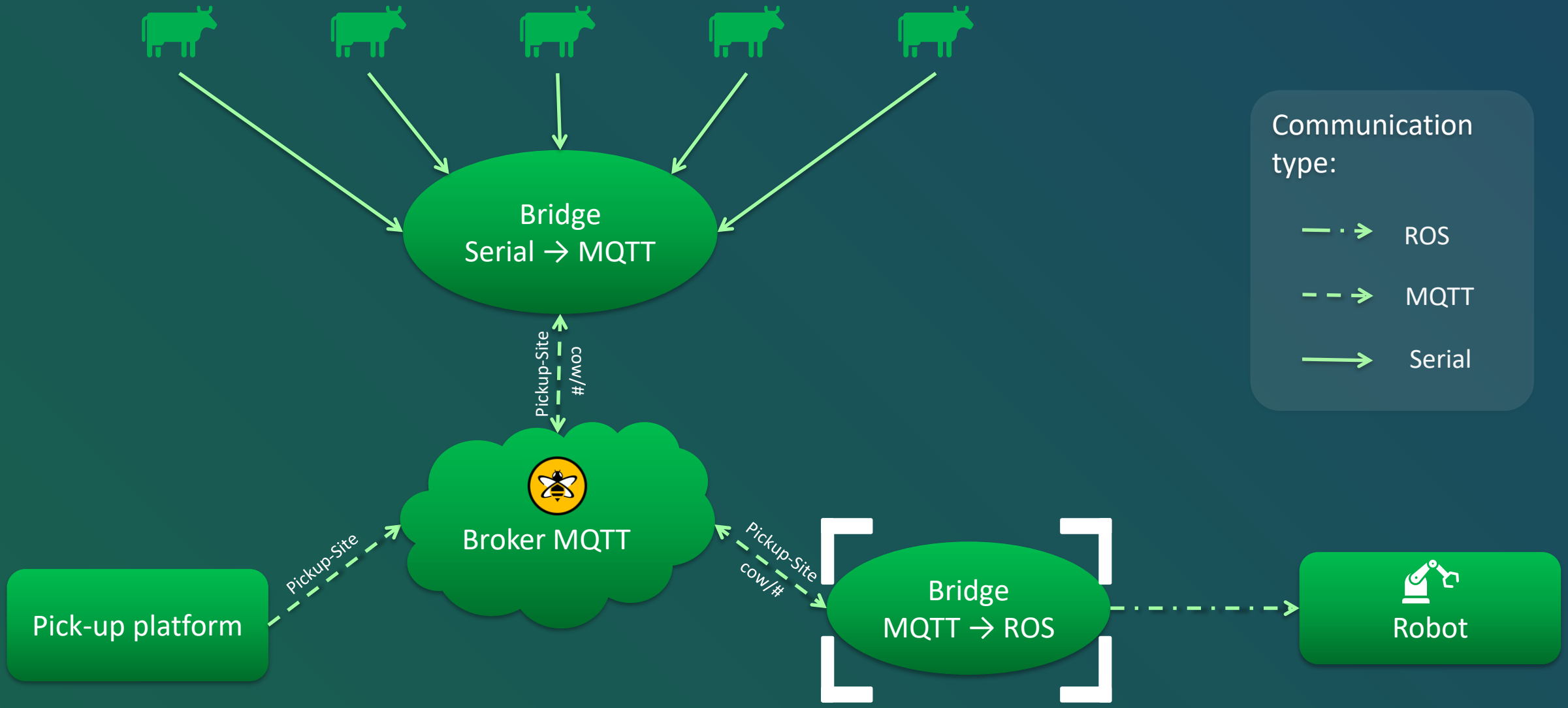
Software Communication



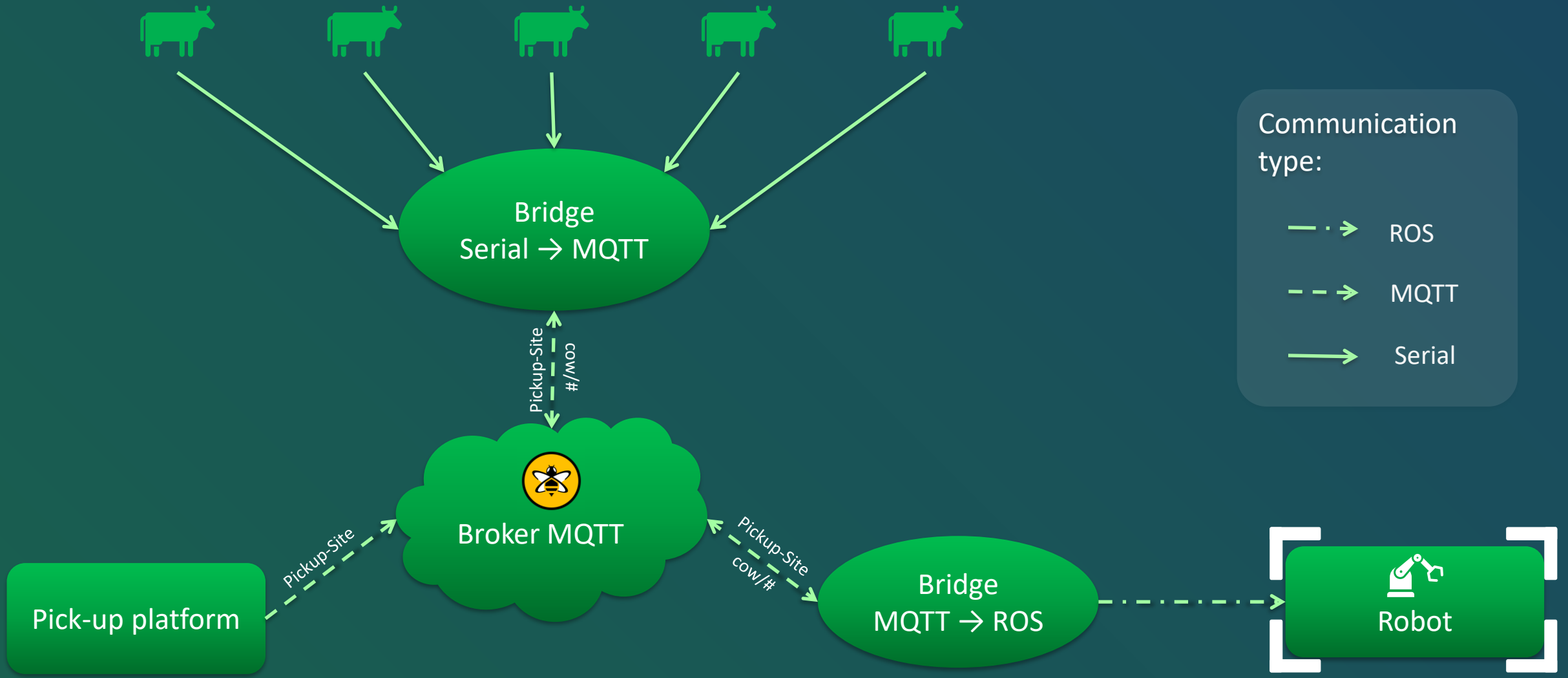
Software Communication



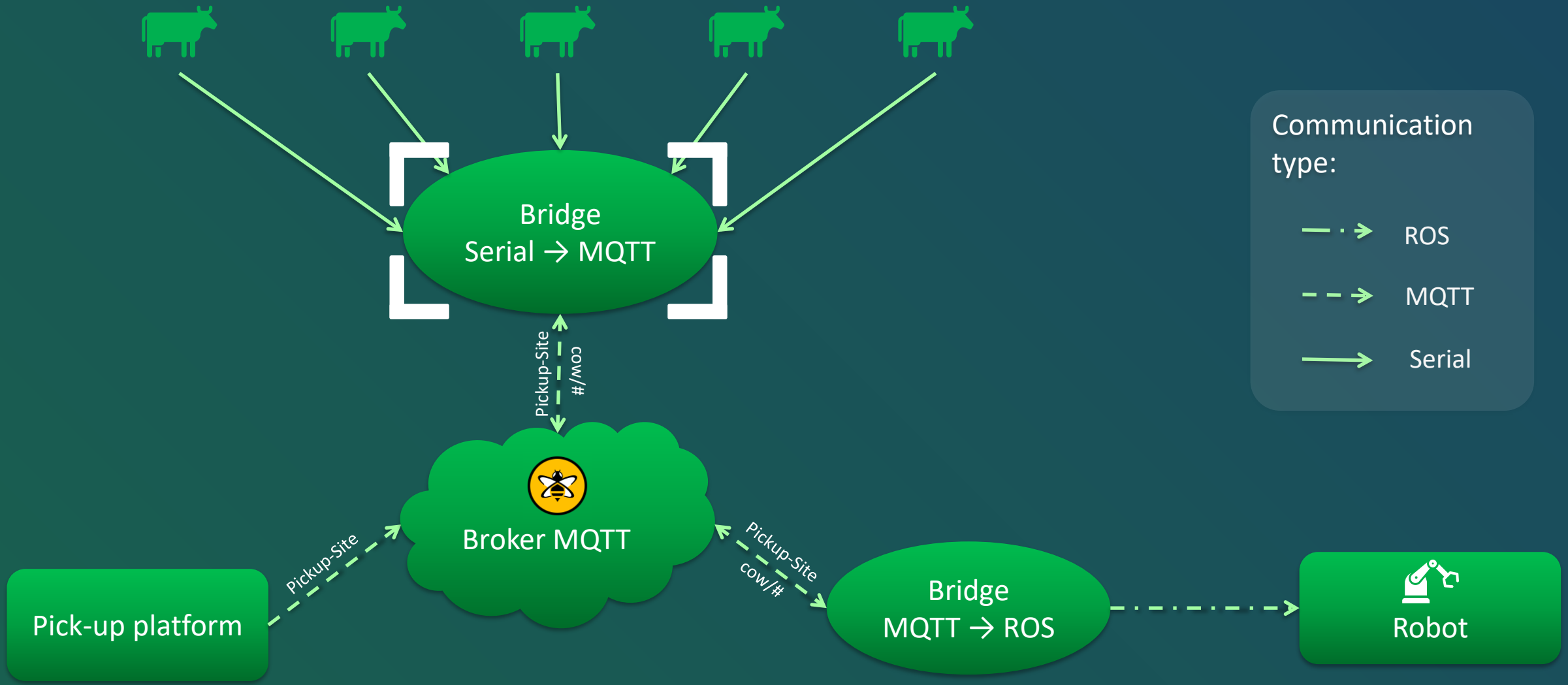
Software Communication



Software Communication



Software Communication



Handling Complex Scenarios

Multi-Cow Delivery

Robot uses **same bucket** to serve multiple cows in sequence

- Optimizes time and resources
- Reduces waste

Incomplete Feeding

Timeout mechanism recalls robot if cow doesn't finish milk

- System logs incomplete feeding events
- Moves partially full bucket to new task
- Can transfer to holding area

Parallel Task Management

Manages **multiple cow-feeding sequences** simultaneously

- Queues new operator requests
- Dispatches tasks as robot becomes available

Future Works

- Real world implementation
- Improve temporal parameters for better movement efficiency
- Acquisition of calf statistics
- Computer Vision system to detect bucket handle
- Incorporate newer or more suitable manipulator models

Live Demo

Thank You

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