

# Industrial IoT for Energy-Efficient Assembly Lines

## Project Overview

**Objective:** Development of an IoT-based framework for energy optimization in industrial assembly lines.

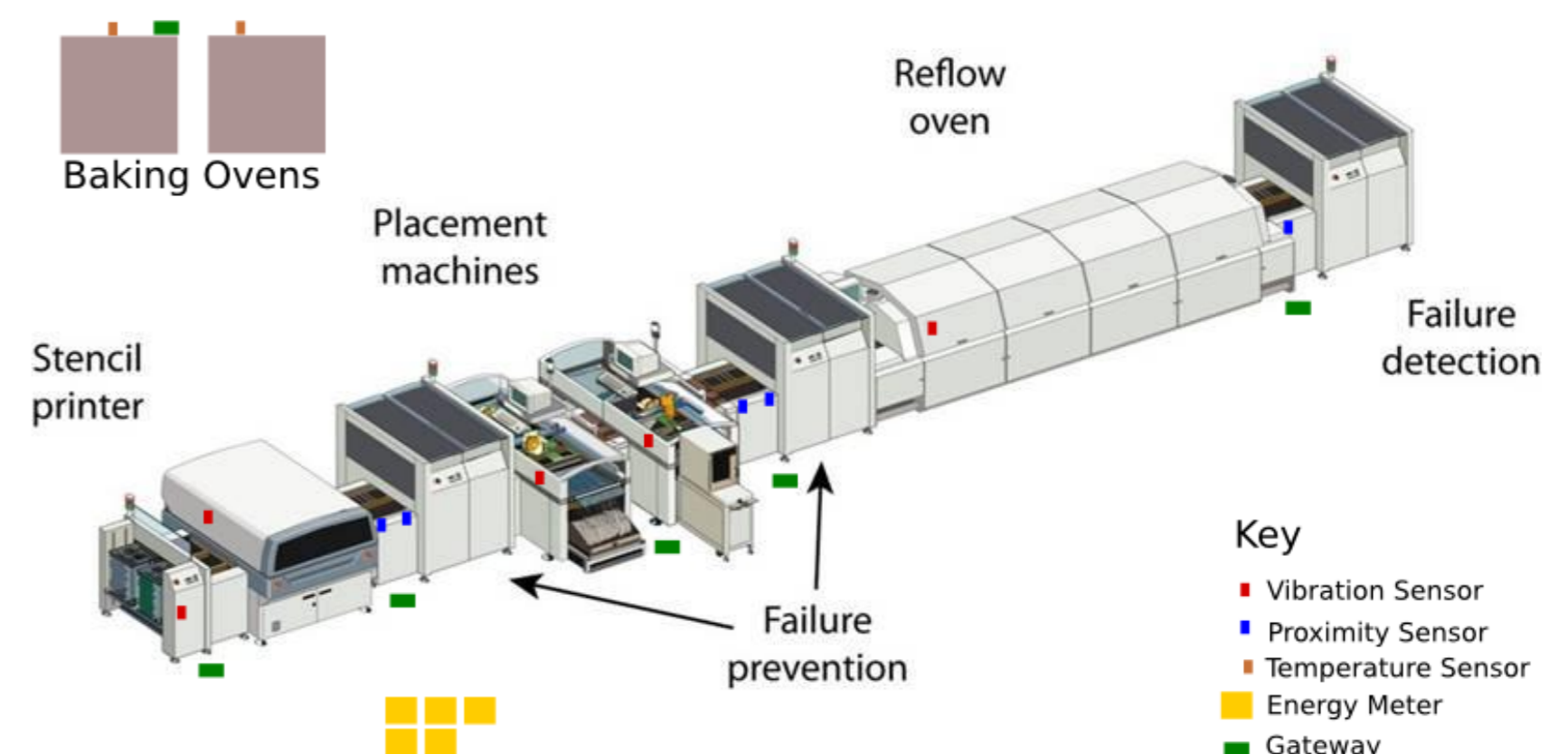
**Case study:** An SMT PCB Assembly Line

### Components:

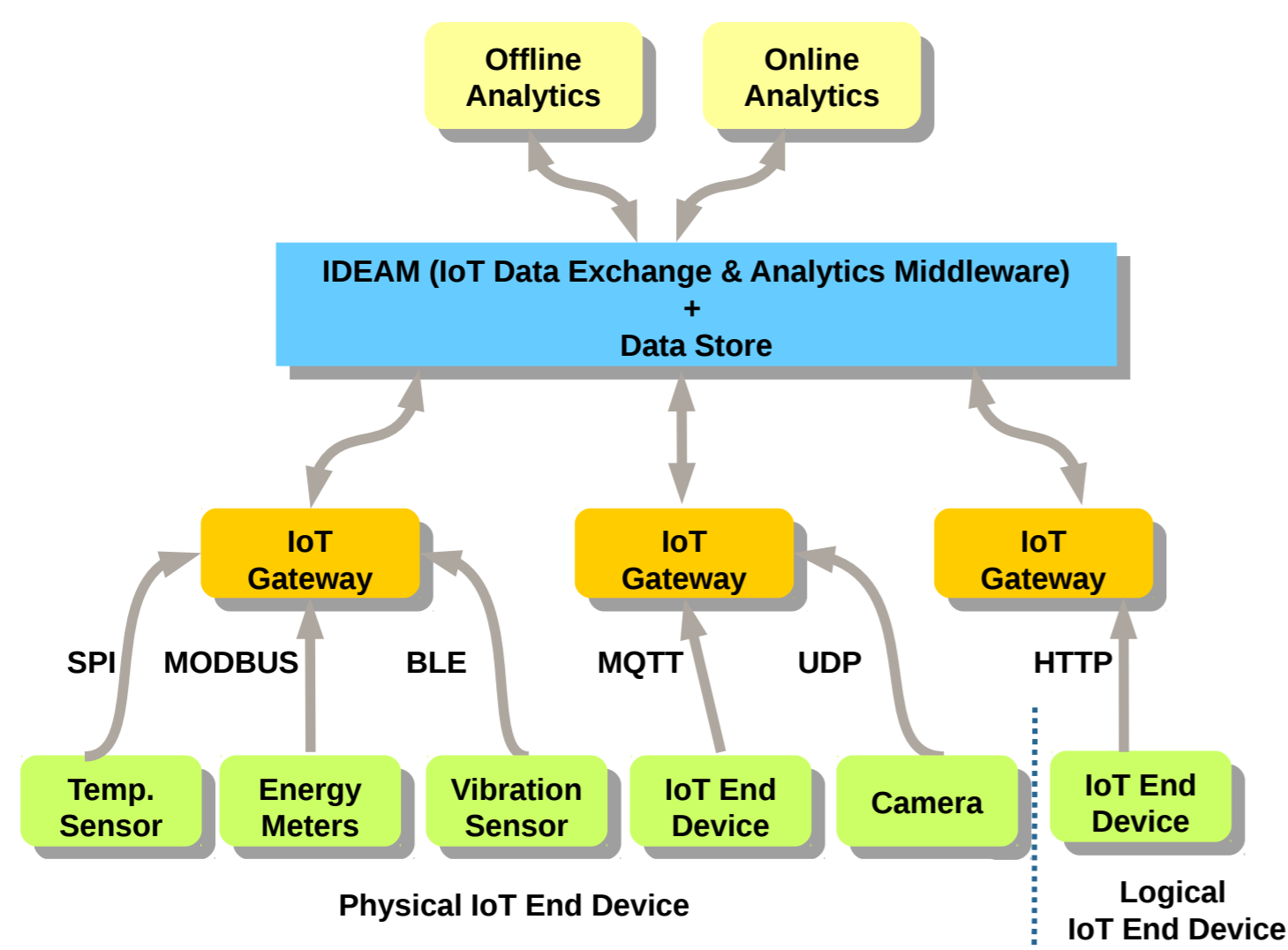
- Data Aggregation Platform
- Data Analysis Engine and KPI displays
- Simulation Model for Prediction and Process Optimization

## Sensor Deployment

### An SMT-PCB Assembly Line

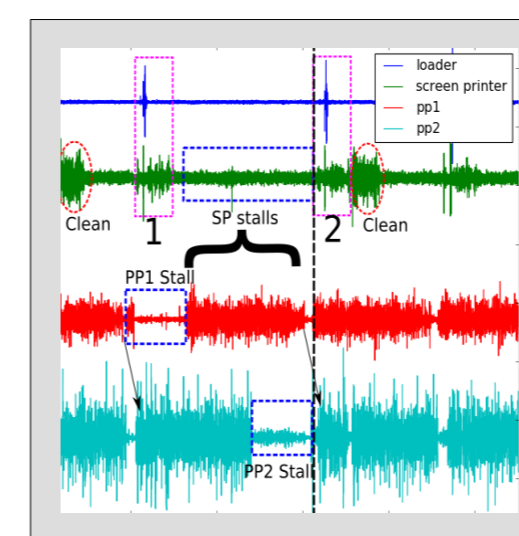


## Data-flow Architecture



## Key Performance Indicators and Insights from Data

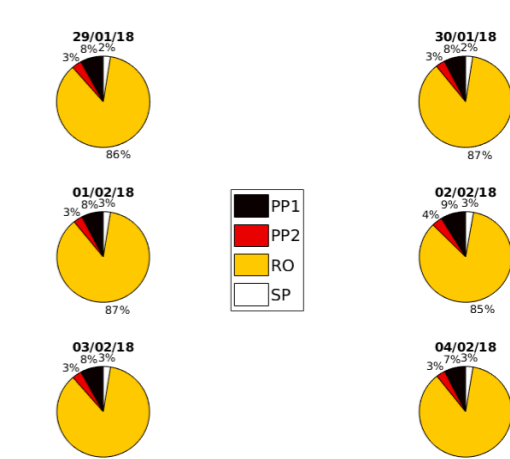
### A Snapshot of Vibration Sensor Data



### Performance Metrics Tracked:

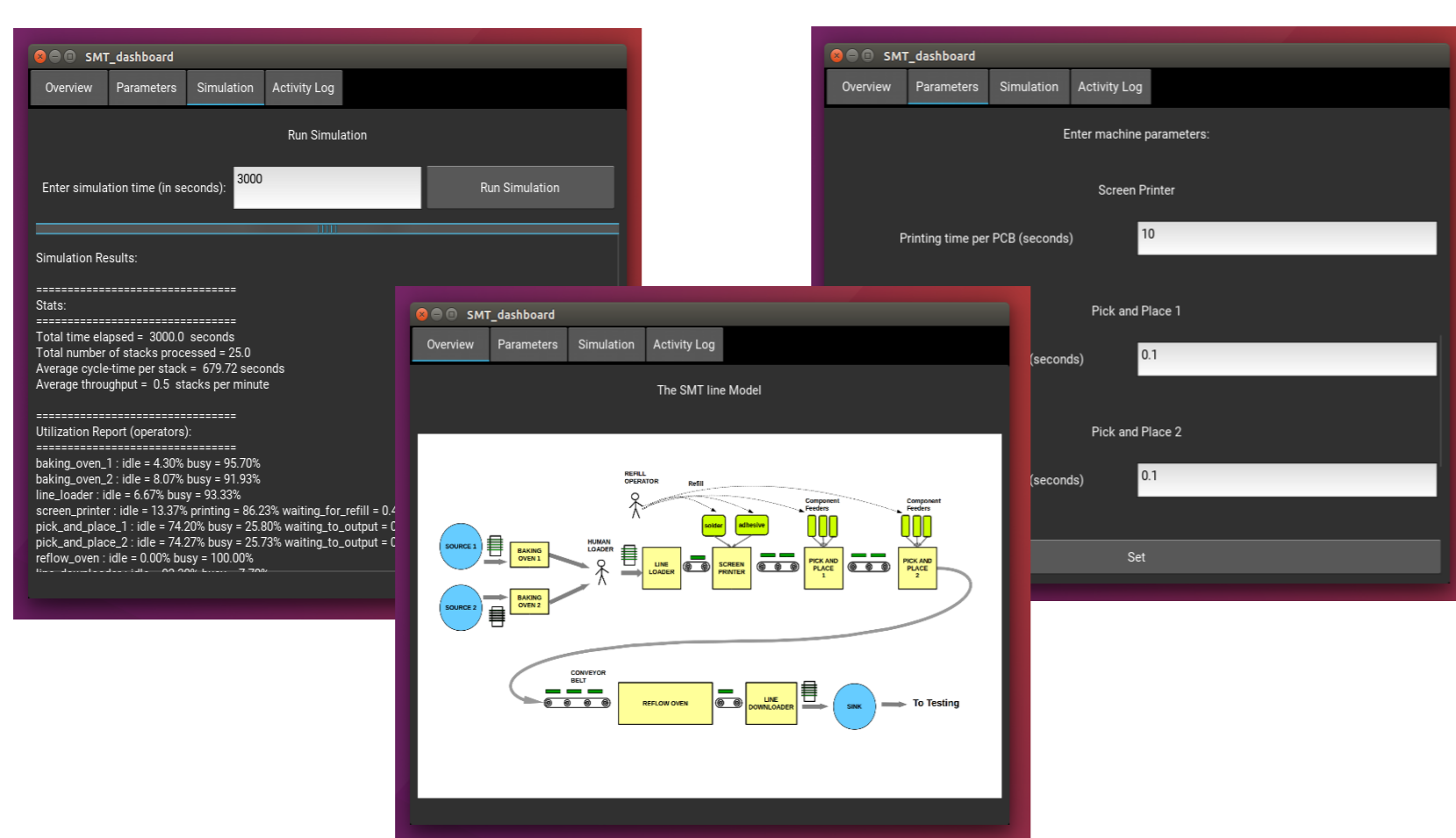
- Machine-wise idle-times, latencies and energy consumption
- System Throughput
- Machine Breakdowns, Shifts.

### Machine-wise break-up of energy over a week



**Insights:** The Re-flow oven accounts for more than 85% of the total energy consumption on average, whereas the Pick and Place machines are often the throughput bottlenecks.

## Parameterized Simulation Model with GUI support



## Energy Optimization and Ongoing Study Items

- **Impact of buffering between the Pick and Place and Re-flow operations** (preliminary results based on simulation indicate that up-to 2X reduction in energy is possible via buffer insertion.)
- **Design space exploration of line configuration**
- **Optimal inspection and re-calibration policies**
- **Human-in-the-loop modelling**
- **Dashboard for real-time operational support**