

**LIVE SESSION**

# The future of **DIGITAL TWINS**

AnyLogic: Simulation that drives decisions.

SPEAKER  
COLIN MACY

 6 AGOSTO - 10:00 AM AST

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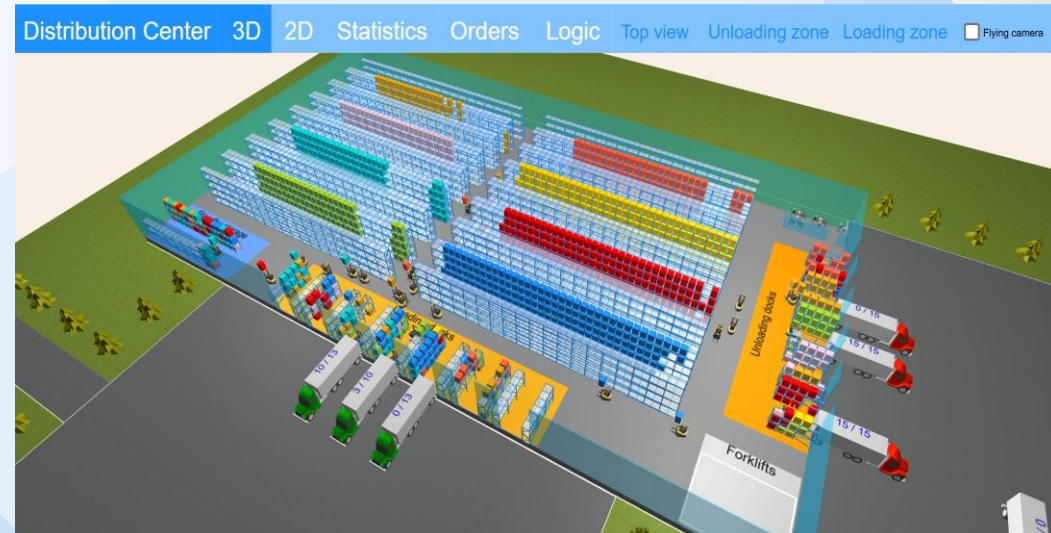


# What is dynamic simulation?

Dynamic Simulation is a **prospection** technique. It enables a business to see the impact of decisions before implementation while allowing for optimization of existing operations.

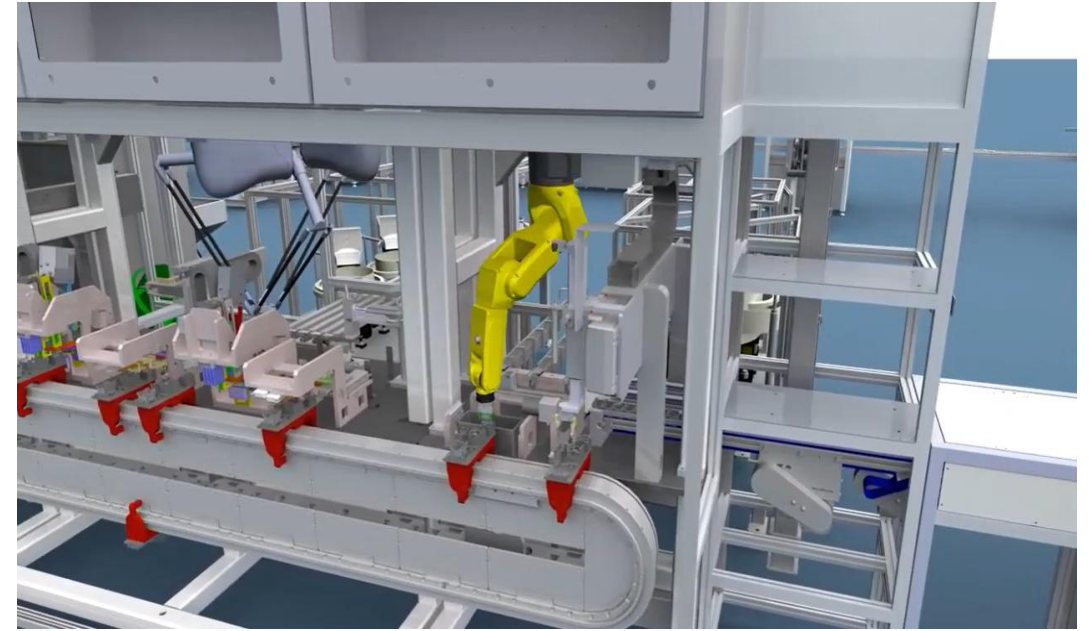


**Real (or planned) System**



**Simulation Model**

# Simulation vs Emulation

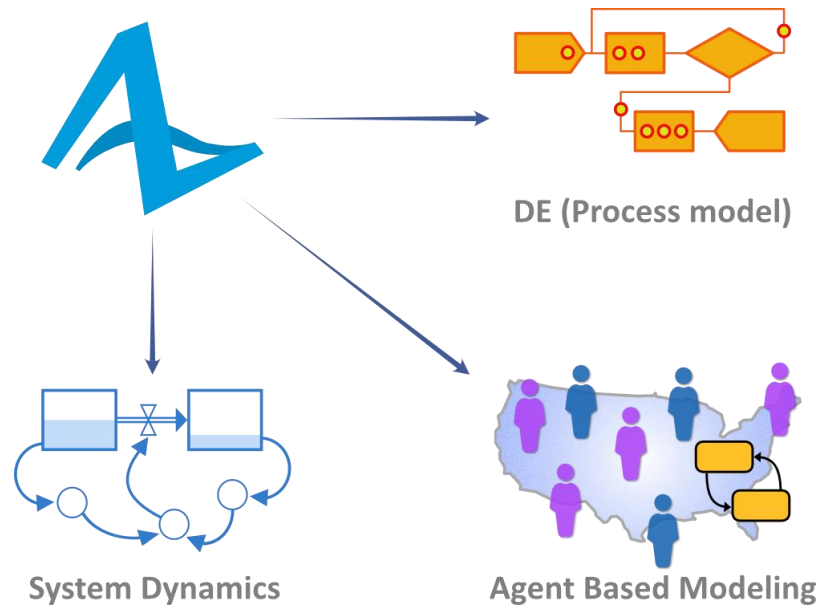


- Focuses on “How well will it perform?”
- Physics abstracted, motion timed from data
- Design, planning, and optimization
- Time compressed, many futures, statistically precise
- Reads from PLC/WCS data but not in lockstep

## Emulation

- Focuses on “Does it work correctly?”
- Physics modeled: geometry, kinematics, collisions
- System validation and control testing
- Real time, 1:1, one future
- Closed loop with the PLC/WCS at signal level

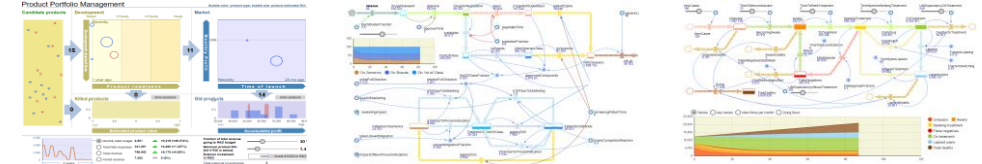
# AnyLogic: what it does and what it does not do



AnyLogic does everything above ("Business applications")

THIS IS WHAT AnyLogic does not do: control systems, "hardcore" physical modeling, finite element method, ...

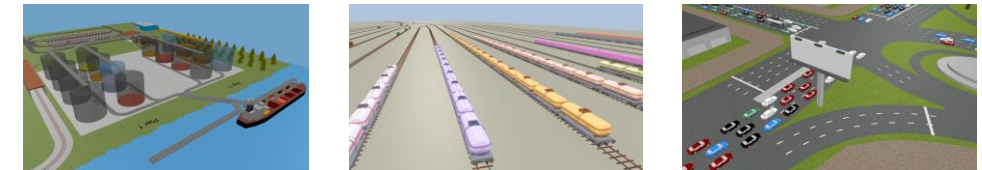
Strategic level: Market, Competition, Product portfolio, etc.



Larger scale: Supply Chains, GIS-based models...



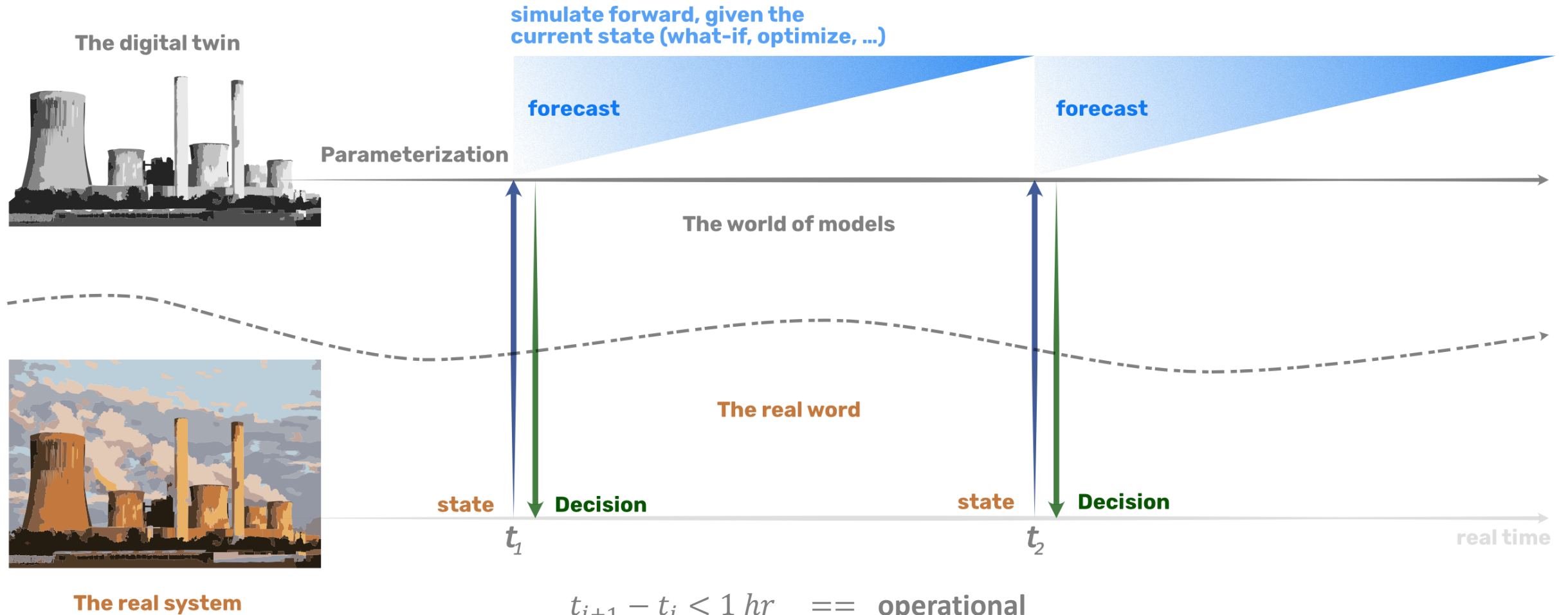
Small scale logistics: Cars, Trucks, Trains, Pipelines, Tanks



"Close to Physical" level: Material handling, Pedestrian



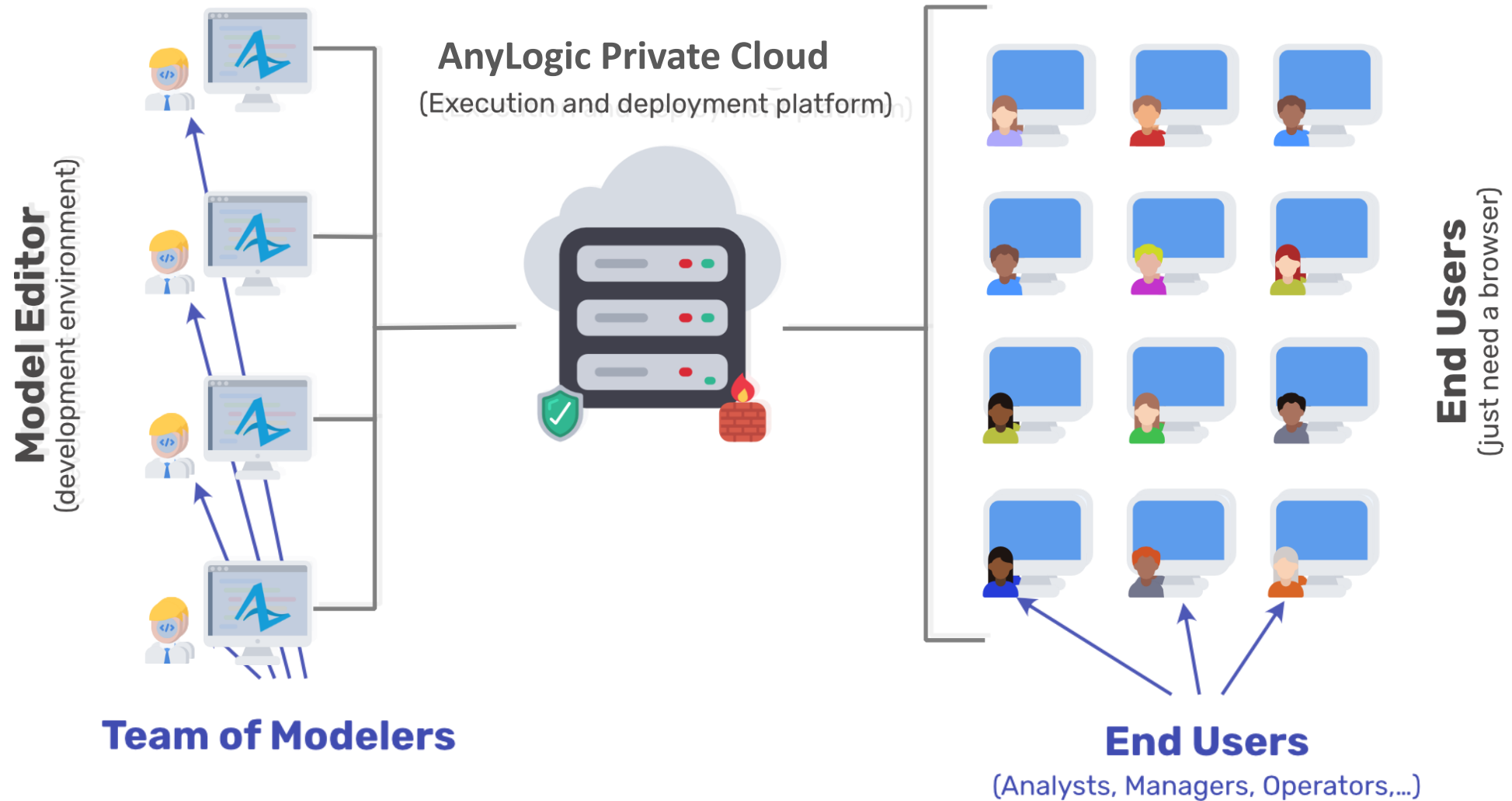
# Simulation-Based Digital Twin



$t_{i+1} - t_i < 1 \text{ hr} \implies \text{operational}$

$t_{i+1} - t_i > 1 \text{ day} \implies \text{tactical}$

# AnyLogic Ecosystem Overview



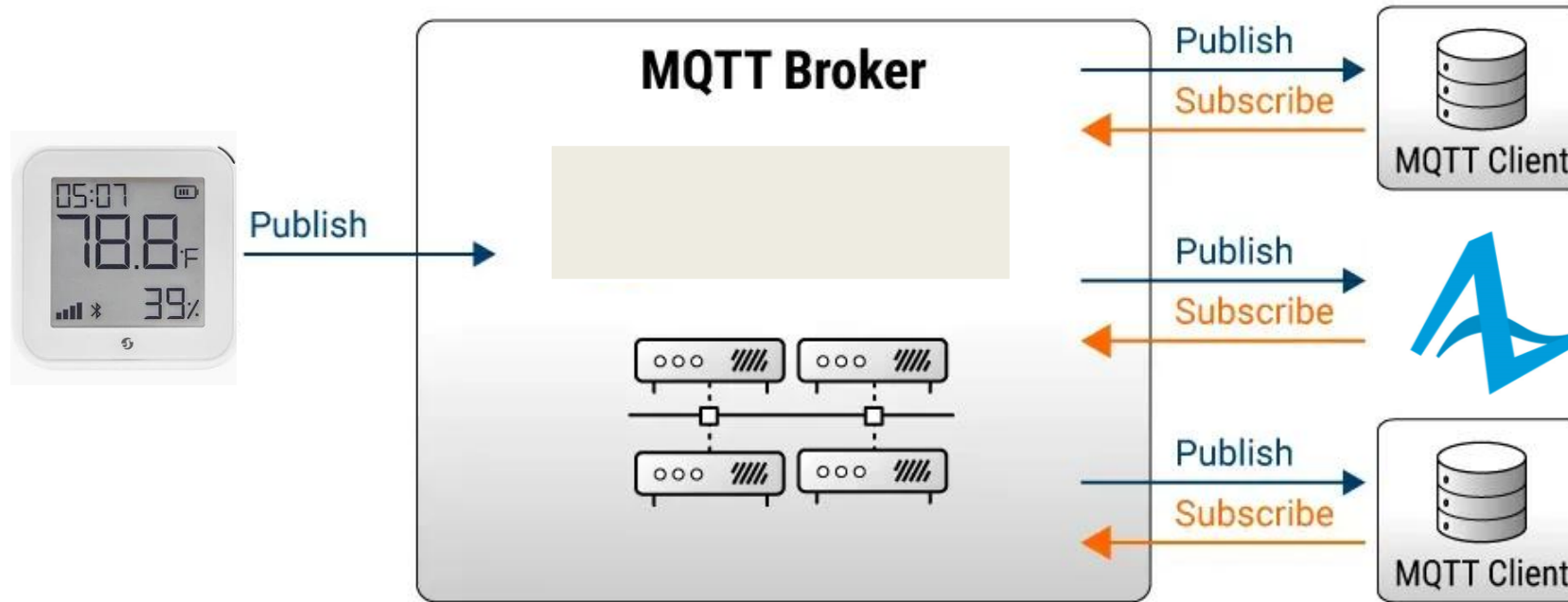
# AnyLogic Ecosystem for Digital Twin



## Requirements:

- **Creating** a high-fidelity simulation model
  - Flexible and deep parametrization
- **Using** (executing) the model on powerful servers
  - Well-developed data connectivity

# MQTT Implementation for AnyLogic



## Stage 1 — Sensor (Publisher)

- Shelly H&T — temp & humidity
- Publishes to topics
- Doesn't know who's listening
- In Production: PLCs, SCADA, gateways

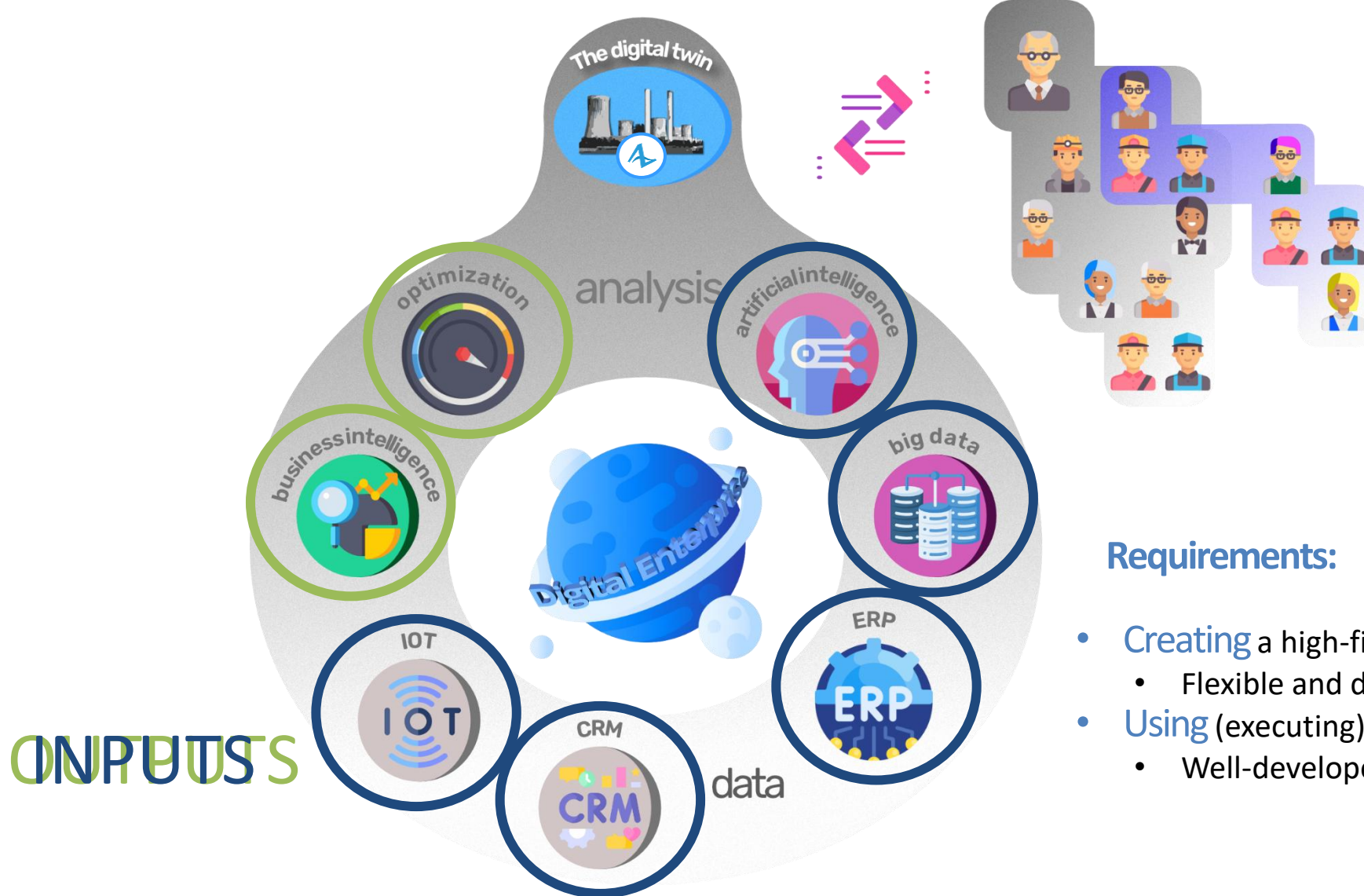
## Stage 2 — Broker (HiveMQ)

- Publishers ↔ subscribers decoupled
- Routes messages by topic
  - shelly/status/temperature
  - shelly/status/humidity

## Stage 3 — AnyLogic (Subscriber)

- Subscribes via Paho (Java)
- Message → callback → model state
- Model updates in real time
- Live mirror of the physical system

# AnyLogic Ecosystem for Digital Twin



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# Case Study #1: Pharmaceutical Digital Twin



## Problem

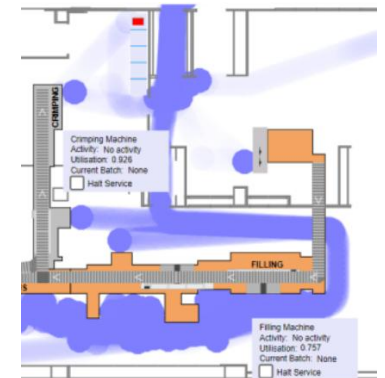
- Replace a sterile production line to meet regulatory standards
- Protect supply of critical drugs during construction
- Volatile demand; equipment, staff, shift decisions unresolved

## Approach

- Phase 1: discrete event model of production process
- Phase 2: digital twin – CAD site plan, 3D view, Gantt, heatmap
- Parameters exposed so planners could reconfigure and re-run

## Results

- 200+ business scenarios evaluated during design
- Hidden constraints and sensitivities surfaced before build
- 20% lower projected capex from right-sizing equipment
- Stage-gate approved with no delay



# Case Study #2: Manufacturing Digital Twin

## Problem

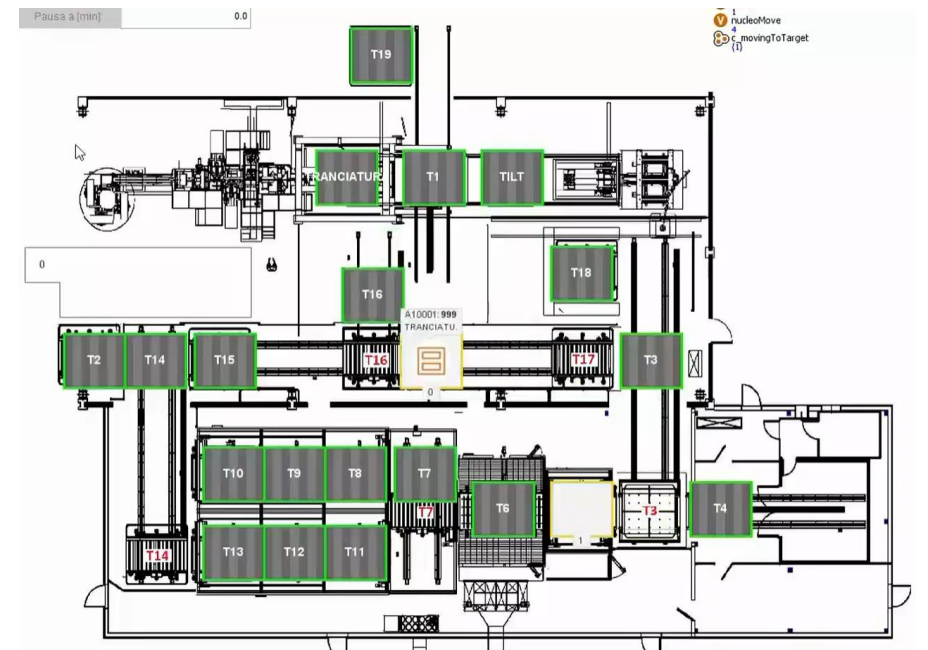
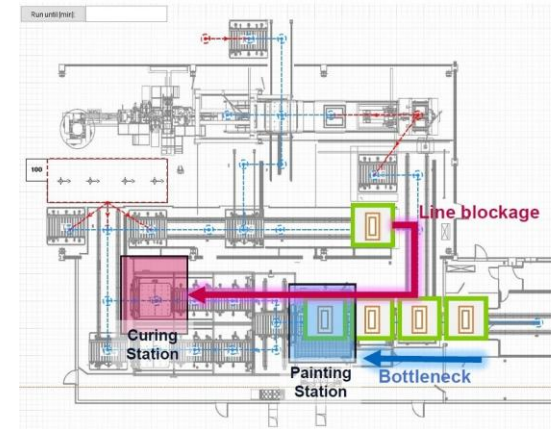
- Ramping volume, processes wouldn't scale
- Cores on steel pallets, moving between stations
- Scheduled manually, short horizon
- One major blockage meant resetting the whole line

## Approach

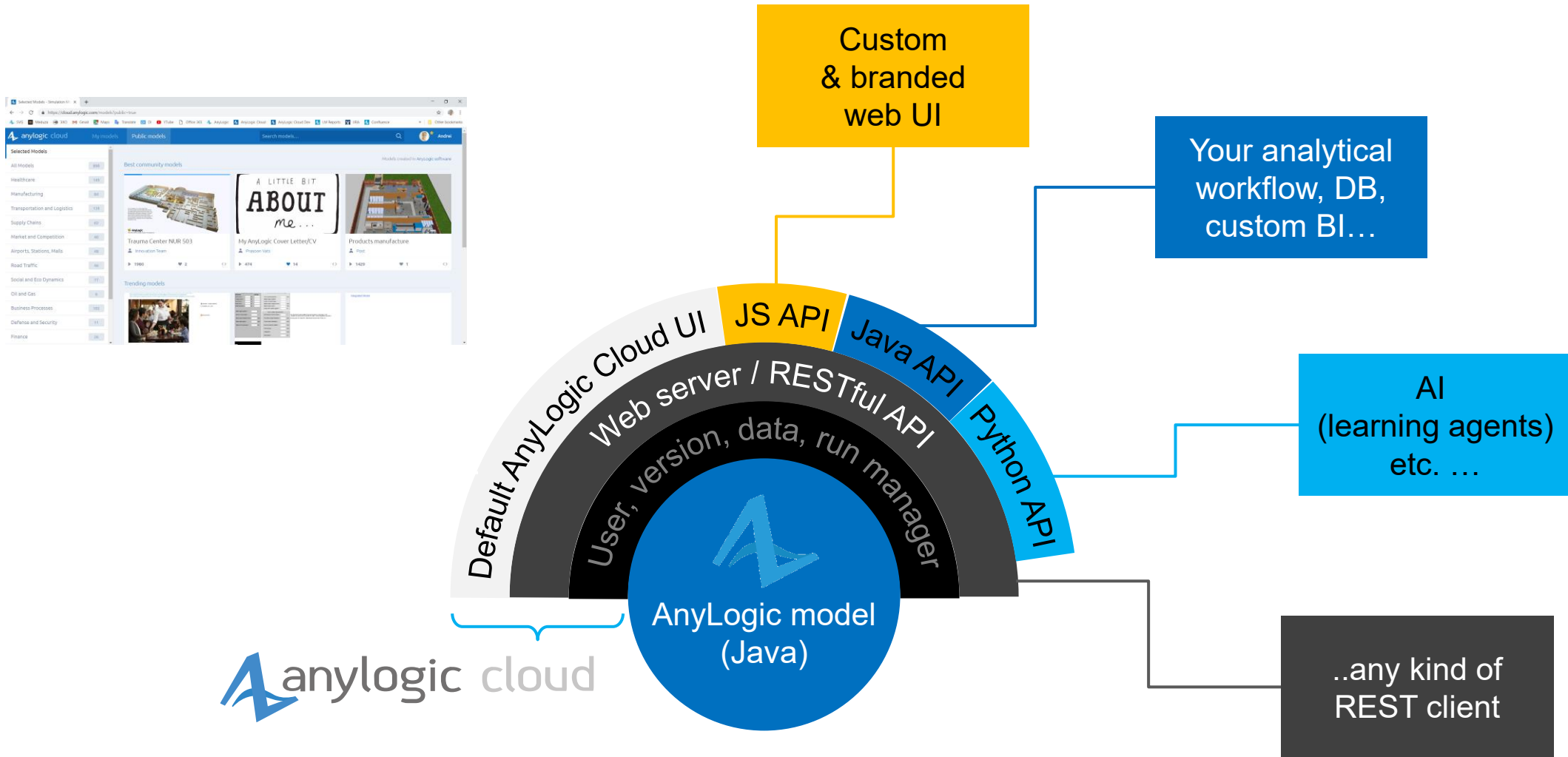
- Agent-based twin of the shop floor
- SCADA-connected for live line status
- Virtual “line manager” routes cores, resolves conflicts
- Heuristics replaced by reinforcement learning

## Results

- Test sequences before running them
- Plans verified against delivery commitments
- Fewer bottlenecks, lower cost

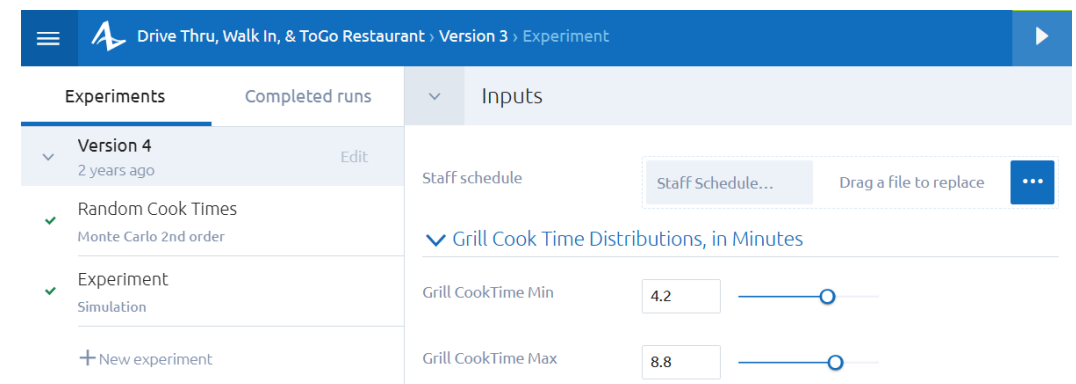
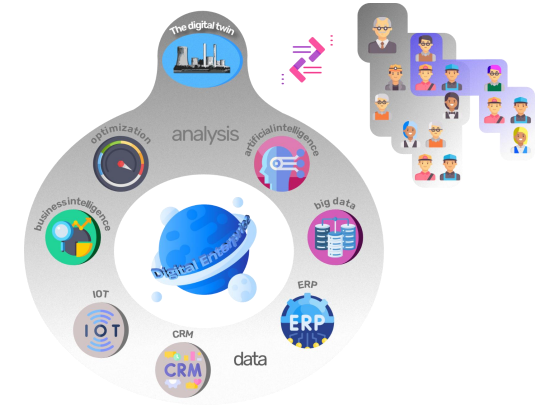


# AnyLogic Cloud is a wrapper around the model providing multiple APIs



# The future of Digital Twins

- **Project → product**
  - Models shift from one-off deliverables to standing assets
  - Built once, maintained and rerun as the business changes
- **Modelers → end users**
  - Models are accessed by analysts, managers, and executives to make informed decisions
  - Accessible via a browser, unlimited end user access
- **Quarterly → daily**
  - Decisions are being made on an operating rhythm
  - Hours and shifts, not project phases



September 15 | Online

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Whether you're exploring simulation or leading innovation with it, the AnyLogic Conference is your opportunity to connect with a global community of experts and practitioners.



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## Why Attend?

- Explore cutting-edge applications of Simulation, AI, and Digital Twins.
- Gain insights from leading companies and researchers.
- Get inspired by real-world case studies from across industries.

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Showcase your project and share your experience with peers.

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# Thank you!

## Questions?



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