IIoT Techniques
For Streaming Data

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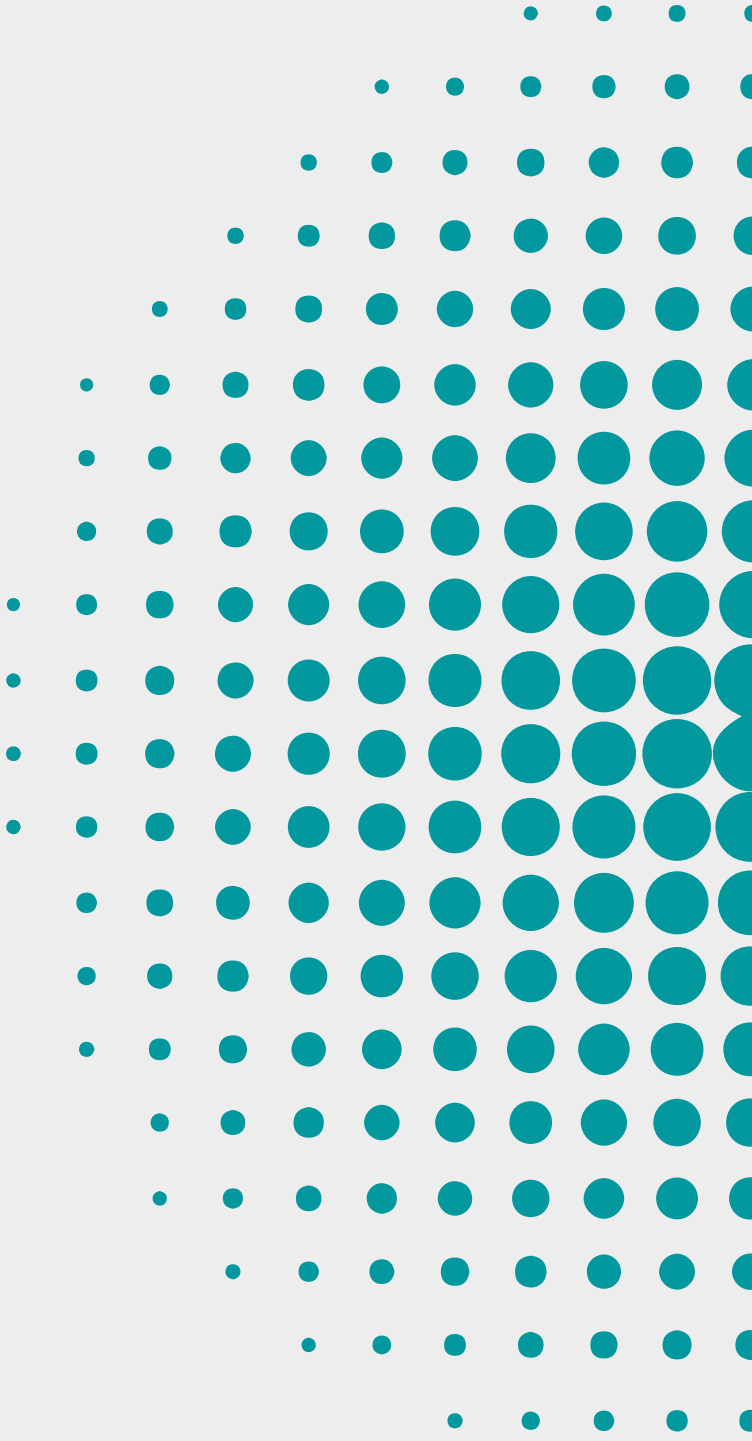
Reliant Technologies



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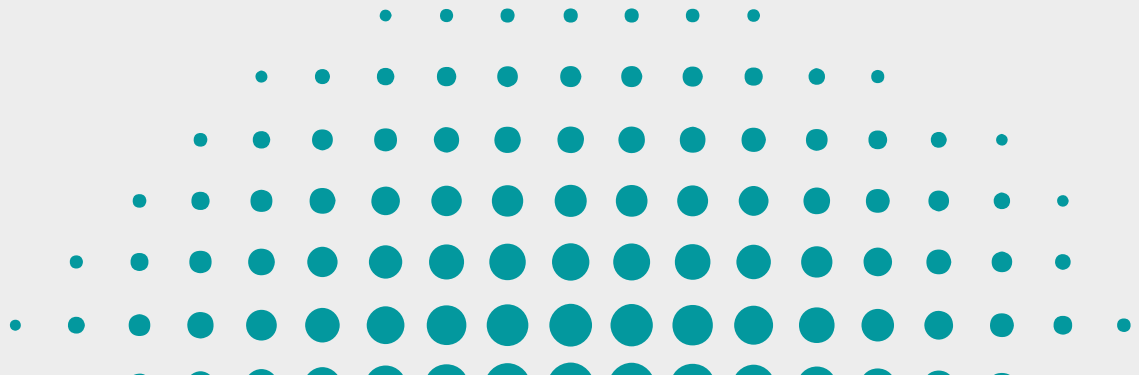
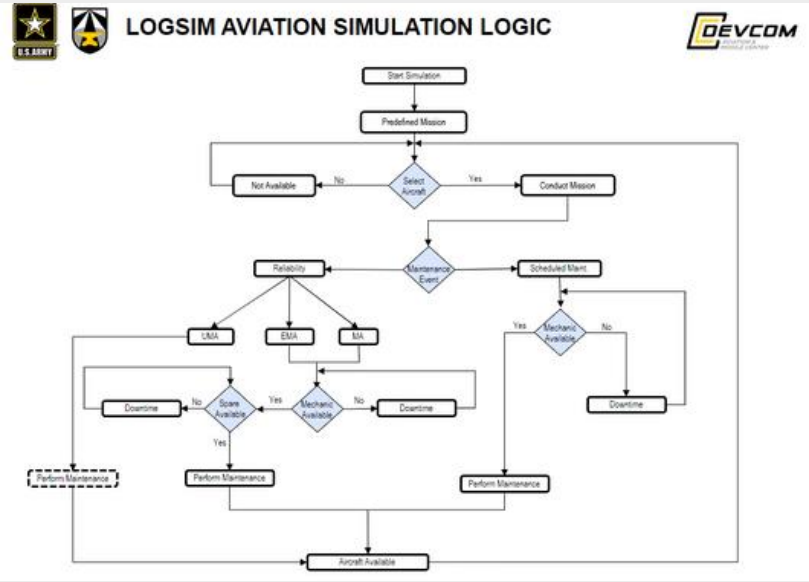


Our Work

Provide Granular Deployment Modeling

Discrete Event Simulation

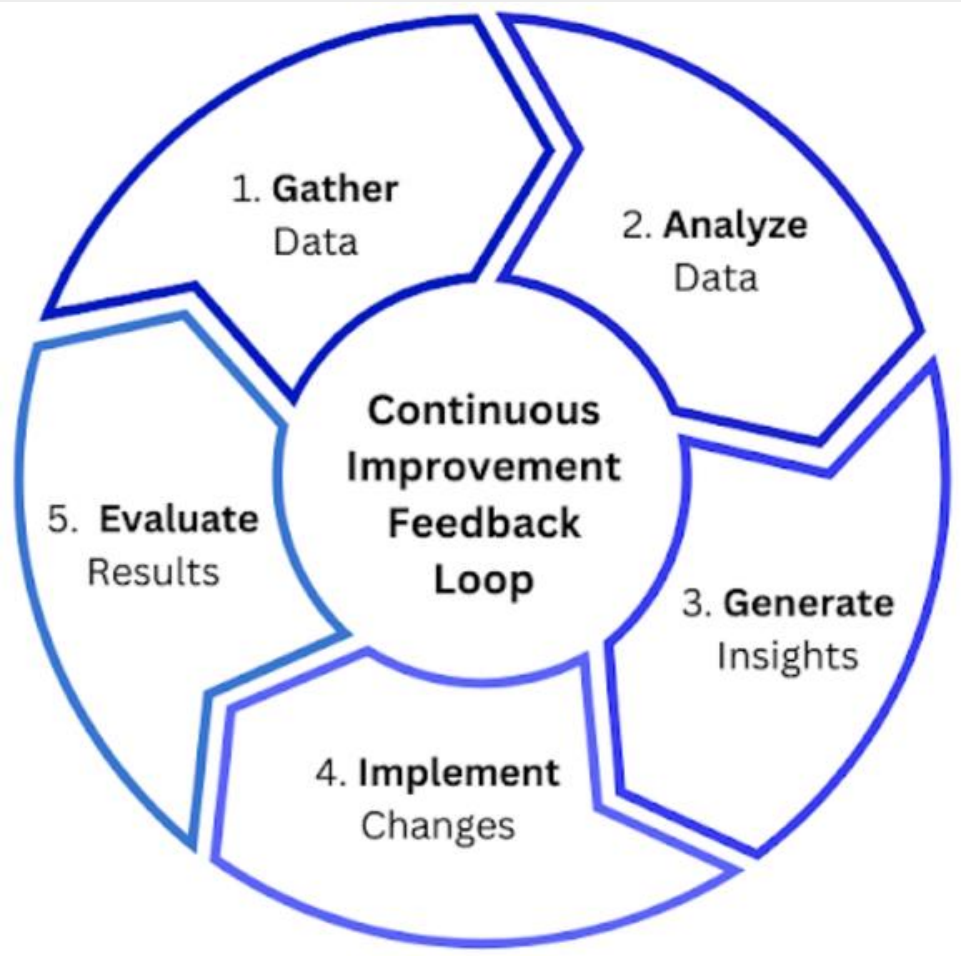
At Reliant Technologies, our team works to support the efforts of the RAM Logistics Lab through the LogSIM project. This project accurately simulates fleet deployments using nominal data collected from OEM documentation.



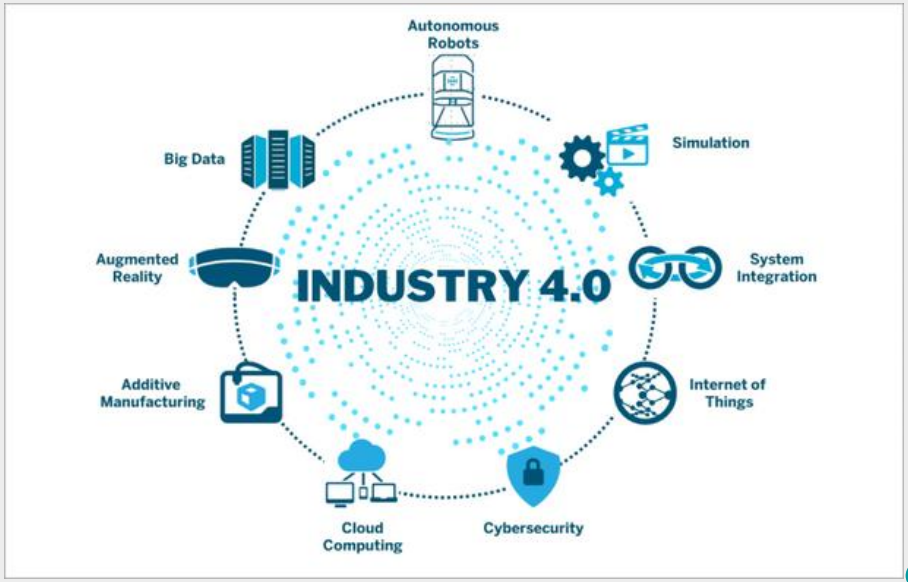
Our Goal

Use existing discrete event simulation framework with integration of real-world, real-time data.

This transition from statistically generated notional events to collected values could create a huge improvement in model accuracy.



Industry 4.0



How the Private Sector is Driving Towards Digital

The integration of digital technologies - including IoT - into various aspect of manufacturing & industrial processes

Examples

Predictive Maintenance

IoT Sensors, ML models, & Data Warehouses

Supply Chain Optimization

RFID/GPS, Blockchain, & Continuous streams

Internet of Things
IoT

Connecting physical sensors in a network for visibility, collaboration, and correction.

As the number of data points shared between devices and the network expands past the ability to be manually analyzed, challenges in autonomous analysis and action arise.

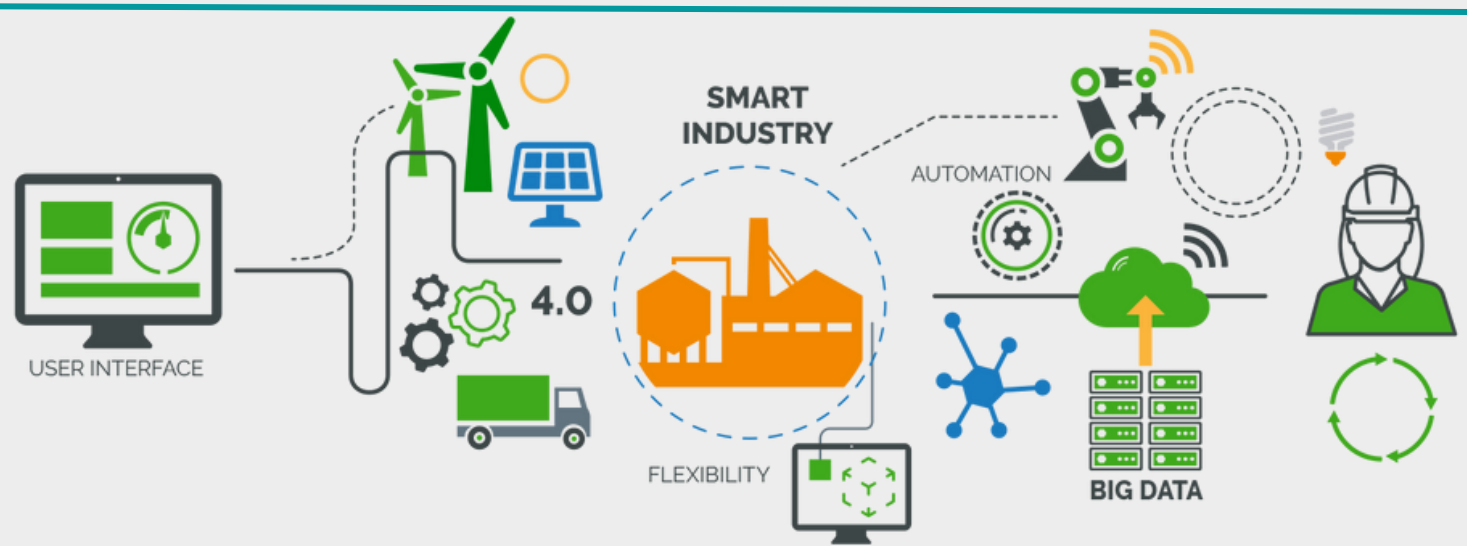
Advanced techniques in streaming data pipelines, machine learning, artificial intelligence are critical for wrangling the massive amount of data produced by these systems

Industrial IoT

A Cyber-Physical System

An engineered system whose operations are monitored, coordinated, controlled, and integrated by a computing & communication core

These integrations of machine computations on physical processes make them more efficient, less prone to error, and much more repeatable



Use Case

Providing 99.9995% Uptime

Predictive maintence in Data Centers

For a data center to be considered operational, it must allow less than 30 minutes of downtime per year. With data passing through in the order of petabytes/second and computers scaled to match, it would be impossible to manage system health through manual analysis.

The speed and scale of data at the enterprise level has created a $10B industry focused on automating the collection & analysis of system health

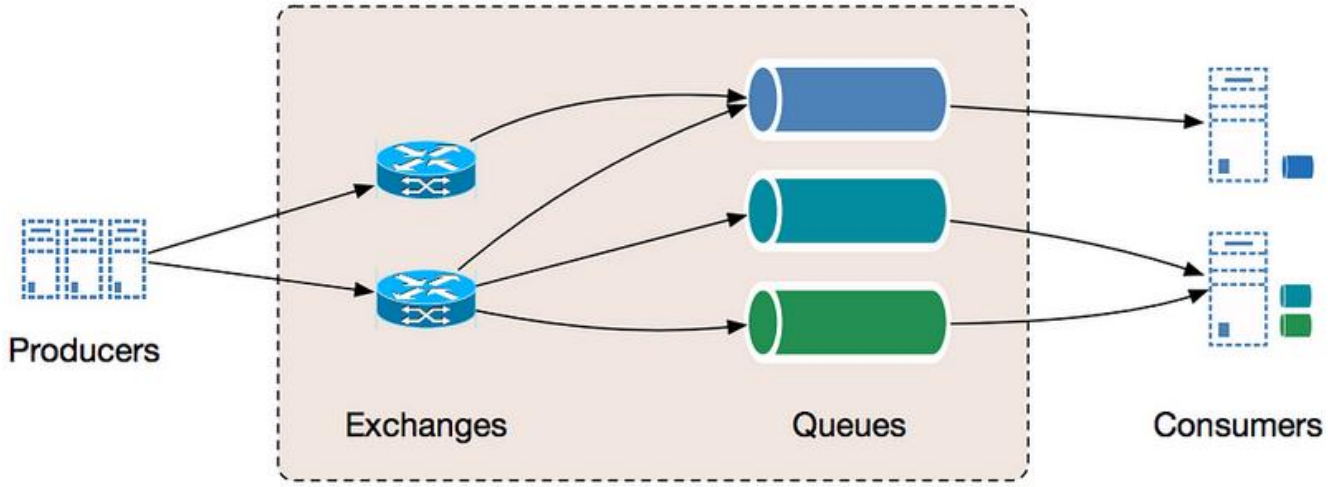
Requirements of an IIoT System

- Asynchronous
  - Data sources must be able to produce at various, variable rates
- Modular
  - Flexibility to add sources, processes, & consumers
- Scalable
  - As the number of assets in the system scales so to must it
- Repeatable
  - These systems must be portable enough to tare down and set up with minimal configuration

Asynchronous

Message Queueing

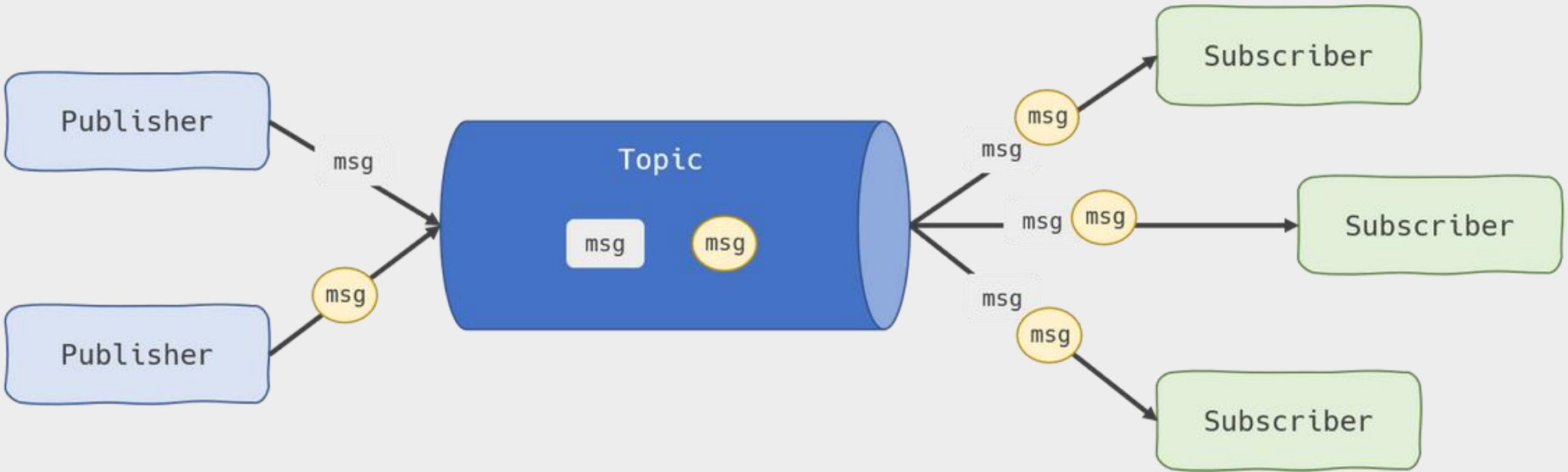
Message queuing is an extremely powerful technique for distributing information to multiple sources with elastic send/receive rates



Modular

Distributed Participation

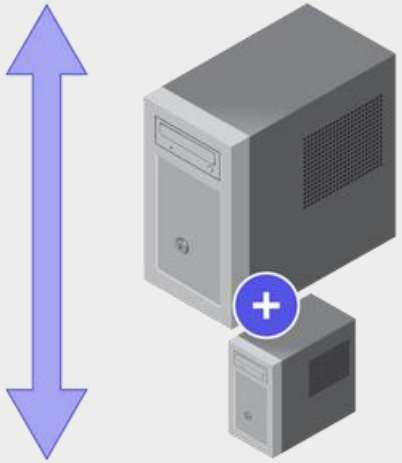
The Publisher-Subscriber model allows producers and consumers to join the network on their own. This allows for extreme flexibility & extensibility as services change their behavior.



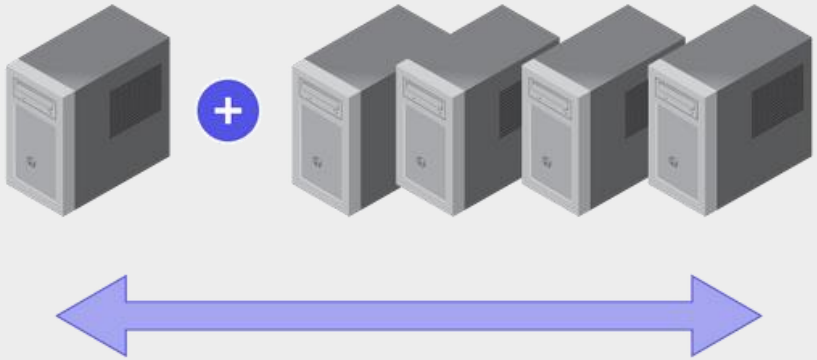
Scalable

Resource Scaling

Working in tandem with the single publisher-multiple subscriber model, resources can be duplicated to improve performance. This scaling can be dynamic, being triggered by increases in load size.



Vertical Scaling
Up and Down



Horizontal Scaling
Out and In

Repeatable

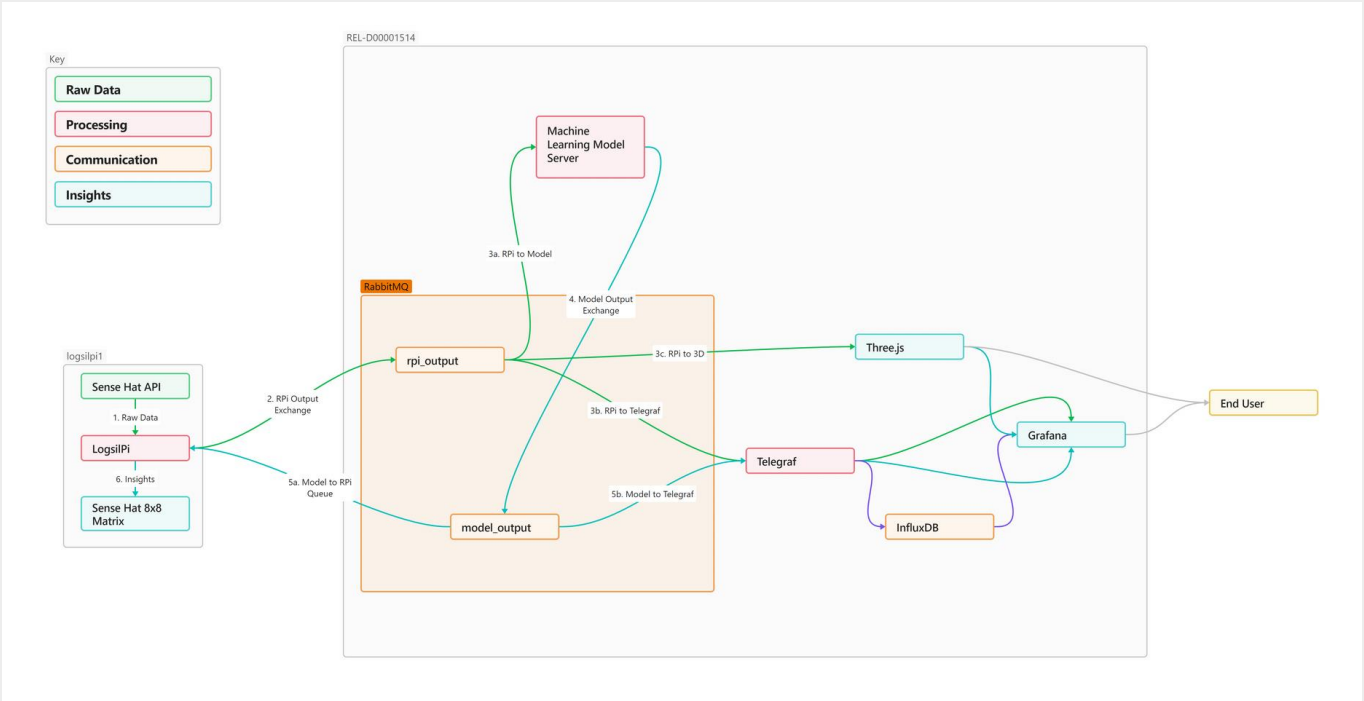
Deployment Automation

CI/CD as well as configuration as code make experimentation and deployment reproducible. Large distributed deployments rely on organization and documentation to allow for quick and easy changes to their configuration.

Our Demonstration

Implementations

- Message Queuing
  - RabbitMQ
- Distributed participation
  - Publisher/Subscriber
- Resource scaling
  - Docker, Kubernetes, Nomad
- Deployment automation
  - Env files, GUI integrations



Lessons Learned

- Data must keep moving
  - With data reaching sizes that exceed storage capabilities, it is important to make datapoints ephemeral
- Visibility is paramount
  - From debugging to validation, granular data monitoring is key
  - See OpenTelemetry, Telegraf, & Grafana
- Data must sign the contract
  - With any type of distributed system, it is imperative that the data schema is upheld by all nodes
  - See Kafka, gRPC & Protocol Buffers

Thank You

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